Report

Tailings and Waste Rock Management Facility Conceptual Design

Minago Nickel Mine

Project I.D.: 11V777

Victory Nickel Inc.
Toronto, Ontario

November 2013

Tailings and Waste Rock Management Facility
Conceptual Design Report
Minago Nickel Mine

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Prepared for

Victory Nickel Inc.

Toronto, Canada

Prepared by

Foth Canada Corporation

November 2013

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List of Abbreviations, Acronyms, and Symbols

API	American Petroleum Institute
ARD	Acid Rock Drainage
ASTM	American Society for Testing and Materials
BAW	Beach Above Water
CDA	Canadian Dam Association
CH	high plasticity clay
CL	clay
cm/s	centimeters per second
EAL	Environmental Act License
FSU	Feasibility Study Update
Foth	Foth Canada Corporation
frac sand	fracturing sand
g	acceleration due to gravity
Golder	Golder Associates
ha	hectare
kg/m^3	kilogram per cubic meter
km	kilometer
m	meter
Ma	mega annum
masl	meter above sea level
ML	metal leaching
mm	millimeter
mm/yr	millimeter per year
m/s	meters per second
m^3	cubic meter
m^3/d	cubic meter per day
$M\text{-}m^3$	million cubic meters
Mt	million tonnes
NAG	non-acid generating
Ni	nickel
OMS	Operation, Maintenance, and Surveillance
PAG	potentially acid generating
PGA	Peak Ground Acceleration
PP	Polishing Pond
SPMDD	Standard Procter Maximum Dry Density
t/m^3	metric tonnes per cubic meter
TWRMF	Tailings and Waste Rock Management Facility

1 Overview

1.1 Introduction

The Minago Site (Site) is located in Manitoba's Thompson Nickel Belt on Highway 6, approximately 225 kilometer (km) south of Thompson Manitoba, Canada (Figure 1). It is situated within a water-saturated peat terrain, a topographically low area with isolated bedrock outcrop "islands" (Figure 2). The Project site is favorably located close to existing infrastructure, including Manitoba Provincial Highway 6, a 230 kV high voltage transmission line running directly beside Highway 6 on the east side of the road, the OmniTRAX Canada Railway Line, and the town of Grand Rapids.

Following the discovery of additional mineralization in the vicinity of the previous Tailings and Waste Rock Management Facility (TWRMF), Victory Nickel resolved to relocate the TWRMF. In parallel with the additional drilling of the north limb Victory Nickel extended their leases to include the shallow valley directly to the west. A series of trial pits were dug across the valley and an aerial survey were conducted in early 2011 which suggested that the valley was ideal for the combined depository.

To confirm that the clay base to the valley identified with the trial pits was thick and consistent and to develop an appropriate design, Victory Nickel engaged Foth Canada Corporation (Foth). In late 2011/early 2012, Foth conducted a site investigation of the valley and commenced with the engineering design for the TWRMF. This work was halted in April 2012 then was restarted in April 2013 with a reduced scope limiting the design to a Conceptual Design rather than the full Feasibility Study Design.

The Government of Manitoba issued the Environmental Act License (EAL) No. 2981 which covers the current location for the TWRMF on August 23, 2011. The EAL would require an amendment to include the new relocated TWRMF.

This work follows the previous studies completed by Wardrop, Golder Associates (Golder), URS, and others. Where information has been abstracted from these reports the source has been identified and the approval of the Client, Victory Nickel obtained.

Since the proposed site is some 4 km from the previous site, the geotechnical information from the previous work has not been incorporated into the design but has been used as a reference to check the appropriateness of the conceptual design and resulting conclusions.

1.2 Scope of Work

The scope of the work for the Conceptual Design of the TWRMF and Polishing Pond (PP) were discussed in a December 11, 2012 meeting at Victory Nickel and outlined in a letter to Victory Nickel dated January 10, 2013. The letter indicated that Foth would prepare a Conceptual Design of the TWRMF prior to conducting a full Feasibility Study Update for the Minago Project, as per the request of Victory Nickel. This information would be sufficient for Victory Nickel to initiate the EAL No. 2981 amendment process before the FSU is finalized. The scope of this work is limited to the TWRMF which includes a PP.

The essential components of work for the Conceptual Design are summarized as:

- Completion of Factual Report for Phase 1 and Phase 2 Field Investigations (Foth, 2013).
- Preparation of a Design Criteria and Basis Memo to be incorporated in the report herein.
- Evaluation of deposition strategies and the development of a deposition plan.
- Stability and seepage analyses, and geotechnical design of TWRMF and PP containment dams.
- Evaluation of Water Management Strategies, and design of the PP and water cover.
- Preparation of the Conceptual Design Report.

1.3 Level of Study

The study levels for the development of a mining project normally include exploration, scoping, prefeasibility, full feasibility followed by final design and construction documents. At this stage, the design is conceptual as distinct from feasibility level engineering. As such the level of detail presented is intended to illustrate the concept without the detail and specification necessary for feasibility level. Ultimately, the findings of this study will feed into the Feasibility Study Update (FSU) for the TWRMF.

1.4 Project Description

The Minago deposit has potential as a large tonnage, low-grade nickel (Ni) sulphide deposit (30.6 Mt at 0.43% Ni, 0.20% cut-off grade) and contains 14.8 million tonnes (Mt) of marketable fracturing sand (frac sand) (Foth, 2013). The potential of the property is supported by a metallurgical test program, where a very high grade nickel concentrate of 22.3% was produced. The excellent recoveries for the ore from the open pit mine are substantiated by historical and current metallurgical testing data.

The economic potential of this deposit could be adversely impacted by an overlay of 80 meters (m) of overburden, dolomite, and sand, with a high open pit strip ratio. However, the 10 m sand layer just above the ultramafic ore bearing rock contains marketable hydraulic frac sand which will offset the cost of the stripping.

The TWRMF is proposed to occupy a long, narrow water-saturated muskeg/peat wetland with some forested areas approximately four km northwest of the proposed pit. This lowland extends approximately 8 km from the southwest to the northeast and is bound on the east and west by sub-parallel dolomite bedrock ridges, approximately 2.5 km apart. The ridges rise nearly 20 meters above the wetland valley that slopes gently at approximately 0.2% but consistently to the north-northeast. The proposed TWRMF structures would be oriented between the east and west ridges, and along the north and south lowland.

To take full advantage of the valley, Victory Nickel has instructed Foth to integrate the design of the containment dams with the dolomite bluffs on either side.

2 Site Characterization

2.1 Site Geology

2.1.1 Surficial Geology

The overburden consists of 1.0 to 2.1 m of muskeg (peat) that is underlain by 1.5 to 10.7 m of impermeable compacted glacial lacustrine clays. The clays are dark brown to grey and carbonate rich overlain with muskeg formed by an accumulation of sphagnum moss, leaves, and decayed matter.

The underlying clay and sporadic till was deposited from former glacial Lake Agassiz. Lake Agassiz once stretched across portions of Saskatchewan, Manitoba and western Ontario, impounded by retreating and transgressing Laurentian ice sheets. The extent of clays deposited in Lake Agassiz is shown in green in Figure A below. The deposit contains silt and some sand and gravel with glacial till found locally below the clay.

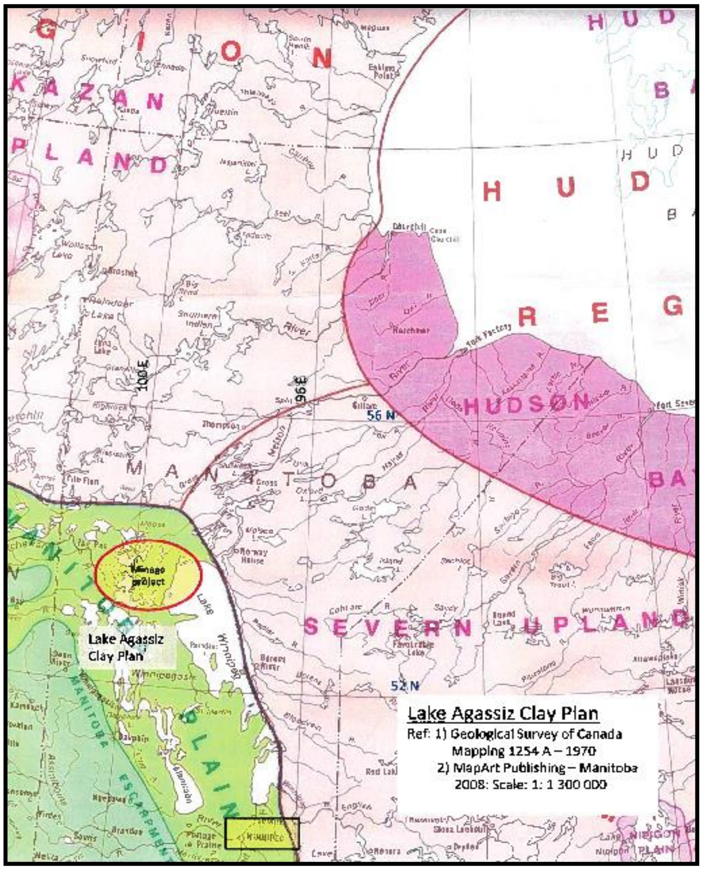

Figure A – Lake Agassiz Clay Plan Showing the Minago Site

2.1.2 Regional Geology

The regional geology comprises the eastern edge of the Phanerozoic sediments of the Western Canada Sedimentary Basin. The basin overlies Precambrian crystalline basement rocks, including the Thompson Nickel Belt. The basin tapers from a maximum thickness of about 6,000 m in Alberta to zero at the north and east, where it is bound by the Canadian Shield. The

Property is located near the northeast corner of the basin, where it comprises approximately 53 m of Ordovician dolomitic limestone underlain by approximately 7.5 m of Ordovician sandstone.

The Precambrian basement rocks of the Thompson Nickel Belt form a northeast southwest trending 10 to 35 km wide belt of variably reworked Archean age basement gneisses and Early Proterozoic age cover rocks along the northwest margin of the Superior Province. Lithotectonically, the Thompson Nickel Belt is part of the Churchill Superior boundary zone. The Archean age rocks to the southeast of the Thompson Nickel Belt include low to medium grade metamorphosed granite greenstone, and gneiss terranes and the high grade metamorphosed Pikwitonei Granulite Belt. The Pikwitonei Granulite Belt is interpreted to represent exposed portions of deeper level equivalents of the low to medium grade metamorphosed granite greenstone and gneiss terranes. The Superior Province Archean age rocks are cut by mafic to ultramafic dikes of the Molson swarm dated at 1883 mega annum (Ma).

Dikes of the Molson swarm occur in the Thompson Nickel Belt, but not to the northwest in the Kisseynew domain. The early Proterozoic rocks to the northwest of the Thompson Nickel Belt comprise the Kisseynew domain that is interpreted to represent the metamorphosed remnants of a back arc or inter arc basin. The variably reworked Archean age basement gneisses constitute the dominant portion (volumetrically) of the Thompson Nickel Belt. The Early Proterozoic rocks that occur along the western margin of the Thompson Nickel Belt are a geologically distinguishable stratigraphic sequence of rocks known as the Opswagan Group.

2.2 Climate and Precipitation

Meteorological data was provided by Golder in 2008 (Golder, 2009a).

The Minago project area is located at approximately 250 meters above sea level (masl) in north-central Manitoba, approximately 100 km north of Grand Rapids on the western shores of Lake Winnipeg.

The region is characterized by warm, wet summers and cold, dry winters with temperatures ranging from 17.6°C in July to -21.5°C in January. The total annual precipitation is estimated at 510 millimeter (mm) consisting of 369 mm (72%) of rain and 141 mm (28%) of snow. The majority of the rain falls between June and September, with a smaller amount falling in early spring and late fall. Essentially 40 mm of rain (10.8% of total rain) falls in the month of May and 329 mm of rain (89.2% of total rain) in the period of June to October (Golder, 2009a). Little rain is recorded for November to March when almost all precipitation falls as snow. The annual lake evaporation was estimated at 566 mm with the maximum monthly evaporation (127 mm) occurring in July. Losses due to sublimation are estimated to be 40 mm over the winter months.

A summary of the meteorological data to be used for the design is presented on Table 1.

2.3 Hydrology and Drainage

A Hydrologic Baseline Study was completed by Golder in 2008 (Golder, 2009a).

Regionally the project site is located within the Nelson River sub-basin, which contains the Minago River, Hargrave River, and William River with the Oakley Creek tributaries. The catchments of these three rivers are within the Lake Winnipeg basin, which ultimately drains northward into Hudson Bay. Within a 30 km radius of the project site there are several small-to-medium sized lakes, along with Limestone Bay on the northwestern edge of Lake Winnipeg.

The Minago and Hargrave Rivers flows in the northeast direction into Cross Lake, before reaching the Nelson River. The Oakley Creek flows in the southeast direction into the William River. The William River flows from William Lake in the northeast direction until reaching about 20 km downstream of Highway 6, where if turns 90 degrees to the southeast direction, draining into Limestone Bay (part of Lake Winnipeg).

Average surface runoff from the overall area was estimated by Golder (Golder, 2009a) to be approximately 117 millimeter per year (mm/yr) based on precipitation and stream gauging records. Recharge and evaporation in muskeg areas has not been directly measured.

Areas on the dolomite ridges will produce surface water runoff that will report towards the area under consideration. Inferred groundwater flow direction is north to northeast towards the Minago River, as shown on Figure 3. Although this will reflect pre-construction and post-closure conditions at the Minago project, open pit dewatering during site preparations and operations may have an impact on the groundwater flow patterns.

2.4 Seismicity

As the Minago project is located in a region historically exhibiting low seismicity an extensive evaluation extending beyond an examination of historic earthquakes is not considered necessary. The 2005 National Building Code seismic hazard calculation indicating the acceleration levels for given probabilities is presented below:

Table A – Peak Ground Accelerations for Different Return Periods.

Probability of Exceedance per Annum	**Probability of Exceedance in 50 Years (%)**	**Return Period (years)**	**Peak Ground Acceleration (PGA) g**
0.01	40	100	0.007
0.0021	10	475	0.021
0.001	5	1,000	0.035
0.000404	2	2,475	0.059

A return period of 475 years is identified for use in design of structures at the site with a corresponding Peak Ground Acceleration (PGA) of 0.021 acceleration due to gravity (g). This design value has been assumed to be applicable for the operational life of the mine. For the longer term post-closure phase a return period of 2,475 years has been assumed with a corresponding PGA of 0.059 g.

2.5 Subsurface Conditions

A geotechnical investigation of the proposed TWRMF site was completed by Foth in 2012. The area of investigation was approximately 3 km by 4 km, centered on a wetland valley bounded on the east and west by bedrock ridges. The results of the geotechnical investigation are included in Appendix A (Foth, 2013). The flanking ridges define the long dimension of an asymmetrical bedrock valley that is partially filled with overburden formations. Previous investigation work was completed by Wardrop in 2007 and 2008 (Wardrop, 2010) and focused on the previous TWRMF site, east of the site proposed herein.

In general the subsurface soils in at the proposed TWRMF site consist of:

- Peat - coarse to fine fibrous peat varying in thickness between 0.8 and 2.3m.
- Upper Clay - soft to stiff, grey to brown, high plasticity clay (CH) varying in thickness between approximately 1 and 2 m.
- Intermediate Clay – firm to stiff, grey to brown, mottled, slightly weathered medium plasticity clay (CL) with a consistent thickness of approximately 5 m.
- Lower Clay – very soft to firm, grey to brown, CH reaching a thickness of 16 m in the center of the valley.
- Dolomite Bedrock – fine grained, weak to medium strong, moderately weathered, moderately jointed, dolomite.

The groundwater table is generally at the ground surface and several bodies of water are present around the site. Relatively high piezometric heads were observed in the dolomite bedrock observations wells, suggesting confined aquifer conditions. There is also presumptive evidence of upward vertical gradients in the dolomite relative to the overburden.

3 Material Characterization

3.1 Geochemistry

A geochemical characterization study was completed by URS in 2007 (URS, 2008). The key findings are summarized below.

3.1.1 Waste Rock

According to the results of the geochemical characterization program undertaken by URS in 2007 (URS, 2008), the overburden, Ordovician dolomite, and Ordovician sandstone overlying the altered Precambrian basement and Precambrian basement lithologies are considered non-acid generating (NAG) material with a minimal potential for metal leaching (ML). The altered Precambrian basement and the Precambrian basement lithologies amphibolite and mafic dike also are considered to be NAG.

The Precambrian granite is typically considered to be NAG, however, localized areas with moderate to high sulphide sulphur and negligible carbonate content may create potentially acid generating (PAG) granite. Precambrian serpentinite is considered to be NAG, primarily due to a high of carbonate content.

Precambrian mafic metavolcanic material is considered to be PAG based on the presence of sulphide content and negligible carbonate content. Precambrian mafic metasedimentary material is considered to be PAG due to low to high variability sulphide sulphur content and low carbonate content.

The Minago Project will produce three types of waste rock, namely, dolomite, country rock (predominantly granitic), and ultramafic rock. The overall quantities for dolomite, granitic country rock and ultramafic PAG waste rock are 111, 116, and 36 million tonnes, respectively.

Based on low estimated mafic metavolcanic and metasediment waste rock quantities and low potentially acid generating granite quantities expected to be generated during mining operations, URS recommends that an operational program for static testing on blast hole cuttings be undertaken and built into a geologic block model, and that it be communicated with open pit operators so that PAG and NAG waste rock can be separated, with PAG waste rock disposed of in an appropriate facility. Based on kinetic test carbonate molar ratios, a preliminary Neutralization Potential Ratio criterion of 1.7 is recommended for segregation PAG from NAG.

The humidity cell test results suggested that dolomite mixed with Precambrian lithologies (cap rock and ore zone) would be effective in providing excess acid neutralization capacity to compensate secondary sulphide oxidation products on a micro-scale or meso-scale in situ.

3.1.2 Mill Nickel Tailings

Static and laboratory kinetic subaqueous column test results indicate that potential tailings material is NAG, due to very low sulphide sulphur content and moderate carbonate mineral content. Based on URS 2008, static and kinetic subaqueous column test results indicate NAG tailings due to very low sulphide sulphur content and moderate carbonate content. Based on their geochemical characteristics, concurrent disposal of tailings and PAG waste rock would mitigate Acid Rock Drainage (ARD) issues associated with ultramafic waste by encapsulating the PAG waste rock in tailings and water cover to minimize sulphide oxidation.

3.1.3 Frac Sand Tailings

The Ordovician sandstone will be processed to produce marketable frac sand and frac sand tailings. The Ordovician sandstone is considered to be NAG (URS, 2008) and hence the frac sand tailings.

3.2 Tailings Physical Properties

3.2.1 Mill Nickel Tailings

A geotechnical characterization of the nickel tailings was conducted by SGS Lakefield (Wardrop, 2010). The tailings sample was generated from the lock cycle test, one of several metallurgical programs set up for the Minago Project.

The tailings sample obtained from the lock cycle testing had a solids content of 45% by weight. Additional testing included settling tests, sieve and hydrometer analysis, specific gravity test, atterberg limits, standard proctor compaction test, hydraulic conductivity test, consolidated undrained triaxial test and an air drying test.

Settling tests were conducted for both undrained and drained conditions. The settled sample in the drained settling test was further subjected to a constant head hydraulic conductivity test. Hydraulic conductivity tests were carried out on compacted samples using a flexible wall permeameter. Specific gravity, sieve and hydrometer tests were conducted as per American Society of Testing and Materials (ASTM) requirements. The column drying test was conducted as per generic mining method rather than ASTM.

The grain size distribution test showed that the tailings sample was relatively fine grained, containing 5% clay, 77% silt, and 18% fine sand. Atterberg limits test gave a liquid limit of 42%, a plastic limit of 28%, and a plasticity index of 14%. A standard Proctor test resulted in a maximum dry density of 1,697 kilogram per cubic meter (kg/m^3) at an optimum moisture content of 16.6%. The initial pulp density for both, drained and undrained conditions was 1.39 t/m^3. When the test was completed nine days later, the density in drained and undrained conditions increased to 1.66 t/m^3 and 1.54 t/m^3, respectively.

Hydraulic conductivity tests on two combined tailings samples (i.e., on initially dry specimen and on slurried sample) were carried out using falling head testing method. Prior to conducting the tests, both samples were saturated. Based on the test results, the hydraulic conductivities were 8.2 x 10-6 centimeters per second (cm/s) and 2.0 x 10-5 cm/s for the initially dry and slurried samples, respectively.

The air drying test was carried out by SGS on a combined tailings sample. The test results show that the bulk of the volume reduction at average room temperature with relative humidity varying between 20 and 50% occurs during the first 800 hours.

3.2.2 Frac Sand Tailings

From a total of 11.5 million tonnes of mined frac sand, approximately 3.5 million tonnes will be sent to the TWRMF as tailings. Primarily, this fraction of the frac sand represents the finest portion of the sand which is that portion passing the American Petroleum Institute (API) Screen Number 140, or less than 116.5 microns and will consist primarily of silt.

4 Design Requirements

4.1 Design Considerations

The Minago TWRMF is designed for concurrent disposal of tailings and the PAG ultramafic waste rock in a stand-alone facility to mitigate ARD issues and facilitate regulatory compliance with Manitoba Provincial Regulatory and EAL 2981 Requirements. Figure 4 shows a plan view of the TWRMF centered on a wetland valley bounded on the east and west by bedrock ridges. The following design considerations were applied in the design

- The peat and clay foundation soils have variable consistency and thickness.

- Displacement and compression of the peat is expected to occur.

- The thick layer of native clay along the valley floor will provide effective seepage containment at the base of the TWRMF.

- A compacted clay liner will be constructed along the upstream slopes of the containment dams to minimize seepage flows into the environment.

- Clause 17 of Manitoba Conservation Environment Act License No.2981 stipulates a clay seal comprising at least 1.000 m of clay with a permeability less than 1x10-7meters per second (m/s).

- The low permeability of the tailings placed along the upstream slope of the containment dam will minimize the seepage flows into the environment.

- The PAG waste rock will be co-mingled with tailings with the following benefits.
    - Reduced oxygen infiltration in the waste rock to minimize ARD;
    - Increased storage capacity of the facility by filling the voids with tailings; and
    - Voids not filled with tailings will be filled with water in within PAG rock mass.

- The materials from the open pit mining operation will provide the construction materials for the TWRMF containment dam. In addition, a search for borrow material should be considered to find equivalent volumes of local eskers as a part of future studies.

- Selective disposal of clay overburden excavated from the open pit and TWRMF in attempt to sort the material by moisture content. This will facilitate the sourcing of clay material that is suitable for construction.

- The pit dewatering will create a cone of depression of hydraulic head in the dolomite and provide effective under-drainage to the overburden clays that underliea portion of the TWRMF. This under-drainage will promote the consolidation of the lower soft clays. The cone of depression contours are shown on Figure 4.

- A geotechnical monitoring program that includes the installation of vibrating wire piezometers and settlement plates should be considered during early stages of construction of the TWRMF containment dam to measure pore pressure dissipation and settlement.

Three containment cells (East Cell, West Cell, and Decant Cell) are designed to provide operational flexibility and to facilitate progressive closure of the TWRMF. During operation, ARD mitigation measures will be undertaken concurrently by encapsulating the PAG waste rock in low permeability NAG tailings. Drainage water is to be captured by the decant pond and ultimately the PP. The quality of the water is to be monitored to ensure all applicable water quality standards are met prior to release to the receiving environment.

4.2 Hazard Potential Classification

The hazard potential classification has been made in accordance with the Canadian Dam Association (CDA) Dam Safety Guidelines 2007. This classification evaluates the consequences of dam failure in terms of risk to population, loss of life, and environmental, cultural, and economic losses.

The hazard potential of the TWRMF and its containment dams is considered to be “low” due to the following reasons:

1. There is no population at risk for loss of life. The dolomite ridges along the east side of the TWRMF provide separation from the mill and camp facilities.

2. The worst case is scenario is considered to be a failure of the dam in the northeast valley (North Dam). The potential inundation area at the downstream toe of the North Dam includes a wetland valley that is contained by topographic ridges (Figure 3).

3. Considering that the tailings could outflow from the failed tailings dam at a slope of 10%, and that the maximum height of the North Dam is 12m, the tailings will not reach any surface water bodies or streams that may represent terrestrial or aquatic habitat. There is no potential for long-term environmental loss.

4. We are not aware of any cultural heritage value at the toe of the North Dam.

4.3 Design Basis

The TWRMF must accommodate a total of 34.1 Mt of nickel and frac sand tailings and 35.7 Mt PAG waste rock over an anticipated 10-year mine life and the facility must provide secure storage for the long-term. On the basis of the current production plan, the Tailings and Waste Rock Production Schedule is shown in Table 2 and the Design Basis for the TWRMF is summarized on Table 3.

4.4 Design Criteria

The design criteria for the proposed TWRMF are provided on Table 4.

5 Conceptual Design of TWRMF

5.1 Sizing

The sizing of the TWRMF is based on the projected production schedule shown in Table 3. The volumes shown on Table 3 were generated based on the tonnages shown in Table 2.

The TWRMF is designed to contain all of the PAG waste rock and tailings produced during the life of the mine. As shown in Table 3, the total volume of tailings produced is 23.0 million cubic meters (M-m^3) and the total volume of PAG waste rock is 17.9 M-m^3. The total volume required to accommodate the all the waste material is 37.7 M-m^3, or 43.3 M-m^3 including a 15% contingency.

An approximate stage-storage curve for the proposed TWRMF is shown below:

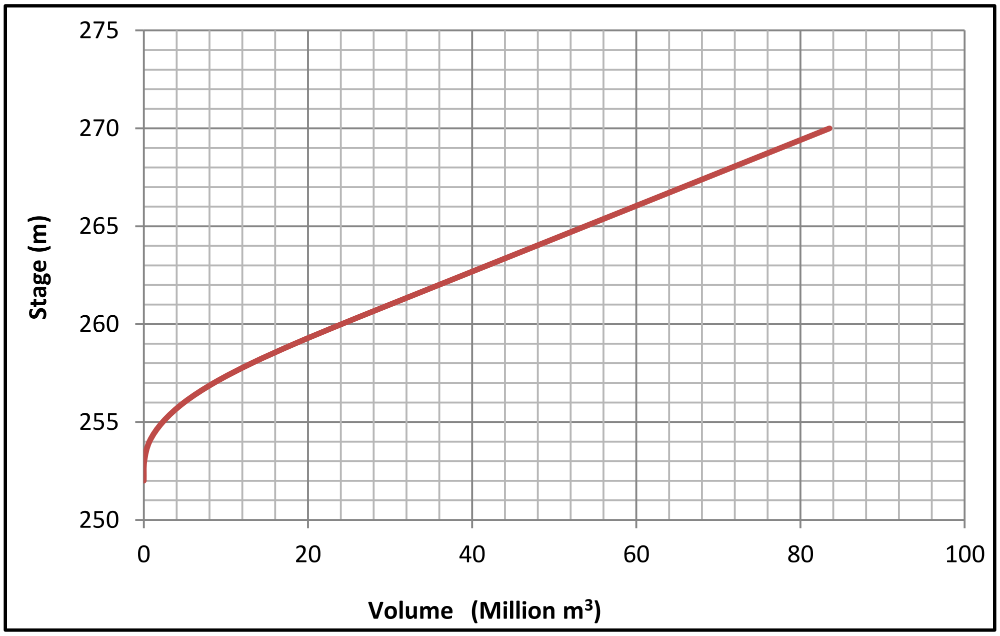

Figure B – Stage-Storage Curve for the Proposed TWRMF

The available storage in the proposed facility is approximately 48.3 M-m^3or 53.8 M-m^3 assuming the facility is filled to a constant elevation of 264m (2m below dam crest) or 265m (1m below dam crest), respectively. In reality, the tailings will not be deposited to a constant elevation. Assuming a 360 degree deposition from an elevation of 264m toward the center of the facility and a final average deposition slope of 0.2%, a reduction in available storage of approximately 10.5 M-m^3 is expected from the 48.3 M-m^3 or 53.8 M-m^3 struck level volumes. Therefore, the effective storage volume is reduced to approximately 37.7 M-m^3 or 43.3 M-m^3, assuming a 2 m and 1 m freeboard, respectively. Note that the 43.3 M-m^3includes a 15% contingency capacity.

5.2 Layout

The proposed layout of the TWRMF is shown in Figure 4. The two existing dolomite bluffs have been utilized to provide containment along the “sides” of the storage area. Dams are proposed on the northeast (North Dam) and south west (South Dam) ends, along with smaller dams along the sidewalls to provide additional containment and prevent infiltration of water into the dolomite bluffs. The TWRMF covers 595 hectare (ha) and the PP covers 120 ha.

The top elevation of the dams is proposed to be at an elevation of 266 m. The floor of the facility will be the existing ground. A PAG waste rock divider dyke and separation dykes will be constructed across the floor as shown in Figure 4. The dykes are intended to divide deposition cells and facilitate deposition and decanting of supernatant water.

The PP is situated to the northeast of the TWRMF and seepage collection ditches are included along the North and South Dams. An additional ditch for runoff diversion is included south of the TWRMF and is designed to intercept water from the head of the valley across to the drainage system around the pit.

5.3 Alternatives Analysis

Three design options were considered:

1. A repeat of the existing Wardrop design.
2. The current design with the TWRMF nestled between the bluffs.
3. An option with the side walls moved in to facilitate drainage around TWRMF.

The first Option was discounted because the new proposed site offered 600 ha in valley (Figure 2) underlain by a thick clay deposit which allowed for minimizing the height of the dam.

The alternative TWRMF arrangement, option 3 involved moving the side dams away from the dolomite bluffs by 100 m to areas of greater clay thickness. This would have resulted in an increased dam height along the sides of the TWRMF but allowed for the construction of seepage collection ditches along the sides of the facility.

Option two was selected as the preferred solution to take full advantage of the natural landscape and the containment afforded by the dolomite bluffs. By careful selection of the side dam location to position these where the in situ clay thickness is assured, option 2 will be the lower cost option. In addition to the in situ clay, the seepage through the sides of the facility is minimized by the compacted clay liner.

5.4 Dam Design

The perimeter containment dams are to be raised from a starter dam to afford a consolidation period before the construction of the balance of the dam. The dam is designed with the required factors of safety against failure in accordance with the design criteria. The required factors of safety are shown in Table 4 and the calculated factors of safety are shown in Appendix B. Figures 5 and 6 show the typical design sections for TWRMF containment dams. The dams are constructed in two main phases: the Pre-load/Starter dam and the Ultimate Dam.

The objectives of the Pre-load/Starter Dam are to:

- allow for displacement and compression of the peat foundation soils;

- develop sufficient strength gain in the clay foundation soils by consolidation before construction of the ultimate dam;

- provide a working platform for construction of the ultimate dam; and

- provide containment for the initial quantities of frac sand tailings and ultramafic PAG waste rock produced during Year -1 (Table 2).

The dams are to be constructed of the dolomite waste rock with a 15 m wide crest at an elevation of 266 m, with 3H:1V side slopes. A 1 m thick zone of compacted clays is provided as a low permeability liner on the upstream slope of the dam and the liner will extend to the TWRMF floor and be keyed into the existing native clay (Appendix A) as shown on Figures 5 and 6. Layers of crushed dolomite filters are to be provided between the compacted clay liner and dam fill materials if the gradation of the fill materials warrant.

Given the abundance of dolomite rock available during the Mine Development Phase, this was the obvious choice of construction material. Similarly, the abundance of clay of suitable moisture content is available from the Open Pit and the TWRMF Site. The option to use crushed dolomite as potential filter materials was addressed in the previous design (Wardrop, 2010) and will be addressed again during the Detail Design Phase. Alternatively, outwash sand and gravel could be considered as a suitable filter materials if identified by future investigations.

5.5 Stability

The stability of the downstream slopes of the Ultimate Dam at Closure was analyzed using a limit equilibrium method with slope stability software Geostudios Slope/W (version 7.21). The upstream slope of the Ultimate Side Dams along the dolomite ridges was also analyzed. The minimum factors of safety against slope failure were calculated using the Morgenstern-Price Method. The slope stability analyses were performed at the critical sections under both static loading and pseudo static earthquake loading conditions.

Different failure modes and mechanisms were considered in the analyses including potential shallow or deep-seated slip surfaces and optimized circular or block type slip surfaces with minimum calculated factors of safety reported. Appendix B presents the details of the stability analyses carried out for the TWRMF dams.

The calculated factors of safety against dam failure for all stability analyses reported in Appendix B ranged from 1.3 to 1.7 and meet the requirements of the design criteria.

5.6 Seepage

The compacted clay liner and thick base of native clay is intended to minimize seepage flows from the TWRMF to the environment. Seepage flow through the North and South dams make up the majority of the seepage flows leaving the TWRMF, and will be collected in seepage collection ditches, diverted to collection ponds, and pumped back into the TWRMF. The rate of seepage flows through both the typical North/South Dam section and the typical Side Dam section at the final stage of the deposition were estimated by carrying out seepage analyses using

Geostudios Seep/W (version 7.21). The results of the analyses are presented in Appendix C and include a sensitivity analysis for varying compacted clay liner thicknesses.

The calculated seepage flow through the dams for the entire TWRMF at closure is 23.1cubic meters per day (m^3/d) with a compacted clay liner thickness of 1 m, which meets the requirements of the design criteria (Table 4). Sensitivity analysis results indicated a seepage rate of 853.1 m^3/d for an unlined rock fill dam. Actual seepage flow may vary due to uncertainties associated with hydraulic conductivity of the clay liner, tailings, and waste rock.

5.7 Appurtenances

5.7.1 Decant Siphon System

A Decant Siphon System is included to allow passive overflow from the Decant Cell to the PP (Figure 4). The siphon inlet will be raised as required. Figure 5 shows that the siphon inlet is at least 2.5 m below the crest of the dam. Additional siphons will be employed as needed to accommodate increasing levels of hydraulic head in the Decant Cell.

5.7.2 Emergency Spillway

An emergency overflow spillway is provided on the North Dam as shown in Figure 4. The spillway is to be constructed out of dolomite waste rock and non-woven geotextile and remain in a single location for the life of the mine. The spill way will be raised with the dam, and will be designed to accommodate a 1 in 1000 year 24 hours storm in accordance with the Design Criteria (Table 4). Additional design details will be included in the FSU.

5.7.3 Polishing Pond

A site wide water balance was performed by Victory Nickel in 2011 (Victory Nickel, 2011). In the water balance, the following three seasonal periods were considered:

- May
- June to October
- November to April

An understanding of the water balance is essential for sizing of the PP and to ensure the retention time meets the design criteria (Table 4) for settling of suspended solids. An approximate summary of the water balance during normal operations as it pertains to the PP water inputs is provided in Table 6. As expected, the table indicates that the critical PP inflow occurs during the May freshet, when the daily flow is 67,532 m^3/d during normal climatic conditions.

Similar to the previous TWRMF design (Wardrop, 2010), a 120 ha PP was selected, as shown on Figure 4. For a pond depth of 1.5 m and a throughput of 67,532 m^3/d, the retention time during normal operations in May is calculated to be approximately 27days and is in accordance with the design criteria.

An extreme 1 in 200 year, 24-hour storm event would contribute an additional 714,000 m^3 of water to the TWRMF. This would result in an excess of approximately 1.5 m of water in the TWRMF Decant Cell. In order to maintain the 7 days retention criteria in the PP, the excess water will be held in the TWRMF Decant Cell and released to the PP at a maximum rate of 217,000 m^3/d. At this rate, it will take approximately 3.3 days to release the excess water to the PP. Sufficient capacity will be maintained in the Decant Cell to accommodate the excess storm runoff.

The layout of the PP is shown on Figure 4. The PP is situated immediately downstream of the TWRMF and is founded on a thick clay base (Foth, 2013). The proposed PP containment dam has a 15 m wide crest at elevation 254.5 m with 3H:1V side slopes and a 1 m thick compacted clay liner on the upstream slope that is keyed into the native clay soils, similar to the typical TWRMF dam section shown on Figure 5. This allows for a maximum pond elevation of 253.5 m, average depth of 1.5 m and a 1.0 m of freeboard.

5.7.4 Water Cover

A water balance of the proposed TWRMF closure pond suggests that a permanent tailings pond covering the entire TMRMF surface area cannot be maintained without perpetual pumping of water from the open pit dewatering wells. The water balance calculations summarized in Figure 7 shows that the post-closure tailings pond area would reach a steady state area between approximately 21% and 50% of the TWRMF area, resulting in a water cover thickness between 1.1 and 1.8 m above the PAG waste rock.

To illustrate the robustness of the partial cover scenario, Figure 7 also shows the effects of a 1 year dry event with a return period of 100 years. In this case we estimate that the pond would shrink to an area between approximately 12% and 40% of the TWRMF area, resulting in a water cover thickness between 0.9 and 1.6 m above the PAG waste rock.

All of the scenarios shown in Figure 9 meet the design criteria (Table 4) for water cover thickness except for the dry year scenario resulting with a water cover thickness of 0.9 m above the PAG waste rock. It should be noted that this scenario used an unlikely upper bound evapotranspiration rate for the tailings ‘Beach Above Water’ (BAW) coupled with an unlikely dry event. Further consideration of the evapotranspiration rates will be required during the preparation of the FSU and detailed design.

During operations, PAG waste rock will not be exposed to the atmosphere for more than one year before being covered and saturated by tailings and water to minimize ARD.

5.7.5 Ditches

Seepage collection ditches are proposed along the North and South Dams of the TWRMF to collect seepage and pump back to the TWRMF, as shown in Figure 4. The compacted clay liner along the east and west Side Dams minimizes seepage into the Dolomite Bedrock.

A runoff diversion ditch is required along the southwest side of TWRMF (Figure 4) to collect water from the head of the sub-watershed. As noted previously this ditch will drain to the perimeter drainage systems to be constructed for the Open Pit. In the current plan, this drainage is taken to a silt trap at Highway 6 and ultimately to the wetland area to the east of Highway 6.

Additional ditch design details will be included in the FSU.

6 Deposition Strategy

The TWRMF comprises three cells designed to facilitate tailings deposition and co-mingling with waste rock. The deposition plan has flexibility in the design that allows for modifications, if required, in the future once actual deposition characteristics are determined during the initial years of operation. The deposition plan and staged construction plan for the TWRMF is shown in Figures 8 and 9 and summarized in Table 5. An adaptive management program shall be in place during operations to optimize the deposition plan based on the observed conditions.

6.1 Deposition Quantities

The following assumptions for deposition quantities have been made for the design:

- The TWRMF will receive approximately 34.1 Mt of nickel and frac sand tailings, and 35.7 Mt of ultramafic PAG waste rock.
- Approximately 60% of the voids in the ultramafic PAG waste rock (3.2 M-m^3 out of 5.4 M-m^3 of total void space) will be filled with tailings.
- Maximum tailings elevation in the proposed deposition plan (Figure 9) is at an elevation of 264 m with the dam crest at an elevation of 266 m which allows for 2 m of freeboard.
- The 2.0 m of freeboard allows for contingency capacity for entrapped ice, modifications to geochemical characterization of waste, and increased project resource.
- The nickel and frac sand tailings are deposited as conventional slurry at approximately 20% and 50% solids, respectively (Wardrop, 2010), as shown in Table 3.
- The average final density of the nickel and frac sand tailings is assumed to be 1.5 metric tonnes per cubic meter (t/m^3) and 1.6 t/m^3, respectively (Wardrop, 2010), as shown in Table 3.
- The average final density of the ultramafic PAG waste before tailings ingress is 2.0 t/m^3 (Wardrop, 2010), as shown on Table 3.

6.2 Deposition Method

The following assumptions for the deposition method have been made for the design:

- Tailings deposition will be sub-aerial from around the perimeter of the cells to promote drainage northeast towards the Decant Cell, and to encapsulated the PAG waste rock in the center of the facility.
- Tailings can be deposited from the cell divider dyke.
- Separation dykes will provide containment for the decant cell and prevent significant amounts of silt from entering decant pipes. The Decant Cell will ultimately be filled with tailings and PAG waste rock.

- A beach will form with a slope of approximately 0.5%.

- Trestles may be used to achieve flatter overall slopes or to optimize the filling and closure of the TWRMF.

- PAG waste rock will be mechanically placed within the PAG waste rock footprint shown In Figure 8, in lifts of 0.5 to 1.0 m thickness, with alternating layers of tailings in lifts of 0.5 to 1.0 m thickness.

6.3 Operational Considerations

The following operational considerations will apply:

- Based on geochemical characterization results (URS, 2008), PAG waste rock will not be exposed to the atmosphere for more than one year before being covered and saturated by tailings and water to minimize ARD.

- Maximum PAG waste rock elevation at 261.5 m. A piezometric surface must be maintained above an elevation of 262.5 m post-closure to maintain the minimum water cover thickness criteria of 1.0 m.

- A key objective of the co-disposal plan is to induce migration of tailings into the voids of the PAG ultramafic waste rock and to encapsulate the PAG waste rock in tailings. The following practices should be considered to enhance migration of tailings into PAG waste rock voids:
  - Placing alternating layers of PAG waste rock and tailings in a “layer-cake” fashion.
  - Ripping upper surfaces of disposed waste rock the enhance tailings ingress.
  - Controlled blasting of tailings to induce liquefaction and enhance migration of tailings into waste rock voids, provided stability of the TWRMF containment dam is not compromised.
  - Maintaining a hydraulic head difference across the disposed waste rock.

The configuration of PAG waste rock disposal should allow for a minimum of 1 m of saturated tailings and water cover at the end of the deposition, in accordance with the design criteria. During operations, the water level in the TWRMF shall be maintained sufficiently below the PAG waste rock surface to ensure stability and the safety of personnel and equipment operating on the PAG waste rock.

6.4 Deposition Phases

Mine waste deposition activities are divided into the following 4 phases:

- Construction – Years -2 to -1
- Normal operations – Years 1 to 10
  - Includes pre-closure operations from Years 7 to 10.
- Post-closure – After Year 10

6.4.1 During Construction – Years -2 to -1

Following construction of the Starter Dam/Pre-load in Year -2, deposition of initial quantities of PAG waste rock and frac sand tailings will begin (Year -1), as shown in Figure 8. It is proposed that the PAG waste rock is used to construct the Divider Dyke and Separation Dykes which will divide the three disposal cells. It is proposed that the frac sand tailings are deposited in the proposed Decant Cell.

6.4.2 During Normal Operations – Years 1 to 10

During Years 1 to 6, deposition of frac sand tailings, mill tailings, and PAG waste rock will be taking place (Figure 8). It is proposed that the frac sand tailings are discharged sub-aqueously in the Decant Cell. The Decant Cell was selected as the proposed disposal area for the frac sand tailings for the life of the mine with the intention of minimizing the operational requirements associated with moving multiple discharge locations. Alternatively, the frac sand tailings could be discharged sub-aerially in the East and/or West Cell. The initial quantities of the mill tailings are deposited in the East Cell, while PAG waste rock is deposited in the West Cell (Figure 8).

Further deposition of mill tailings and PAG waste rock shall be in lifts of approximately 0.5 to 1 m thick and alternate between the East and West Cells approximately every 6 months, so that PAG waste rock is placed on top of a previously placed lift of tailings, before being covered by the subsequent lift of tailings in a “layer-cake” fashion, as shown in Figure 9. This alternating disposal scheme will promote co-mingling of the tailings and PAG waste rock (tailings ingress into the voids of the PAG waste rock). At no time shall mill tailings and PAG waste rock be disposed of in the same cell simultaneously.

Supernatant water from the mill tailings along with storm runoff will be collected in the Decant Cell, either by seeping through the Separation Dykes or through temporary cross sectional swales cut across the crest of the Separation Dykes. The Separation Dyke shall be raised progressively with the tailings pond level so that swales can be easily excavated as needed.

6.4.2.1 During Pre-closure Operations – Design For Closure

During Years 7 to 10, pre-closure operations will commence and the deposition strategy will be altered so that the desired post-closure geometry of the facility can be achieved (Figures 7 and 8). During this period, the crest of the central PAG waste rock stockpile will remain at its ultimate elevation of 261.5 m and there will no longer be division between the East and West Cells. The final quantities of PAG waste rock in Years 7 and 8 will be dumped into the Decant Cell and the frac sand tailings disposal site will change to the north ends of the East and West Cells, to ensure there is sufficient capacity for disposal of PAG waste rock in the Decant Cell, and to contribute to the tailings cover in the East and West Cells. Mill tailings will continue to be discharged from the perimeter dam towards the center of the facility, while contributing to the tailings cover and desired post-closure tailings beach geometry, and shown in Figures 7 and 8.

During Years 9 and 10, there will be no further PAG waste rock disposal and only frac sand tailings and mill tailings will be deposited in the TWRMF (Table 2). Frac sand tailings (or mill tailings) will be used to cover the PAG waste rock in the Decant Cell, filling the cell so there will no longer be division between the East, Well, and Decant Cells. Mill tailings will continue to be discharged from the outer portions of the facility towards the center, as shown in Figure 9. At this time, trestles will be required to achieve overall deposition slopes flatter than the angle of repose of the tailings (assumed to be 0.5%) to contribute to the final tailings cover and desired post-closure tailings beach geometry near the center of the facility.

6.4.3 Post-closure – After Year 10

After Year 10, there is no further deposition in the TWRMF and the desired post-closure geometry of the facility will be achieved, which will consist of a conical shaped tailings beach with a central closure pond, as shown in Figures 7 and 8. A permanent closure pond will exist to maintain saturation of the PAG waste rock to minimize the potential for ARD.

6.5 Safety

Careful planning is needed to ensure safety of personnel and equipment operating on the deposited PAG waste rock within the repository. Vibratory loads from haul trucks and dozers may cause liquefaction of the rock fill with voids filled with saturated tailings. The potential for liquefaction of the co-mingled tailings and PAG waste rock can be minimized by ensuring adequate compaction and by preventing saturation the PAG waste rock. This can be achieved by compacting the PAG waste rock and by controlling the water level in the TWRMF so it is at least 1 to 2 m below the crest of the current lift being placed.

7 Water Management

7.1 Water Management System

The following two seasonal periods were considered in the development of the Water Management System:

- Warm months (May to October)
- Winter months (November to April)

The overall Water Management System (Figure 4) incorporates the following components:

- A decant cell within the co-disposal facility where the order of 500,000 cubic meter (m^3) of water resides at all times.

- A decant barge system which allows overflow from the Decant Cell to the PP (Figure 4).

- A PP that provides the minimum retention time for the settling out of suspended solids.

- A pump and channel system to allow PP overflow to be discharged to the Minago River.

- An emergency spillway and stilling basin designed to convey the design storm (Figure 4).

- Seepage collection ditches along the north and south dams with collection ponds and a pump-back systems (Figure 4), designed to convey seepage and runoff from the design storm (Table 4).

- A runoff diversion ditch along the south seepage collection ditch (Figure 4), to intercept runoff from the head of the valley where the proposed clay dump is located, and diverted to the site drainage system around the pit to avoid the Oakley Creek. The runoff diversion ditch will be designed to convey the design storm (Table 4).

- Silt traps will be employed as needed.

- All discharges from the PP will be directed to the Minago River.

Water will be released to the receiving environment to feed the Minago River through two structures depending upon the season:

- In the warm months a distribution manifold will feed water to the muskeg over a reasonable width of muskeg to mimic the natural flow.

- In the winter months the pipe outlet will discharge to an open ditch located after the distribution manifold at the Minago River.

7.2 Water Management Phases

Similar to the mine waste deposition activities, the water management activities can also be divided into the following 4 phases:

- Construction – Years -2 to -1
- Normal operations – Years 1 to 10
  - Includes pre-closure operations from Years 7 to 10.
- Post-closure – After Year 10

7.2.1 During Construction – Years -2 to -1

During site preparation (early Year -2, winter months), a drainage ditch will be excavated along center of the valley to promote drainage of the muskeg during the May freshet. This will facilitate the construction of the Starter Dam/Pre-load and the compacted clay key trench (Figures 5 and 6). The key trench, seepage collection ditches, and runoff diversion ditches will also be excavated at this time.

During construction of the Pre-Load/Starter Dam and PP (Year -2, warm months), runoff will be collected in the ditches and diverted to the environment in order to maintain dry site conditions and avoid pooling of water. Silt traps will be employed as needed.

During construction of the Ultimate Dam (Year -1, warm months), deposition of initial quantities of PAG waste rock and frac sand tailings will be under way (Figure 8). Water from the frac sand tailings, frac sand plant, sewage treatment plan and from storm runoff within the TWRMF will be collected at the northeast end of the facility in the Decant Cell. A Decant Barge System will be constructed to allow overflow from the Decant Cell to the PP. PP inflows will include TWRMF overflows and water from the dewatering of the Open Pit. PP overflow will be discharged to the Minago River.

An Emergency Spillway will also be constructed to convey runoff from extreme storm events. Seepage will be collected in the Seepage Collection Ditches (Figure 4) and pumped back to the TWRMF. Runoff from the head of the valley will be collected in the Runoff Diversion Ditch and diverted to silt traps and the environment.

7.2.2 During Normal Operations – Years 1 to 10

During Years 1 to 6, deposition of frac sand tailings, mill tailings, and PAG waste rock will be taking place. It is proposed that the frac sand tailings are discharged sub-aqueously in the Decant Cell and that the mill tailings and PAG waste rock are deposited in the East and West Cells (Figure 8).

7.2.2.1 During Warm Months

During the warm months, supernatant water in the TWRMF is collected in the Decant Cell, either by seeping through the Separation Dykes (Figure 4) or through temporary swales in the Separation Dykes. A water balance, including a list of TWRMF water inputs, is shown in Table 6. The Decant Barge System continues to allow overflow from the Decant Cell to the PP.

The average TWRMF overflow rate ranges from approximately 27,532 m^3/d to 18,574 m^3/d during normal climatic conditions (Table 6), reaching a rate of approximately 217,000 m^3/d during a 1 in 200 year, 24-hour storm event, as described in section 5.7.3 of this report. PP water inputs will include TWRMF plus an additional 40,000 m^3/d from the dewatering of the Open Pit (Table 6). PP overflow will be discharged to the Minago River at an average rate ranging from approximately 67,532 m^3/d to 58,574 m^3/d during normal climatic conditions (Table 6), reaching a maximum of approximately 257,000 m^3/d during extreme storm events, as described in 5.7.3 of this report.

The Emergency Spillway will remain in place to convey runoff from extreme storm events from the TWRMF to the PP. Seepage will continue to be collected in the Seepage Collection Ditches (Figure 4) and pumped back to the TWRMF. Runoff from the head of the valley will continue to be collected in the Runoff Diversion Ditch and diverted to silt traps and the environment.

7.2.2.2 During Winter Months

During the winter months, it is assumed that the majority of the water in and around the TWRMF will remain entrapped in ice until the May freshet (Table 6). Any liquid water will report to the overall Water Management System as described in Section 7.2.2.1. The Emergency Spillway will allow overflow to the PP in the event that ice blockage occurs. PP overflow will consist primarily of water from the dewatering of the Open Pit and will be discharged to the Minago River at a rate of approximately 41,680 m^3/d (Table 6).

7.2.2.3 During Pre-Closure Operations – Design for Closure

During Years 7 to 10, pre-closure operations will commence and the deposition strategy will be altered so that the desired post-closure geometry of the facility can be achieved (Figures 7 and 8), as discussed in Section 6.4. During this period, the crest of the central PAG waste rock stockpile will remain at its ultimate elevation of 261.5 m and be covered by tailings. The final quantities of PAG waste rock (in Years 7 and 8) will be dumped into the Decant Cell. During Years 7 and 8, the water management activities will be the same as during normal operations. However, during the final ‘tailings only’ years (Years 9 and 10), the PAG waste rock in the Decant Cell will be covered by tailings so that the tailings pond shifts from the Decant Cell, towards the center of the TWRMF. At this time, the Decant Barge System will be decommissioned and another temporary decant system will be employed, which will involve pumping of water from the tailings pond to the PP through temporary pipelines. The temporary decant system will be decommissioned in the final weeks of pre-closure operations so that the desired closure pond is allowed to form (Figures 7 and 8). The Emergency Spillway and ditches will continue to operate normally.

7.2.3 Post-Closure

After Year 10, there is no further deposition in the TWRMF and the desired post-closure geometry of the facility will be achieved, which will consist of a conical shaped tailings beach with a central closure pond, as shown in Figures 7 and 8. The closure pond will increase in size due to precipitation and shrink due to evaporation. Evaporation rates will increase as the size of the pond increases, which will result in the closure pond reaching a steady-state size (essentially when precipitation equals evaporation). This process was modeled by performing a water balance of the post-closure TWRMF. The water balance is summarized in Figure 9, and a steady-state pond with surface area between approximately 21% and 50% of the total TWRMF area, resulting in a water cover thickness between 1.1 and 1.8 m above the PAG waste rock, as discussed in Section 5.7.4.

7.3 Effluent Quality

For the current TWRMF design (Wardrop, 2010), Victory Nickel evaluated the contaminant levels at the final PP effluent and at various other stages in the water management system (Victory Nickel, 2011). As the contaminant levels have not changed and the quantity of storm runoff being routed through the TWRMF has increased (due to increased catchment area), the trace contaminant levels projected at the various stages will be further diluted with the proposed TWRMF design.

8 Construction Considerations

8.1 Construction Requirements

Effective drainage of the TWRMF area as a pre-construction activity perhaps a year prior will facilitate construction. The removal of water will improve excavation operations and reduce the amount of material to be removed as ice. Once drainage has been implemented, the tree clearing which is required beneath the perimeter dam footprint can begin.

The existing drainage trench which was cut in the area of the open pit in March 2012 has proved very effective at this location. This ditching exercise demonstrated that ditches cut along the existing 1/500 land profile would provide effective drainage.

Excavation of muskeg and soft clay will be facilitated by a frozen surface during the winter months suggesting a January start. With these initial activities complete the fill placement activities can commence in the spring, summer and fall. The placement of frozen fill containing snow or ice within the dam structure will limit these winter operations.

8.2 Construction Staging

Access to the site is available along the access road to the dolomite bluff which will serve as a staging post for the TWRMF site. The TWRMF construction could start with the east wall of the TWRMF which abuts the east dolomite bluff.

8.2.1 Starter Dam – Pre-load Construction

The Pre-load/Starter Dam lift has to be sufficient to safely support equipment but is limited to a maximum of 1.0 m above original ground. Proof rolling of the Pre-load/Starter Dam lift is required to verify competent dam foundation conditions.

8.2.2 Ultimate Dam

Subsequent lifts of dolomite are to be placed in lifts of 0.5 to 1.0 m thickness and compacted to 95% of the Standard Proctor Maximum Dry Density (SPMDD). A field trial will be carried out during construction to verify compaction requirements and the optimal lift thickness. The construction schedule has been structured to allow for displacement and compression of the muskeg and clay foundation. This will allow for the necessary strength gain in the supporting clay before the construction of the ultimate dam. To optimize the consolidation times, the initial lifts of dolomite will be placed at the north dam, where the dam height is highest and clay thickness is greatest.

The construction quantities are included in Table 5.

8.3 Construction Schedule

The Pre-load/Starter Dam are scheduled to be constructed during the first year of mine development (Year -2) when dolomitic limestone will be available from overburden removal. The Ultimate Dam is scheduled to be constructed during the second year of mine development (Year -1) with the dolomite waste rock and clay overburden from the open pit. Direct disposal of the dolomite waste rock and clay overburden at the site of the TWRMF perimeter dam will minimize double handing of material.

The delivery of ultramafic PAG rock is schedule for the middle of Year -1, frac sand tailings at the end of Year -1 and nickel tailings at the end of Year 1. TWRMF site preparation and mine development will start approximately one year prior to the disposal of PAG ultramafic waste rock and 2 years prior to the deposition of nickel tailings.

A simplified construction schedule is shown in Figure C below. Construction quantities are shown in Table 5.

		Year -2				Year -1				Year 1				Year 2				Year 3			
Clay Production		🟨	🟨	🟨	🟨	🟨	🟨														
Dolomite Production				🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨			
Sandstone Production						🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	
Country Rock Production						🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨
PAG Waste Rock Production							🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨
Frac Sand Tailings Production									🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨
Mill Tailings Production												🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨	🟨
TWRMF Site Preparation		🟧	🟧																		
Doloimite Placement	Starter Dam / Pre-load		🟧	🟧	🟧																
Clay Placement	Starter Dam / Pre-load			🟧	🟧																
Doloimite Placement	Ultimate Dam						🟧	🟧	🟧												
Clay Placement	Ultimate Dam							🟧	🟧												
Polishing Pond Dolomite Placement			🟧	🟧	🟧																
Polishing Pond Clay Placement				🟧	🟧																

Figure C – Simplified TWRMF Construction Schedule

9 Monitoring and Surveillance

The following is a general list of monitoring and surveillance requirements during construction and operation of the TWRMF. An Operations, Maintenance, and Surveillance (OMS) Manual will be developed for the facility after the first stage of construction is complete.

- Daily monitoring of dyke for subsidence, cracking, and water flow, during construction.

- Regular surveying for as-build reporting, settlement identification and quantity measurements during construction.

- Monitor grain size distribution, bulk density and moisture content of all material used for dam construction or deposited in the TWRMF cells.

- Four cross sections instrumented with vibrating wire piezometers, thermistors, settlement plates and inclinometer casings will be included around the co-disposal facility to measure pore water pressure dissipation, temperature settlement and lateral deformation, during construction, operations, and closure.

- Environmental monitoring wells will be installed downstream of the TWRMF for future groundwater monitoring during operations and closure.

10 Closure Considerations

The goal of the proposed TWRMF closure concept is to encapsulate all PAG waste rock in saturated tailings and water at closure. This will be achieved by maintaining a permanent closure pond as shown in Figures 7 and 8. The closure pond will ensure saturation of the PAG waste rock and minimize ARD.

In addition, the following closure considerations will apply:

- The Decant Barge System will be decommissioned.
- Emergency spillway will remain in operation at closure, and will be designed to convey the design storm.
- Seepage collection ditches, ponds, and pump back systems will remain operational post closure.
- The tailings BAW is expected to retain moisture from closure pond which will minimize dusting.

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Tables

Table 1
Meteorological Data

Table 1a: Estimated Monthly Precipitation, Evaporation and Temperature at the Minago Site

Month	Mean Precipitation (mm)	Lake Evaporation (mm)	Mean Temperature (degrees Celsius)
January	20.2	0	-21.5
February	17.8	0	-17.3
March	22.4	0	-10.4
April	26.8	17.6	0.2
May	42.8	112	8.2
June	74.4	121	14.3
July	78.3	127	17.6
August	69.6	107	16.2
September	65.8	64.1	9.8
October	39	17.6	3
November	28.2	0	-8
December	25	0	-17.3
Annual	510	566	-0.4

Table 1b: Estimated Precipitation Data for Various Return Periods at the Minago Site

Return Period	Annual Precipitation (mm/yr)		24 hr Rainfall Event (mm)
	Wet Year	Dry Year	
5 year	577	446	67
10 year	610	410	79
20 year	637	380	89
50 year	666	346	102
100 year	686	323	111
200 year	703	301	120
500 year	724	275	132
1000 year	739	257	141

Source: Golder 2009a

Prepared By: MJV2
Checked By: MAN

Table 2
Tailings and Waste Rock Production Schedule (tonnes)

Unit (tonne)	Overburden	Dolomite	Country Rock	Mill (Ni) Production	Frac Sand Plant Production	Mill (Ni) Tailings to TWRMF	Frac Sand Tailings to TWRMF	Ultramafic (PAG) Waste Rock To TWRMF	Total Tailings to T&PAGWRM
Year - 2	6,600,000	29,653,000	0	0	0	0	0	0	0
Year - 1	2,685,000	41,066,000	3,389,000	0	285,000	0	68,000	2,026,000	68,000
Year 1		26,060,000	11,031,000	900,000	1,140,000	889,000	356,000	4,189,000	1,245,000
Year 2		13,928,000	12,465,000	3,600,000	1,140,000	3,555,000	356,000	5,896,000	3,911,000
Year 3		325,000	27,165,000	3,600,000	1,140,000	3,555,000	356,000	4,945,000	3,911,000
Year 4		0	27,200,000	3,600,000	1,140,000	3,555,000	356,000	4,100,000	3,911,000
Year 5		0	16,236,000	3,600,000	1,140,000	3,555,000	356,000	4,223,000	3,911,000
Year 6		0	11,043,000	3,600,000	1,140,000	3,555,000	356,000	5,218,000	3,911,000
Year 7		0	6,836,000	3,600,000	1,140,000	3,555,000	356,000	4,449,000	3,911,000
Year 8		0	786,000	3,600,000	1,140,000	3,555,000	356,000	613,0000	3,911,000
Year 9		0	0	3,600,000	1,140,000	3,555,000	356,000	0	3,911,000
Year 10		0	0	1,254,000	770,000	1,238,,000	240,000	0	1,478,000
Year 11		0	0	0	0	0	0	0	0
Total	9,285,000	111,032,000	116,147,000	30,954,000	11,315,000	30,567,000	3,512,000	35,659,000	34,079,000

Prepared by: JMH3
Checked by: JBH1

Table 3
Design Basis for the TWRMF

Item	Value
Life of TWRMF	10 years
Total Nickel Tailings (Tonnes)	30,567,000
Total Sand Tailings (Tonnes)	3,512,000
Total Combined Tailings to TWRMF (Tonnes)	34,079,000
Total PAG Waste Rock (tonnes)	35,569,000
Tailings Specific Gravity (Nickel)	2.6
Initial Tailings Void Ratio (Nickel)	1.0
Initial Tailings Density (Nickel)	1.30 t/m³
Average Final Tailings Density (Nickel)	1.46 t/m³
Tailings Pulp Density (solid weight) (Nickel)[1]	45%
Average Initial Tailings Density (Sand)	1.40 t/m³
Average Final Tailings Density (Sand)	1.60 t/m³
Tailings Pulp Density (solid weight) (Sand)	20%
Ultramafic Waste Specific Gravity	2.59
Ultramafic Waste Swelling	30%
Void Space in PAG Waste Rock	5,369,502 m³
Total Volume of Ni Tailings	20,807,560 m³
Total Volume of Sand Tailings	2,195,000 m³
Total Combined Tailings Volume	23,002,560 m³
Total PAG Waste Rock (solids and voids)	17,858,166 m³
Total Ni-Tailings Ingress into Voids of Ultramafic Waste Rock (at initial tailings density)[2]	3,221,701 m^3
Required TWRMF	37,679,199 m³
Required TWRMF Storage (with 15% contingency included)	43,331,079 m³

Prepared by: MJV2
Checked by: JPH3

Notes:

[1] A 45% tailings solids density is used in the current study. However, higher water-to-solids ratios to enhance transport into and through the rock fill are recommended for consideration in detailed engineering.

[2] It is assumed that 60% of the voids in the PAG ultramafic waste rock will be filled with tailings during co-disposal. The actual amount of tailings ingress into waste rock voids is dependent on the grain size of the PAG waste rock and the method of deposition. Sensitivity analysis should be carried out to assess the impact of varying levels of tailings ingress into the voids of the waste rock. During construction, field trails should be carried out to determine the actual amount of tailings migration into waste rock voids that can be achieved.

Table 4

Design Criteria for the TWRMF

Item	Target	Comments
1. Geotechnical Slope Stability Factor of Safety (F.O.S)		
♦ Construction (in stages)	♦ Static F.O.S. 1.3, pseudo static F.O.S 1.05.	
♦ Normal Operating	♦ Same as above.	
♦ Closure	♦ Static F.O.S. 1.5, pseudo static F.O.S 1.05.	
2. Seepage	♦ Target seepage volume of less than 50m^3/day[1].	♦ Analyses to be carried out using Geostudios SEEP/W software. ♦ Low permeability barrier to be provided on the upstream face of the containment structure to reduce seepage through ultramafic waste rock – tailing composite. ♦ Seepage from the TWRMF to be collected via collection ditches or ponds.
3. Hydro technical		
♦ Construction Diversion Peak Flow	♦ 1:20 yr - 24 hr rainfall	♦ All peak flows are estimated from catchment time of concentration and storm. Seepage to be collected via collection ditches or ponds reporting to the overall water management system
♦ Operation peak flow	♦ 1:200 yr – 24 hr rainfall	♦ Runoff to be segregated from seepage, with seepage reporting to the overall water management system.
♦ Closure Spillway and Diversion peak flow	**1:1000 yr – 24 hr rainfall**	♦ Determine wave run-up in the freeboard
♦ Freeboard	♦ 1.0 m on the top of Closure Spillway wet section for 1:200 year runoff ♦ 1.0 m operational freeboard	
♦ Closure Flood	♦ 1:1000 yr – 24 hr rainfall	
♦ Runoff Coefficient	♦ 1	♦ All runoff derived from precipitation falling on the TWRMF will report to the PP, via decant structure, emergency spillway, or seepage collection ditches and ponds.

Table 4 *(Continued)*

4. Polishing Pond		
♦ Water Storage	♦ Minimum seven days retention.	
5. Closure Cover	♦ A minimum of 0.5m of water in the permanent tailings pond at closure, a minimum of 1.0m of saturated tailings and water over PAG waste rock at all times.	♦ Consider runoff (dry year), seepage, infiltration and evaporation to ensure a minimum thickness water cover.
6. Seismicity		
♦ Operating Design Basis Earthquake	♦ 1: 475 year return	
♦ Closure Earthquake	♦ 1:2,475 year return	

Prepared by: MJV2
Checked by: JBH1

Note:

[1] Seepage target rate was selected by Foth based on the results of seeepage sensitivity analysis.

Table 5
TWRMF Construction and Deposition Schedule

Operating Period	Duration (years)	TWRMF Operating Phase	Dolomite Placement		Compacted Clay Placement		Frac Sand Tailings Deposition		Nickel Tailings Deposition		PAG Waste Rock Deposition	
			Quantity (M-m^3)	Location	Quantity (M-m^3)	Location	Quantity (M-m^3)	Location	Quantity (M-m^3)	Location	Quantity (M-m^3)	Location
Year -2	1	Starter Dam / Pre-load Construction	1.3	TWRMF Dams	0.1	TWRMF Dams	-	-	-	-	-	-
			0.3	Polishing Pond Dams	0.05	Polishing Pond Dams	-	-	-	-	-	-
Year -1	1	Ultimate Dam Construction	1.9	TWRMF Dams	0.2	TWRMF Dams	0.04	Decant Cell	-	-	1.0	Divider Dyke and Separation Dyke
Year 1	1	Operations	-	-	-	-	0.3	Decant Cell	0.6	East Cell	2.1	West Cell
Year 2 to Year 3	2	Operations	-	-	-	-	0.4	Decant Cell	4.8	Alternating between East and West Cells	5.5	Alternating between East and West Cells
Year 4 to Year 6	3	Operations	-	-	-	-	0.7	Decant Cell	7.3	Alternating between East and West Cells	6.8	Alternating between East and West Cells
Year 7 to Year 8	2	Operations / Closure	-	-	-	-	0.4	Tailings Cover	4.8	Tailings Cover	2.5	Decant Cell
Year 9 to Year 10	2	Operations / Closure		-	-	-	0.4	Tailings Cover	3.3	Tailings Cover	-	-
		Total	3.5		0.35		2.2	-	20.8	-	17.9	-

Prepared by: MJV2
Checked by: JBH1

Table 6

TWRMF Water Balance for Sizing of Polishing Pond

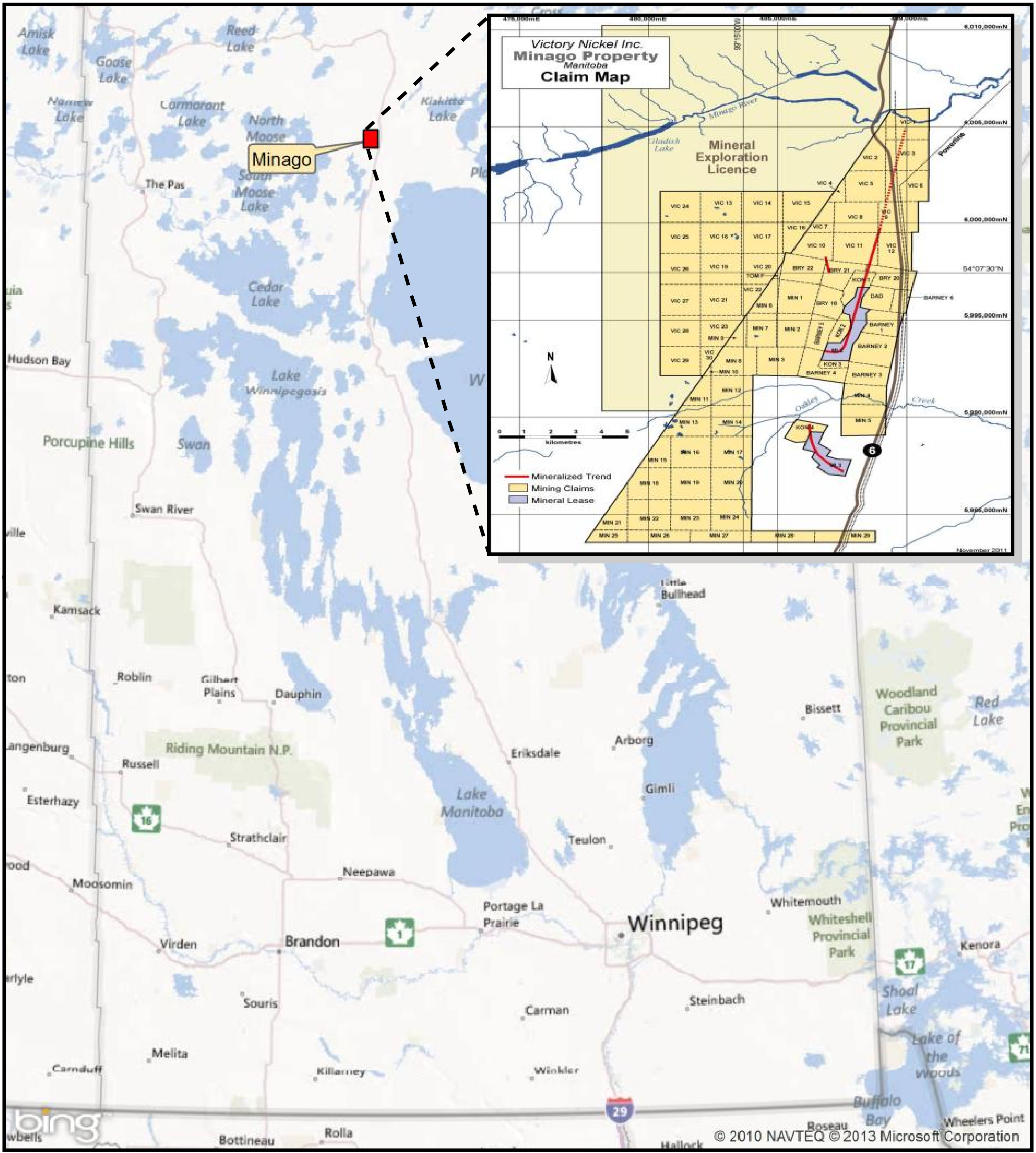
Period	TWRMF Water Inputs[1]			Water Retained in / Lost from TWRMF			Water Discharged to Polishing Pond from TWRMF		
	Flow	Quantiy (m^3/day)	Reference	Flow	Quantiy (m^3/day)	Reference	Flow	Quantiy (m^3/day)	Reference
May	Water from Mill Tailings	12,072	Victory Nickel, 2013	Water Retained in Voids of Tailings and Waste Rock	1,467	Victory Nickel, 2013	Water from Open Pit Dewatering Wells	32,000	Victory Nickel, 2013
	Water from Frac Sand Plant	2,892	Victory Nickel, 2013	Evaporation[2]	10,748	Golder, 2009a	Water from Open Pit	8,000	Victory Nickel, 2013
	Water from Frac Sand Tailings	772	Victory Nickel, 2013				Water from TWRMF[5]	27,532	(24,627-12,215+15,121)
	Water from Sewage Treatment Plant	676	Victory Nickel, 2013						
	Precipitation	8,215	Golder, 2009a						
	May Total TWRMF Inputs	24,627	(sum)	May Total Retained / Lost	12,215	(sum)	May Total PP Inputs	67,532	(sum)
Jun-Oct	Water from Mill Tailings	12,072	Victory Nickel, 2013	Water Retained in Voids of Tailings and Waste Rock	1,467	Victory Nickel, 2013	Water from Open Pit Dewatering Wells	32,000	Victory Nickel, 2013
	Water from Frac Sand Plant	2,892	Victory Nickel, 2013	Evaporation[2]	8,436	Golder, 2009a	Water from Open Pit	8,000	Victory Nickel, 2013
	Water from Frac Sand Tailings	772	Victory Nickel, 2013				Water from TWRMF	18,574	(28,477-9,903)
	Water from Sewage Treatment Plant	103	Victory Nickel, 2013						
	Precipitation	12,638	Golder, 2009a						
	Jun-Oct Total TWRMF Inputs	28,477	(sum)	Jun-Oct Total Retained / Lost	9,903	(sum)	Jun-Oct Total PP Input	58,574	(sum)
Nov-Apr	Water from Mill Tailings	12,072	Victory Nickel, 2013	Water Retained in Voids of Tailings and Waste Rock	1,467	Victory Nickel, 2013	Water from Open Pit Dewatering Wells	32,000	Victory Nickel, 2013
	Water from Frac Sand Plant	2,892	Victory Nickel, 2013	Sublimation[3] + Evaporation[2]	2,109	Golder, 2009a	Water from Open Pit	8,000	Victory Nickel, 2013
	Water from Frac Sand Tailings	772	Victory Nickel, 2013	Water Entrapped in Ice[4]	15,121	(20377-1467-2109)*0.9	Water from TWRMF	1,680	(20,377-18,697)
	Water from Sewage Treatment Plant	0	Victory Nickel, 2013						
	Precipitation	4,641	Golder, 2009a						
	Nov-Apr Total TWRMF Inputs	20,377	(sum)	Nov-Apr Total Retained / Lost	18,697	(sum)	Nov-Apr Total PP Input	41,680	(sum)

Notes:

1. TWRMF Water Inputs do not include seepage collection return water which will vary over the life of the mine untill it reaches a maximum of approximately 23 m^3/d at closure (Appendix C).
2. Evaporation rates from the TWRMF are assumed to be 50% of the lake evaporation measured for big lakes in the vicinity of the Minago Project. Lake evaporation rates are based on Golder, 2009a.
3. Sublimation rates are assumed to be 39% of annual snowfall (Golder, 2009a).
4. It is assumed that 90% of the supernatant water in the TWRMF remains entrapped in ice during the winter months.
5. Includes water entrapped in ice in the TWRMF during the winter months.

Prepared By: MJV2
Checked By: MAN

Figures



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Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION

CHECKED BY: MJV2 DATE: JUL. '13
APPROVED BY: SVD1 DATE: JUL. '13
APPROVED BY: DATE:

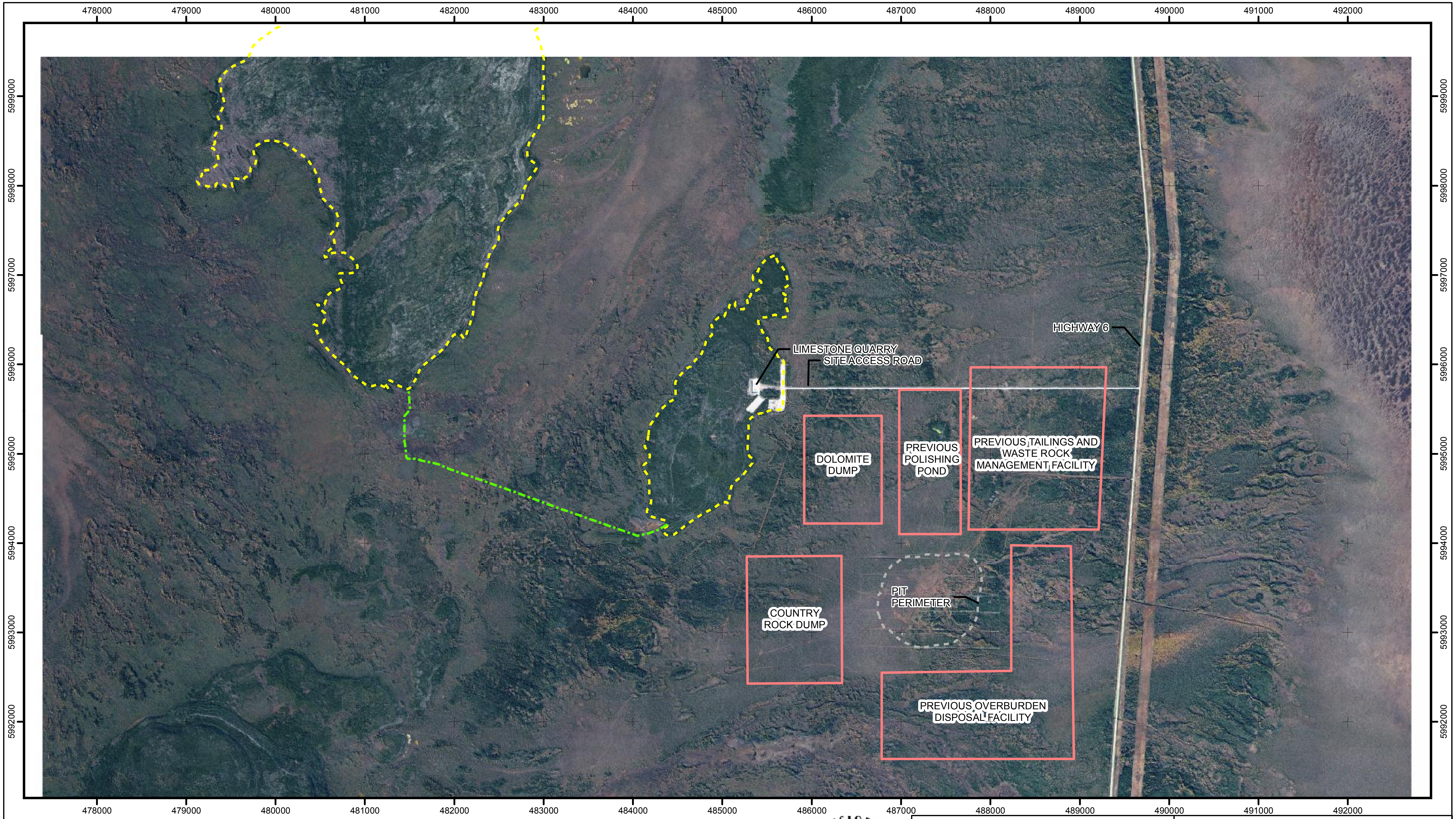
VICTORY NICKEL INC.

FIGURE 1

SITE LOCATION

Scale: 0 40 80 Km
Date: JULY 2013
Prepared by: DAT
Project No: 11V777

Path: X:\GB\IE\2011\11V777\GIS\mxd\July2013\Figure 1.mxd Date: 7/15/2013



NOTES

1. Digital orthophoto imagery provided by Victory Nickel. Reference to Survey Data (ATLIS in 2011)
2. Horizontal datum based on WGS 1984. Horizontal coordinates based on WGS 84 UTM Zone 14N.
3. All dimensions and coordinates are approximate and are shown in meters unless otherwise noted.

LEGEND

- Trails
- Outcrop (Aerial Photo Interpretation)
- Previous Facility Boundary
- Pit Boundary

0 400 800 1,200 Meters

N

VICTORY NICKEL INC. 2007 Ni

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REVISED	DATE	BY	DESCRIPTION
1	JAN. '12	AZ	SCOPE CHANGE

CHECKED BY: MJV2 DATE: JUL. '13
APPROVED BY: SVD1 DATE: JUL. '13
APPROVED BY: DATE:

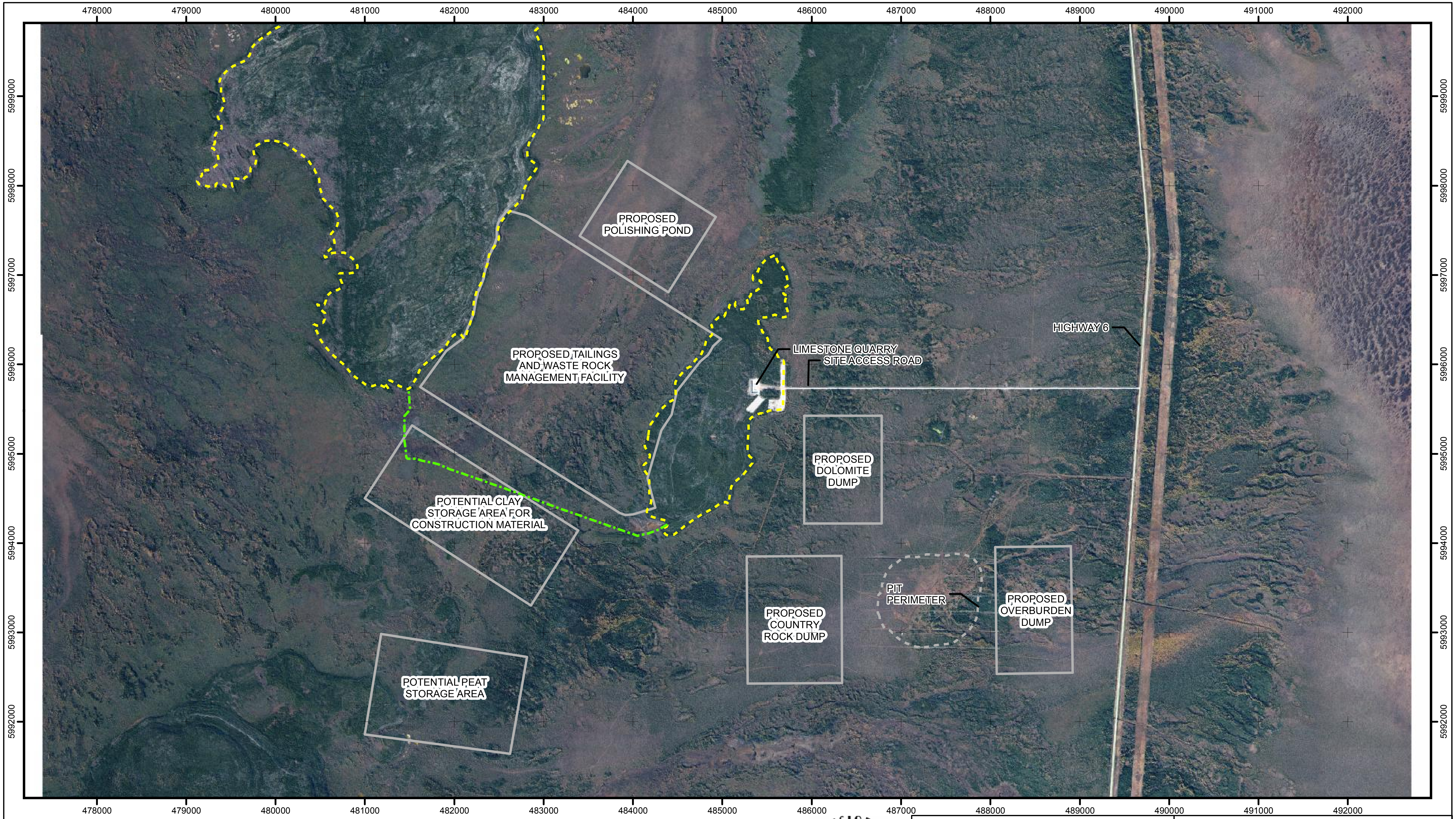
VICTORY NICKEL INC.

FIGURE 2

PREVIOUS GENERAL SITE PLAN

Scale:	AS SHOWN	Date:	AUGUST 2013
Prepared by:	DAT	Project No:	11V777

Path: X:\GB\IE\2011\11V777\GIS\mxd\August2013\Figure 2.mxd Date: 8/26/2013



NOTES

1. Digital orthophoto imagery provided by Victory Nickel.
   Reference to Survey Data (ATLIS in 2011)
2. Horizontal datum based on WGS 1984.
   Horizontal coordinates based on WGS 84 UTM Zone 14N.
3. All dimensions and coordinates are approximate and are shown in meters unless otherwise noted.

LEGEND

- Trails
- Outcrop (Aerial Photo Interpretation)
- Pit Boundary
- Proposed Facility Boundary

Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION
1	JAN. '12	AZ	SCOPE CHANGE

CHECKED BY: MJV2 DATE: JUL. '13
APPROVED BY: SVD1 DATE: JUL. '13
APPROVED BY: DATE:

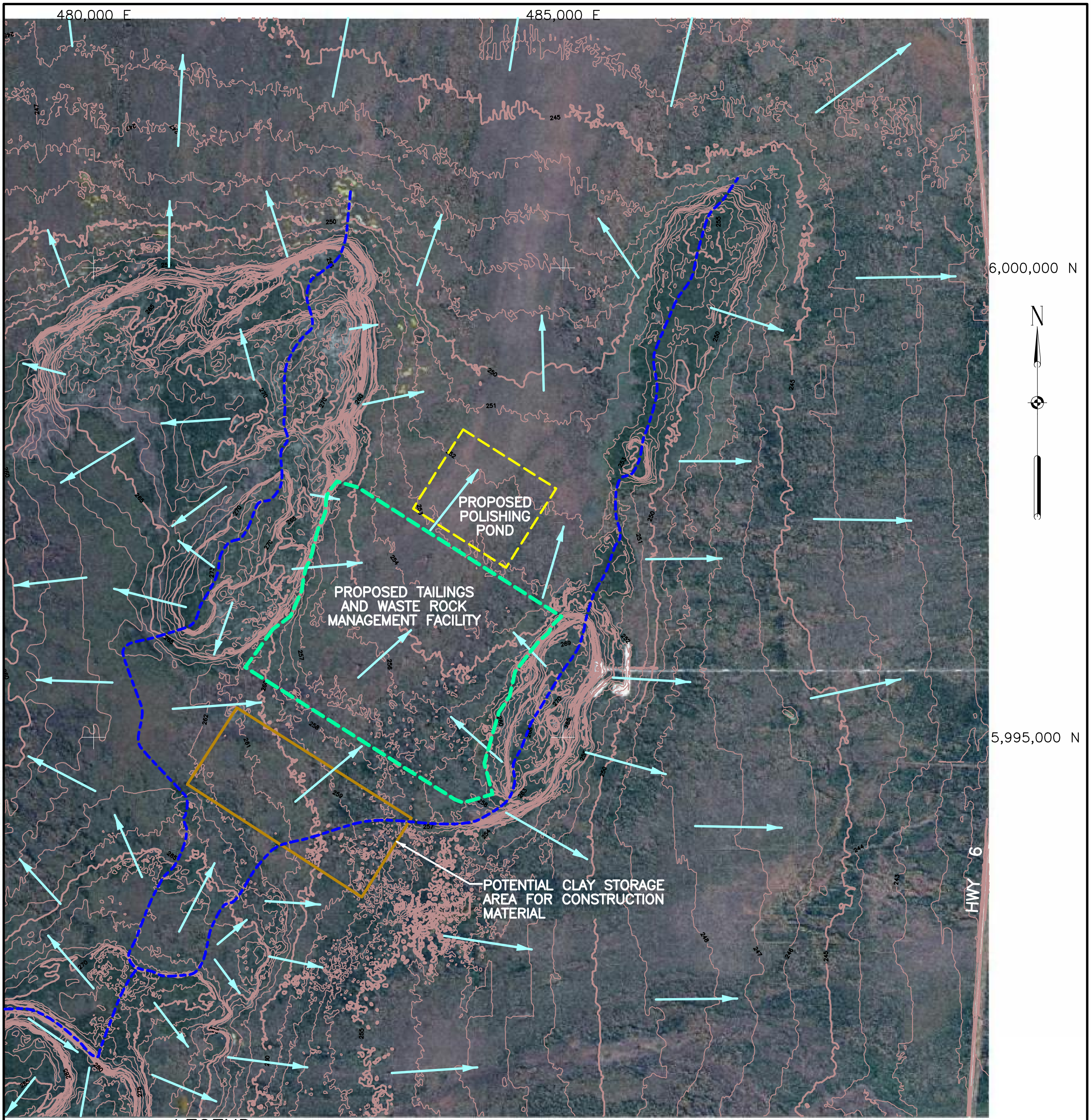
VICTORY NICKEL INC.

FIGURE 3

GENERAL SITE PLAN

Scale: AS SHOWN
Date: AUGUST 2013
Prepared by: DAT
Project No: 11V777

Path: X:\GB\IE\2011\11V777\GIS\mxd\August2013\Figure 3.mxd Date: 8/28/2013



LEGEND

- 250 EXISTING CONTOUR
- SUB–WATERSHED DIVIDE
- FLOW DIRECTION

VICTORY NICKEL INC.
2007 Ni

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Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION

CHECKED BY: JSL/MRV2 DATE: JULY '13
APPROVED BY: DATE:
APPROVED BY: DATE:

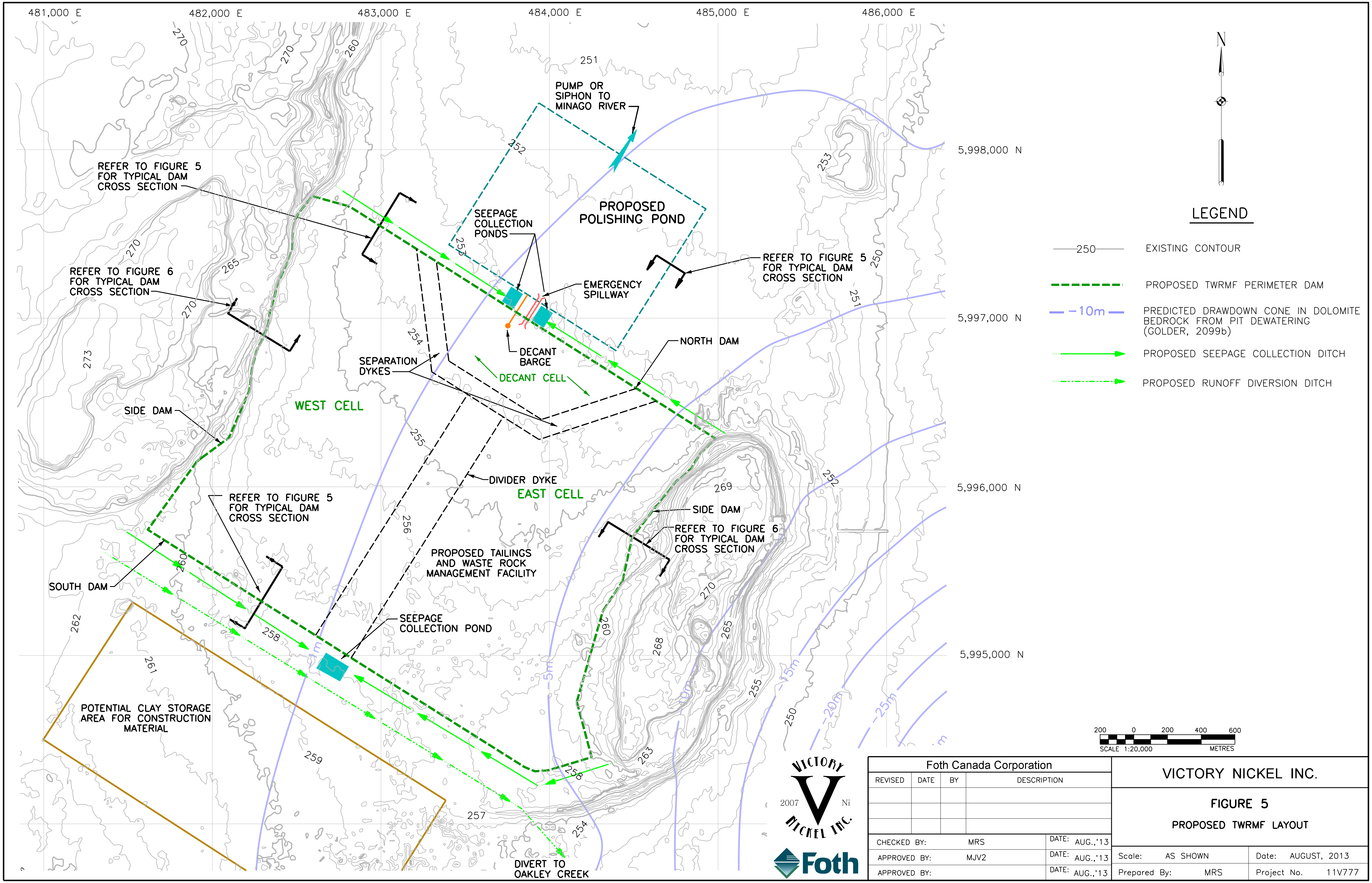
VICTORY NICKEL INC.

FIGURE 4

SITE TOPOGRAPHY AND DRAINAGE

Scale: 0 750m 1,500m
Date: AUGUST, 2013
Prepared By: JOW
Project No. 11V777

X:\GB\IE\2011\11V777\cad\figures\August 2013 revision\FIGURE 4 existing conditions.dgn
8/28/2013 JOW



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REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	MRS	DATE:	AUG.,'13
APPROVED BY:	MJV2	DATE:	AUG.,'13
APPROVED BY:		DATE:	AUG.,'13

VICTORY NICKEL INC.

FIGURE 5

PROPOSED TWRMF LAYOUT

Scale:	AS SHOWN	Date:	AUGUST, 2013
Prepared By:	MRS	Project No.	11V777

X:\GB\IE\2011\11V777\cad\figures\August 2013 revision\FIGURE 5 twrmf layout.dgn
8/28/2013 bjwl

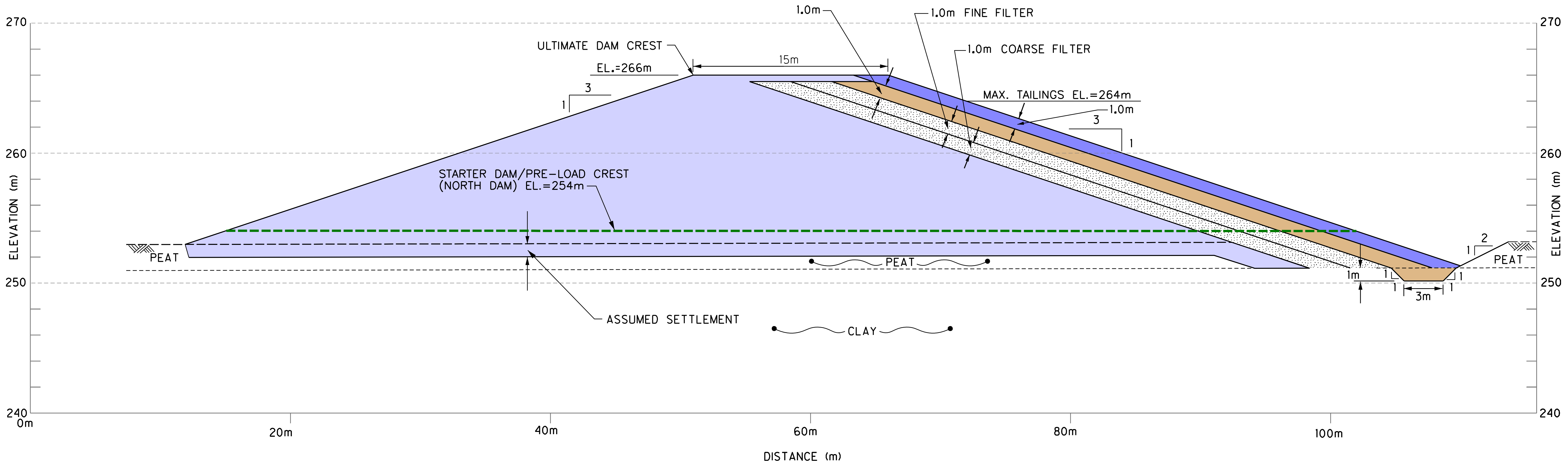
LEGEND

🟫 COMPACTED CLAY

⬜ COMPACTED ROCK FILL

🟦 MISCELLANEOUS ROCK FILL

▨ FILTER MATERIAL



SCALE 1:300 METRES

NOTES:

1. PEAT DISPLACEMENT/SETTLEMENT IS ASSUMED TO BE 50% OF THE ORIGINAL PEAT THICKNESS.
2. TYPICAL DAM CROSS SECTIONS FOR THE SOUTH DAM AND POLISHING POND DAM WILL BE SIMILAR BUT SHORTER.
3. FILTER MATERIAL SHALL BE USED AS BEDDING AROUND THE DECANT PIPE.

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CHECKED BY: MRS DATE: AUG.,'13
APPROVED BY: MJV2 DATE: AUG.,'13
APPROVED BY: DATE: AUG.,'13

VICTORY NICKEL INC.

FIGURE 6

TYPICAL NORTH DAM CROSS SECTION

Scale: AS SHOWN
Date: AUGUST, 2013
Prepared By: MRS
Project No. 11V777

X:\GB\IE\2011\11V777\cad\figures\August 2013 revision\FIGURE 6 north dam cross section.dgn
8/28/2013 bjwl

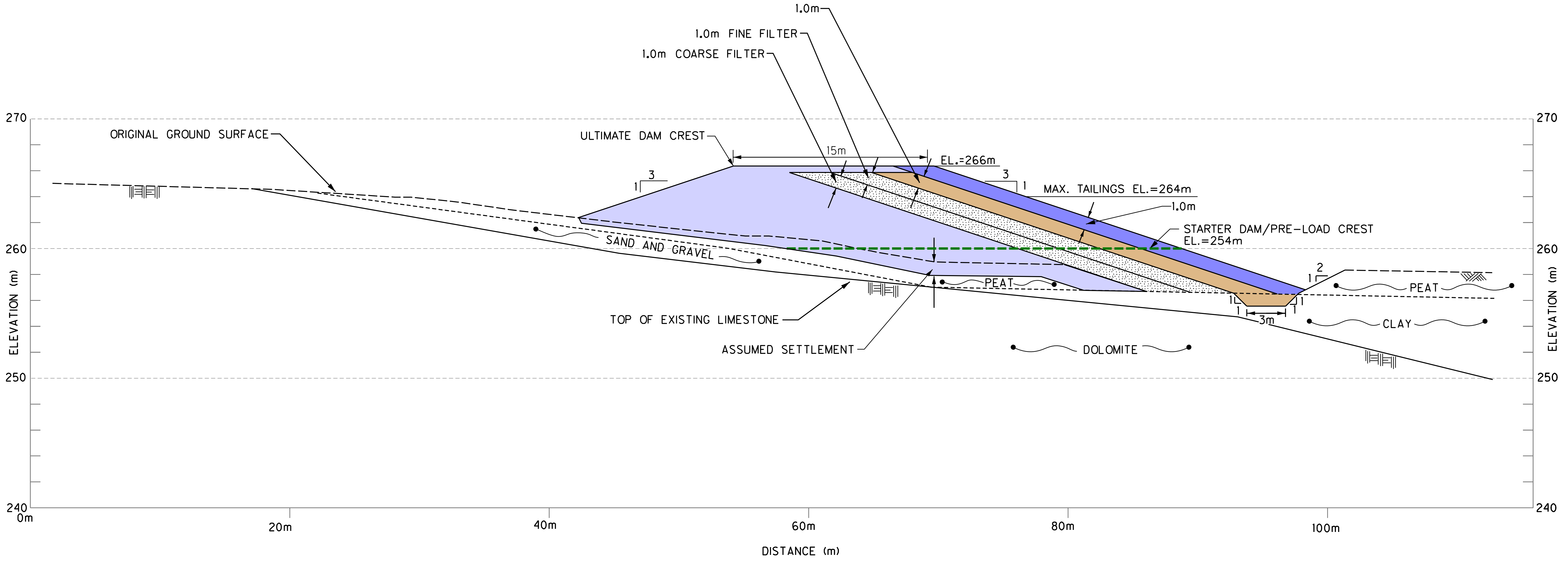
LEGEND

🟫 COMPACTED CLAY

⬜ COMPACTED ROCK FILL

🟦 MISCELLANEOUS ROCK FILL

▨ FILTER MATERIAL



3 0 3 6 9

SCALE 1:300 METRES

NOTES:

1. PEAT DISPLACEMENT/SETTLEMENT IS ASSUMED TO BE 50% OF THE ORIGINAL PEAT THICKNESS.
2. TYPICAL SIDE CROSS SECTIONS ARE ASSUMED TO BE SIMILAR ON EITHER SIDE OF THE TWRMF.

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CHECKED BY: MRS DATE: AUG.,'13
APPROVED BY: MJV2 DATE: AUG.,'13
APPROVED BY: DATE: AUG.,'13

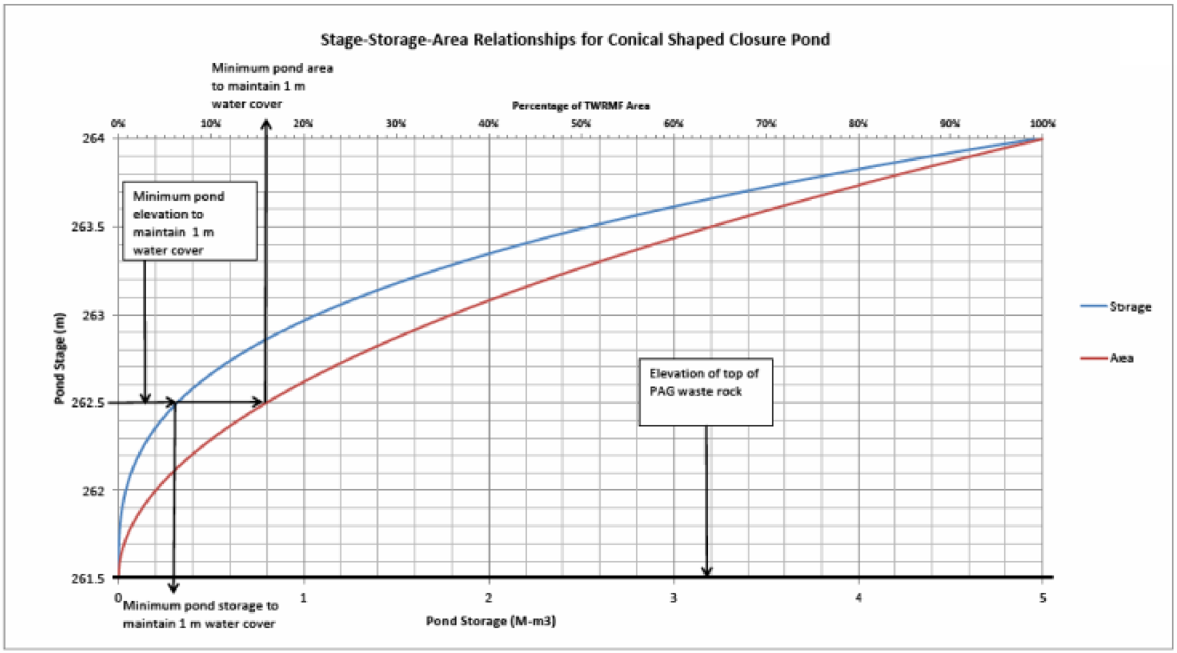
VICTORY NICKEL INC.

FIGURE 7

TYPICAL SIDE DAM CROSS SECTION

Scale: AS SHOWN
Date: AUGUST, 2013
Prepared By: MRS
Project No. 11V777

X:\GB\IE\2011\11V777\cad\figures\August 2013 revision\FIGURE 7 side dam cross section.dgn
8/28/2013 bjwl

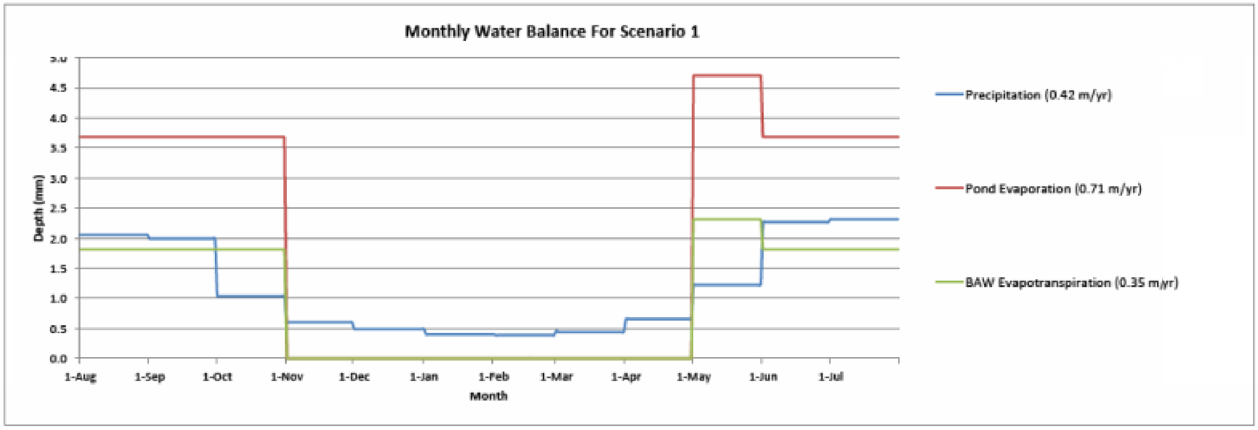


Closure Pond Water Balance Results

Scenario	Net Precipitation[1] (m/yr)		Pond Evaporation Rate[2] (m/yr)	BAW Evapotranspiration Rate[3] (m/yr)	Pond Size (% of Total TWRMF Area)	Pond Surface Elevation (m)	Water Cover Thickness Above Top of PAG Waste Rock (m)	Comment
1	0.424	mean	0.71	0.35	21%	262.6	1.1	Long-term steady state pond size
2	0.288	100-yr dry year	0.71	0.35	12%	262.4	0.9	After 1 year dry event, beginning with : 21% pond area.
3	0.424	mean	0.71	0.25	39%	263	1.5	Long-term steady state pond size
4	0.288	100-yr dry year	0.71	0.25	29%	262.8	1.3	After 1 year dry event, beginning with : 39% pond area.
5	0.424	mean	0.71	0.15	50%	263.3	1.8	Long-term steady state pond size
6	0.288	100-yr dry year	0.71	0.15	40%	263.1	1.6	After 1 year dry event, beginning with : 50% pond area,

Notes:

1. Net precipitation is equal to the total annual precipitiation minus sublimation (Golder 2009a). The monthly distribution of precipitation shown in Table 1 of this report was considered in the water balance.
2. Pond evaporation rate is assumed to be equal to the pan evaporation rate estimated to be 710 mm/yr (Golder 2009a). The monthly distribution of evaporation rates was considered in the water balance, and was based on the ratios shown for lake evaporation rates in Table 1 of this report.
3. "BAW" refers to the tailings 'Beach Above Water'. Evapotranspiration estimates at the Minago site range from 338 mm/yr (Golder 2009a) to as much as 400mm/yr (EMRC, 1995). Actual evapotranspiration rates for the TWRMF BAW are expected to be lower, due to the presence of an unsaturated tailings barrier and minimal vegetation growth. The monthly distribution of the evapotranspiration rates was considered in water balance, and was based on the ratios shown for lake evaporation lakes in Table 1 of this report.
4. A tailings porosity of 0.3 has been assumed in the water balance.
5. A seepage rate of 30 m^3/day has been assumed in the water balance.



VICTORY 2007 Ni NICKEL INC.

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REVISED	DATE	BY	DESCRIPTION

CHECKED BY: MJV2 DATE: AUG.,'13
APPROVED BY: MJV2 DATE: AUG.,'13
APPROVED BY: DATE: AUG.,'13

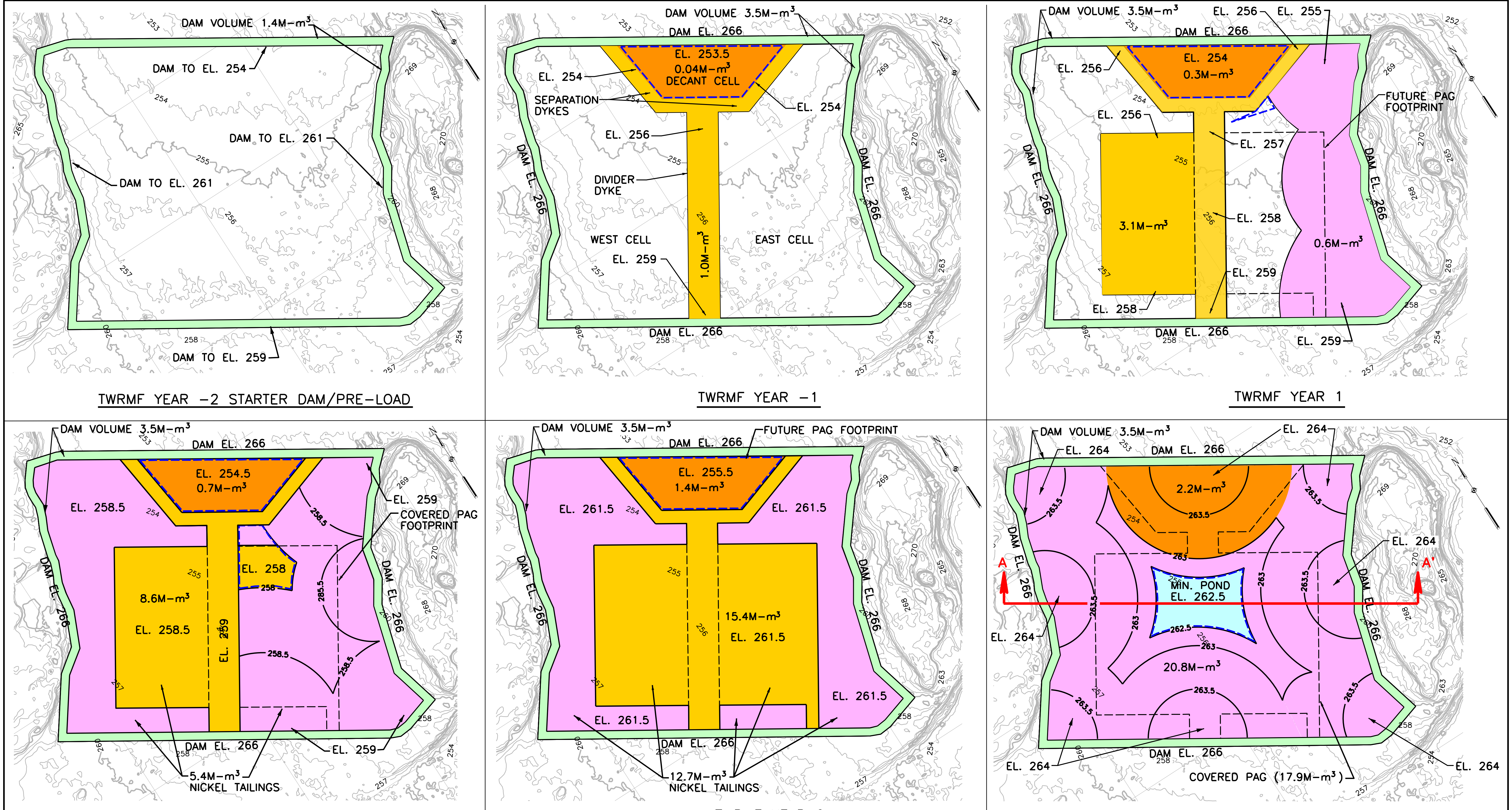
VICTORY NICKEL INC.

FIGURE 8

CLOSURE POND DETAILS
AND WATER BALANCE RESULTS

Scale: NOT TO SCALE
Date: AUGUST, 2013
Prepared By: MRS
Project No. 11V777

X:\GB\IE\2011\11V777\cad\figures\August 2013 revision\FIGURE 8 closure pond detail.dgn
8/28/2013 bjwl



TWRMF YEAR -2 STARTER DAM/PRE-LOAD

TWRMF YEAR -1

TWRMF YEAR 1

TWRMF YEAR 3

TWRMF YEAR 6

TWRMF YEAR 10 – CLOSURE

LEGEND

- — 250 — EXISTING CONTOUR
- 🟩 DOLOMITE WASTE ROCK
- 🟪 NICKEL TAILINGS
- 🟨 PAG WASTE ROCK
- 🟧 FRAC SAND TAILINGS
- - - - POND

NOTES:
1. PEAT SETTLEMENT IS ASSUMED TO BE 50% OF THE ORIGINAL PEAT THICKNESS.
2. NICKEL AND FRAC SAND TAILINGS WILL BE DEPOSITED AS TWO SEPARATE WASTE STREAMS, BUT THEY DO NOT REQUIRE SEPARATE DISPOSAL AREAS AS THE FIGURE MAY SUGGEST.
3. REFER TO FIGURE 8 FOR SECTION A-A'.

300 0 300 600 900
SCALE 1:30,000 METRES

Foth Canada Corporation						
REVISED	DATE	BY	DESCRIPTION			
CHECKED BY:		MRS		DATE:	AUG.,'13	
APPROVED BY:		MJV2		DATE:	AUG.,'13	
APPROVED BY:				DATE:	AUG.,'13	

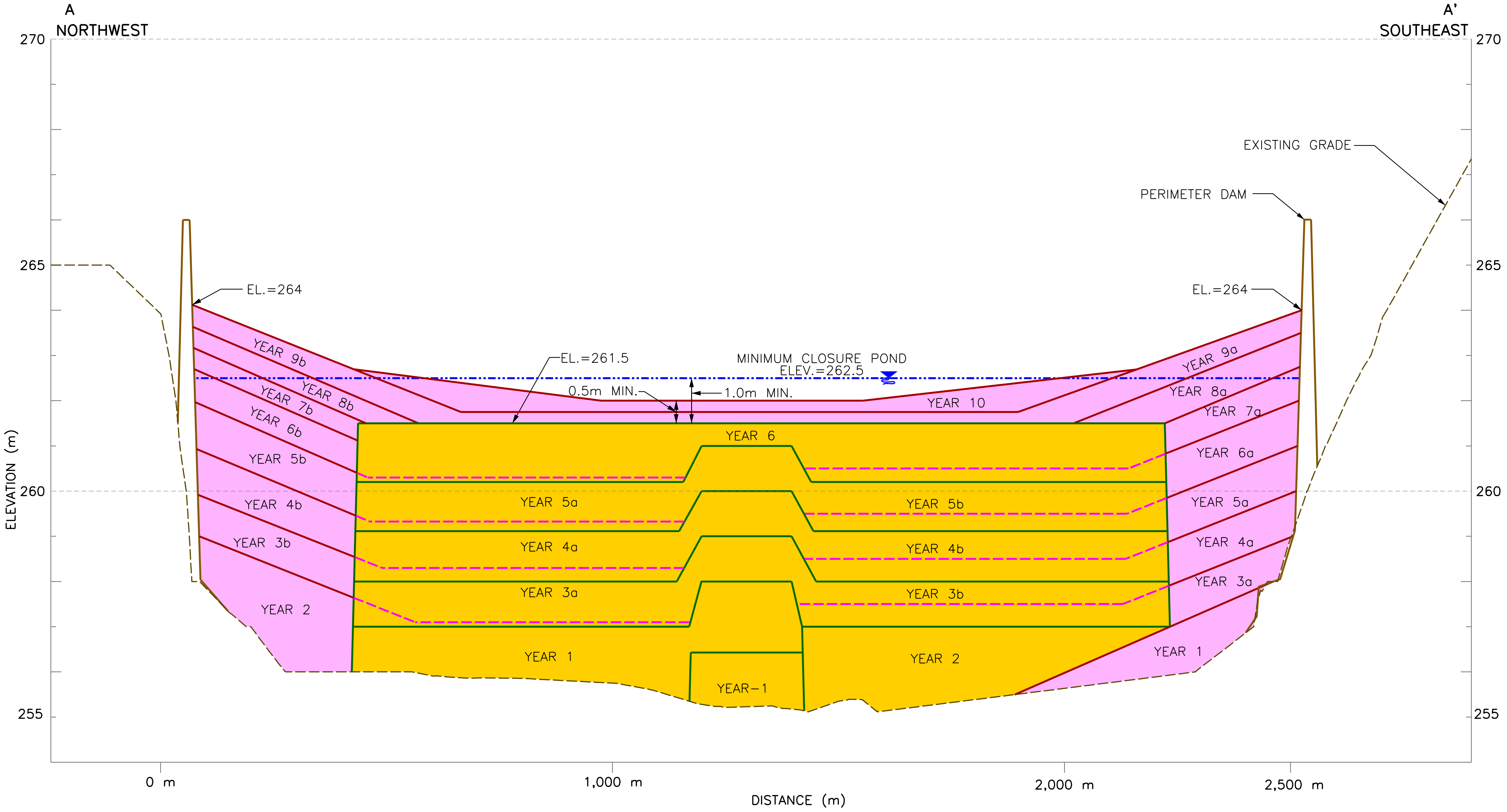
VICTORY NICKEL INC.

FIGURE 9

SCHEMATIC TWRMF DEPOSITION PLAN

Scale: AS SHOWN
Date: AUGUST, 2013
Prepared By: MRS
Project No. 11V777

X:\GB\IE\2011\11V777\cad\figures\August 2013 revision\FIGURE 9 DEPOSITION PLAN.dgn
8/28/2013 bjwl



LEGEND

🟨 PAG WASTE ROCK

🟪 NICKEL TAILINGS

- - - - DEPOSITED TAILINGS SURFACE THAT IS COVERED BY PAG WASTE ROCK

NOTES:

1. "YEAR 3a" AND "YEAR 3b" REFER TO THE FIRST AND SECOND HALVES OF YEAR 3, RESPECTIVELY.
2. A TAILINGS DEPOSITION SLOPE OF 0.5% HAS BEEN ASSUMED. FLATTER OVERALL SLOPES SUCH AS THOSE SHOWN IN YEAR 10 CAN BE ACHIEVED USING TRESTLES.
3. TAILINGS SURFACES THAT APPEAR HORIZONTAL ARE DEPOSITED FROM THE SOUTHWEST (SOUTH DAM).
4. FINAL QUANTITIES OF PAG WASTE ROCK ARE PRODUCED IN YEARS 7 AND 8 AND WILL BE DEPOSITED IN THE DECANT CELL (TABLE 5).
5. REFER TO FIGURE 7 FOR THE CROSS SECTION LOCATION.

1 0 1 2 3
VERTICAL SCALE 1:100 METRES

100 0 100 200 300
HORIZONTAL SCALE 1:10,000 METRES

Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION

CHECKED BY: MRS DATE: AUG.,'13
APPROVED BY: MJV2 DATE: AUG.,'13
APPROVED BY: DATE: AUG.,'13

VICTORY NICKEL INC.

FIGURE 10
SCHEMATIC SECTION A-A'
TWRMF AT CLOSURE

Scale: AS SHOWN
Date: AUGUST, 2013
Prepared By: MRS
Project No. 11V777

X:\GB\IE\2011\11V777\cad\figures\August 2013 revision\FIGURE 10 cross section.dgn
8/28/2013 bjwl

Appendix A

Geotechnical Investigation Factual Report

Report

Geotechnical Investigation Factual Report

Minago Nickel Mine

Project I.D.: 11V777

Victory Nickel Inc.
Toronto, Ontario

August 2013

Geotechnical Investigation Factual Report
Minago Nickel Mine

Distribution

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Geotechnical Investigation Factual Report
Minago Nickel Mine

Project ID: 11V777

Prepared for
Victory Nickel Inc.
Toronto, Ontario

Prepared by
Foth Canada Corporation

August 2013

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Geotechnical Investigation Factual Report
Minago Nickel Mine

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List of Abbreviations, Acronyms, and Symbols

Cc	compression index
cm/s	centimeters per second
CU	Consolidated Undrained
Foth	Foth Canada Corporation
ASTM	American Society for Testing and Materials
Golder	Golder Associates Ltd.
FI	Fracture Indices
ISRM	International Society for Rock Mechanics
km	kilometer
mm	millimeter
O.D.	outer diameter
PP	Polishing Pond
PVC	polyvinyl chloride
RQD	Rock Quality Designation
SCR	Solid Core Recovery
Site	Minago Site
SPT	Standard Penetration Tests
TCR	Total Core Recovery
TWRMF	Tailings and Waste Rock Management Facility
USCS	Unified Soil Classification System
yr	year

1 Overview

1.1 Introduction

Foth Canada Corporation (Foth) conducted geotechnical site investigations known as Phase 1 and Phase 2 during January and March 2012, respectively. These investigations were conducted in an area of additional recent land lease purchase that was unavailable during the previous 2010 Feasibility Study (Wardrop, 2010). The scope of this work comprises the compilation of the Factual Data pertaining to the 2012 investigations and the subsequent Material Testing by Golder Associates Ltd. (Golder).

The Phase 1 site investigation program included geotechnical drilling, performing in-situ tests, installation of monitoring wells, and soil sampling for laboratory testing. The Phase 2 site investigation involved test pit and trench excavations with a specific focus on characterizing the bedrock topography in the overburden areas bordering bedrock outcrops proposed for the containment structures. The results of these geotechnical investigations are used to define the geotechnical profile including the overburden soils, the upper dolomite bedrock, as well as groundwater conditions in the area of investigation.

1.2 Project Description

The Minago Site (Site) is located in Manitoba's Thompson Nickel Belt on Highway 6, approximated 225 kilometer (km) south of Thompson Manitoba, Canada (Figure 1). It is situated within a water-saturated peat terrain, a topographically low area with isolated bedrock outcrop "islands" (Figure 2). The previous Geotechnical Investigation work by Wardrop in 2007 and 2008 focused on an area to the east of the 2012 investigation, on the other side of a limestone bluff (Wardrop, 2010). Because of the discovery of mineral resources below the current Tailings and Waste Rock Management Facility (TWRMF), an alternative site to the west of the limestone bluff was investigated.

The structures which are to be relocated to the proposed site comprise:

- The TWRMF to store some 44 million cubic meters of rock and tailings.
- The associated Polishing Pond (PP) designed to receive effluent from the TWRMF.

The TWRMF and PP are proposed to occupy a long, narrow water-saturated muskeg/peat wetland with some forested areas approximately 4 km northwest of the proposed pit. This lowland extends approximately 8 km from the southwest to the northeast and is bound on the east and west by sub-parallel dolomite bedrock ridges, approximately 2.5 km apart. The ridges rise nearly 20 meters above the wetland valley that slopes gently (approximately 0.2%), but consistently to the north-northeast. The proposed TWRMF and PP structures would be situated between the ridges, and along the lowland.

2 Background Information

2.1 Site Geology

The relevant units of the stratigraphic column are the unconsolidated Quaternary to Recent overburden of the Manitoba Plain, which in this area includes an uppermost peat horizon overlying stratified clay horizons with a clastic base and the underlying upper Ordovician dolomite bedrock.

2.2 Site Hydrology and Drainage

Regionally the project site is located within the Nelson River sub-basin, which contains the Minago River, Hargrave River, and William River with the Oakley Creek tributaries. The catchments of these three rivers are within the Lake Winnipeg basin, which ultimately drains northward into Hudson Bay. Within a 30 km radius of the project site there are several small-to-medium sized surface water bodies, including Limestone Bay, which forms the northeastern end of Lake Winnipeg.

The Minago and Hargrave Rivers flows in the northeast direction into Cross Lake, before reaching the Nelson River. The Oakley Creek flows in the southeast direction into the William River. The William River flows from William Lake in the northeast direction until reaching about 20 km downstream of Highway 6, where it turns 90 degrees to the southeast direction, draining into Limestone Bay (part of Lake Winnipeg).

Annual precipitation is approximately 510 millimeter (mm), with approximately 40 mm consumed as sublimation during the winter. Evaporation from open water surfaces is estimated at approximately 560 mm/year (yr). Golder (2009) estimated average runoff from the overall area at approximately 117 mm/yr based on precipitation and stream gauging records. Recharge and evaporation in muskeg areas has not been directly measured.

Areas on the dolomite ridges will produce surface water runoff that will report towards the area under consideration. Inferred groundwater flow direction is north to northeast towards the Minago River. Although this will reflect pre-construction and post-closure conditions at the Minago project, open pit dewatering during site preparations and operations may have an impact on the groundwater flow patterns. Further evaluations may be required to allow regulatorsto establish monitoring requirements in relation to the compliance point, where water is discharged from the PP to the environment.

3 Geotechnical Investigation

3.1 Previous Investigations

The subsurface conditions in the vicinity of the deposit were investigated during the winter months of 2007 and 2008 under the supervision of Wardrop (Wardrop, 2010). For these investigations by Wardrop, a total 90 boreholes were drilled and 8 test pits were excavated (Figure 3). Additional test pits were excavated by Victory Nickel in 2011. The locations of the 2011 test pits are shown on Figure 3 and the results are shown in Appendix A. Since the current investigation is some five km from the area of the original investigations, that information is not presented with this Factual Report.

3.2 Current Investigations

The subsurface conditions in the vicinity of the proposed TWRMF and PP were investigated during the winter months, January and March of 2012. This field work was supervised on a full-time basis by Foth's field representative who observed drilling, excavating, sampling, and in-situ testing procedures.

The drilling was completed using an Acker Soil Sentry track-mounted hydraulic rig equipped with a 125 mm diameter solid/hollow stem continuous flights auger operated by Paddock Drilling Ltd. of Winnipeg, Manitoba. Samples from the upper 3.5 meters of soil were recovered at 0.76 meter intervals using a 50 mm outer diameter (O.D.) split-spoon sampler by conducting Standard Penetration Tests (SPT) in accordance with the procedures outlined in the American Society for Testing and Materials (ASTM) Specification D1586. Below this depth of 3.5 m, the soil samples were recovered at 1.52 meter intervals until refusal to auguring. Upon determining the continuity of the peat and clay formations, sample intervals varied between 1.52 and approximately 6 meters.

A total of 17 boreholes were advanced to characterize the proposed TWRMF and five boreholes were advanced to characterize the proposed PP (Figure 4). Of the 22 boreholes advanced, 8 boreholes were advanced to auger refusal without sampling the overburden. Single piezometers were installed in 8 boreholes and nested piezometers were installed in 2 boreholes. Bedrock was cored in 2 boreholes. A complete list of test pits and as-drilled boreholes conducted by Foth, including the coordinates, elevations, and other pertinent information such as thickness and depth to the individual soil strata encountered, total drilled depths in overburden and bedrock is provided in Appendix B. Details about the subsurface conditions and observation well construction are provided in the Borehole and Test Pit Logs in Appendix C and D, respectively. Photo log documentation from the test pit/trench investigation is shown in Appendix E and the drill core photos is provided in Appendix F. Appendix G includes the packer test data. The geotechnical laboratory report prepared by Golder is included as Appendix G.

Four trench and test pit transects were excavated along each ridge that bounds the proposed TWRMF (Figure 4). The transects extended from bedrock exposures into the lowlands in order to characterize the subsurface conditions along the margins of the wetland valley. The transect was terminated when two meters of clay was encountered in the excavation.

Additional test pits were excavated by Victory Nickel during the 2012 Geotechnical Investigation completed by Foth. The proposed test pit locations are also shown on Figure 4.

3.3 Current Field Identification

Field identification of the unconsolidated soil formations was based on visual and tactile examination of the samples obtained from the split-spoon barrel, auger cuttings, excavation equipment, and from the bottom of thin-walled Shelby tubes. The in-situ undrained shear strength of cohesive soils was estimated using pocket penetrometer, nilcon vane, and standard vane equipment. The pocket penetrometer tests were conducted on recovered cohesive soil samples, while the vane tests were conducted down-hole.

Disturbed and undisturbed soil samples were collected from boreholes and test pits for geotechnical laboratory analysis. Disturbed samples were collected from split-spoon barrels or as grab samples and were logged and placed in labeled plastic bags. Undisturbed samples were collected using thin-walled Shelby tubes which were sealed with plastic end caps and duct tape and placed in insulated boxes. Soil samples were shipped to Golder's Mississauga geotechnical laboratory for analysis.

A total of two out of 16 boreholes were drilled into the bedrock along the east and west margin of the wetland basin within the proposed TWRMF footprint, where the overburden thickness was minimal. The use of HQ size wireline equipment allowed recovery of 63.5 mm diameter rock cores. The recovered cores were placed in core boxes, logged and photographed and then shipped and stored at Victory Nickel's core shack in Grand Rapids, Manitoba. Total Core Recovery (TCR), Solid Core Recovery (SCR), Rock Quality Designation (RQD) values, and Fracture Indices (FI) were recorded by Foth's representative at the site. These parameters were recorded in accordance with the conventions used by the International Society for Rock Mechanics (ISRM). Two in-situ single packer tests were conducted in the lower 3 meters of bedrock to determine the hydraulic conductivity ("K" value) of the Ordovician dolomite.

3.4 Current Observation Wells

A total of eight 50 mm diameter observation wells were installed in the clay overburden at the proposed TWRMF and PP to monitor piezometric heads. Two additional 50 mm diameter observation wells were installed at the bottom of the boreholes drilled into the bedrock in order to monitor the piezometric heads originating in bedrock. The wells were designed with a screened portion at the bottom of a polyvinyl chloride (PVC) pipe with an above-grade extension of approximately one meter. Well gravel was placed in the annular space between the borehole and the PVC pipe up to 50 mm above the screen segment. A mixture of granular bentonite and soil cuttings was used for sealing the wells above the screen. The borehole survey was conducted by Pollock and Wright contracted directly by Victory Nickel in March 2012, approximately one month after completion of the field investigation program.

Victory Nickel personnel conducted additional geotechnical investigations in the area of the proposed pit. This data is not included in this report.

4 Geotechnical Profile

The area of investigation is approximately 3 km by 4 km, centered on a wetland valley bounded on the east and west by bedrock ridges (Figure 4). The flanking ridges define the long dimension of an asymmetrical bedrock valley that is partially filled with overburden formations. These are, from youngest to oldest: Peat, Colluvium, Upper Clay, Intermediate Clay, Lower Clay, and Glacial Till all underlain by Dolomite Bedrock.

The transect basemap and geotechnical cross-sections from the geotechnical drilling are shown on Figures 5, 6, and 7. The test pit subsurface data was interpreted into multiple transects along the east dolomite bedrock ridge and west dolomite bedrock ridge. The transect basemap and geotechnical cross-sections from the test pit excavations are shown on Figures 8 and 9.

A brief unit specific summary is provided below, including a summary of all field and geotechnical laboratory results. A detailed summary of supporting field and laboratory data in a table format is presented in Tables 1 through 12.

4.1 Peat

Peat is found at the surface in the lowest part of the valley between the two limestone bedrock ridges. The peat is comprised of fine to coarse organic material formed from muskeg, which is an accumulation of sphagnum moss, leaves, and decayed wetland vegetation. Peat generally exhibits coarse to fine fibrous structure with woody and non-woody components, grading downward into granular, then amorphous organic material.

A total of 8 SPTs were conducted in the field on the peat unit. The SPT results ranged from one (very soft) to seven (firm) blows per 0.3 meters, with an average SPT of 2.8 indicating a soft unit. The field results are summarized in Table 1.

Laboratory tests were conducted on peat samples including moisture content Atterberg limits, specific gravity, hydraulic conductivity, and consolidation. The laboratory results are presented in Appendix H and summarized in Table 2.

Moisture content tests were generally high, ranging from 43% to 1,184%, with an average of 491%. Specific gravity test was conducted on one sample, resulting in a value of 1.65. Atterberg Limit tests were conducted on two samples: one that had approximately the average moisture content of all samples tested, and the other with moisture content on the lower end. Liquid limit, plastic limit, and plasticity index of the sample with the average moisture content 305%, 269%, and 36%, respectively. The Unified Soil Classification System (USCS) symbol for this soil unit is peat.

Liquid limit, plastic limit, and plasticity index of the sample with the lower end moisture content is 65%, 36%, and 29%, respectively. The liquid limit plasticity classification indicated the samples exhibit a high plasticity; and the plasticity chart indicated the sample behavior is comparable to high plasticity silt or organic clay (MH/OH).

Hydraulic conductivity and one-dimensional consolidation test was conducted on one peat sample. The peat sample had a hydraulic conductivity of 3.26E-7 m/s indicating a low relative permeability. The consolidation tests compression index (Cc) for the material was 2.1.

4.2 Colluvium

Clastic material was found overlying the flanking bedrock ridges extending down to the wetland valley. This earth material consists of silty sand, gravel and cobbles that has accumulated along the slope of the bedrock ridge as a result of erosion. Moderately sorted sand lenses are locally intercalated with the colluvium.

This unit was identified in all test pits and trenches except FCD-11, which is located within the wetland valley. These deposits are characterized by wide variations in grain size over short distances. The tabular or “flag stone” nature of the coarsest fraction of these deposits display a distinctive imbricate structure.

4.3 Upper Clay

The upper clay unit is 1-2 meters thick and exhibits a high plasticity and typically soft to firm consistency. This upper unit occurs directly beneath the peat on the west side of the valley. The inclusion of similarly soft, but slightly less plastic clay extends the limits of this upper horizon to all borehole locations except the two northern-most logged boreholes. The upper clay unit is underlain by an intermediate clay unit.

SPT values ranged from 3 (soft) to 6 (firm) in this material with an average of 4 blows per 0.3 meters, suggesting a firm clay. Undrained shear strengths measured using the pocket penetrometer ranged from 24 (soft) to 96 kPa (stiff) averaging 72 kPa (stiff). One in-situ vane shear test recorded initial 57 kPa (stiff) and remoulded 11 kPa, indicating a low sensitivity. The field results are summarized in Table 3.

Laboratory tests were conducted on the upper clay samples including moisture content, specific gravity, and consolidation. The laboratory results are presented in Appendix H and summarized in Table 4.

Moisture contents ranged from 22.5% to 38.2%, with an average of 28%. Specific gravity test resulted in a value of 2.68. One-dimensional odometer consolidation tests were conducted on one undisturbed (Shelby tube) sample taken from FTWR30. The sample was subjected to various increments of constant stress and then unloaded. Based on the test results, the upper clay unit is considered to be in an over-consolidated state, with an over-consolidation ratio of 3.3; the Cc was 0.16.

4.4 Intermediate Clay

The Intermediate Clay unit occurs below the peat unit or below the upper clay unit where present. This clay unit displays a generally consistent thickness of approximately five meters in the wetland valley, becoming somewhat thicker to the east and south. Near the east side of the wetland valley the intermediate clay thins to approximately two meters before grading laterally into and becoming locally overlain by colluvium derived from the flanking ridges.

The intermediate clay unit exhibits evidence of clay weathering that extends from approximately half to the entire thickness of the unit. The clay weathering was observed in test pits (FCD11; VNEE01-TP06; VNEE01-TP07; VNEE02-TP04; VNEE02-TP06; and VNEE03-TP04), and in soil boring samples at the geotechnical laboratory. The observations of clay weathering included a range of features including:

- Grey colouration over the entire interval or grey colored inclusions within brown mass;
- “Mottled” texture;
- Presence of organics or trace organics;
- Friable fabric;
- Planar lamination features that appear as fissures, running parallel and/or perpendicular to bedding; fissures may also exhibit grey coloration; and
- Blocky structure.

The potential cause of the clay weathering could be explained by dessication of the sample, unloading of the overlying soil column, or post-glacial weathering prior to the development of the peat horizon.

The unit is underlain by the lower clay unit over the majority of the valley, where the soil column exceeds six meters on the west and 10 meters on the east. Along the western and eastern edges of the valley, this unit is underlain by dolomite bedrock and ranges in thickness from 1 to 7 meters.

A total of 63 field tests were conducted on the Intermediate Clay including SPT and undrained shear strength based on the pocket penetrometer and in-situ vane shear. The SPT results range from 3 (soft) to 21 (very stiff), with an average 12.8 blows per 0.3 meters, indicating a stiff material. Undrained shear strengths measured using the pocket penetrometer ranged from 0 (very soft) to 431 kPa (hard), with an average of 262 indicating a hard material. The in-situ vane shear test initial strength ranged from 29 (firm) to 76 (stiff), with an average of 53 kPa indicating a stiff material. A calculation of the initial to remoulded undrained shear strength indicated a low sensitivity on average. The field results are summarized in Table 5.

A total of 60 laboratory tests were conducted on intermediate clay samples including grain size distribution, Atterberg limits, moisture content, unit weight, specific gravity, hydraulic conductivity, consolidation, and triaxial tests. The laboratory results are presented in Appendix H and summarized in Table 6.

The grain size distribution results ranged from: silt with trace fine-medium sand (ML), to silty clay with some fine-coarse sand and trace fine gravel (CL), to clayey silt with trace fine-medium sand (CL-ML).

The liquid limit, plastic limit, and plasticity index of the samples averaged 43%, 17%, and 26%, respectively. The liquid limit plasticity classification indicated the samples exhibit a medium plasticity; and the moisture contents ranged from 18% to 48%, with an average of 24%. The unit weight of the material averages 20 kN/m3.

Hydraulic conductivity tests were carried out on undisturbed (Shelby tube) samples taken from FTWR-11 and FTWR-16. Note: both of these samples were collected from the zone of observed clay weathering. The sample tested from FTWR-11 had a hydraulic conductivity of 5.10E-9 centimeters per second (cm/s) and the sample from FTWR-16 was 1.21E-8 cm/s, indicating relatively impervious materials.

One-dimensional odometer consolidation tests were conducted on two undisturbed (Shelby tube) samples taken from FPP4 and FTWR11. The samples were subjected to various increments of constant stress and then unloaded. Based on the test results, the intermediate clay unit is considered to be in an over-consolidated state, with an average over-consolidation ratio of 4.0; the average Cc was 0.17.

Consolidated Undrained (CU) Triaxial tests with pore pressure measurements were carried out on undisturbed (Shelby tube) samples recovered from FPP4 and FTWR11. Three samples were trimmed from each Shelby tube and tested under different confining pressures. Each specimen was saturated using the backpressure technique, consolidated, and then subjected to compressive loading. The effective internal angle of friction is 28 degrees and 26 degrees for FPP4 and FTWR11, respectively. The effective cohesion is 31 kPa and 35 kPa for FPP4 and FTWR11, respectively.

4.5 Lower Clay

The lower clay unit exhibits a high plasticity and the consistency of the clay becomes softer as the thickness of the unit increases. The lower clay always occurs directly beneath the stiff clay unit described above, reaching a thickness of 16 meters. This unit is thickest to the east of the long axis of the valley and thins to approximately two meters at the foot of the east and west limestone ridges. The lower clay unit is underlain by dolomite bedrock, except in isolated areas where a meter or less of poorly sorted, clastic material separates this unit from the bedrock.

A total of 75 field tests were conducted on the lower clay including SPT and undrained shear strength based on the pocket penetrometer and in-situ vane shear. The SPT results range from 1 (very soft) to 27 (very stiff), with an average of 7 blows per 0.3 meters, indicating a firm material. Undrained shear strengths measured using the pocket penetrometer ranged from 0 (very soft) to 431 kPa (hard), with an average of 93 kPa indicating a stiff material. The in-situ vane shear test initial strength ranged from 1 kPa (very soft) to 24 kPa (soft), with an average of 10 kPa indicating a very soft material. A calculation of the initial to remoulded undrained shear strength indicated a high sensitivity on average. The field results are presented in Appendix H and summarized in Table 7.

Laboratory tests were conducted on samples from this unit including grain size distribution, Atterberg limits, moisture content, unit weight, specific gravity, consolidation, and triaxial tests. The laboratory results are presented in Appendix H summarized in Table 8.

The grain size distribution results ranged from: clay (CH), to clay with some fine-coarse sand, and trace fine gravel (CH), to clay with trace fine-medium sand (CH).

The liquid limit, plastic limit, and plasticity index of the samples averaged 53%, 21%, and 36%, respectively. The liquid limit plasticity classification indicated the samples exhibit a high plasticity; and the plasticity chart indicated the sample behavior is comparable to high plasticity clay (CH).

Moisture contents ranged from 7.4% to 60.5%, with an average of 35.3%. The unit weight of the material averages 19 kN/m3.

One-dimensional odometer consolidation tests were conducted on two undisturbed (Shelby tube) samples taken from FTWR14 and FTWR30. The samples were subjected to various increments of constant stress and then unloaded. Based on the test results, the lower CH unit is considered to be in a slightly over-consolidated state. The average over-consolidation ratio is 1.3. The average Cc is 0.4.

CU Triaxial tests with pore pressure measurements were carried out on four undisturbed (Shelby tube) samples recovered from FPP12, FPP14, FPP4, and FTWR30. Three samples were trimmed from each Shelby tube and tested under different confining pressures. Each specimen was saturated using the backpressure technique, consolidated and then subjected to compressive loading. The effective internal angle of friction ranged from 19 degrees to 27 degrees with an average of 23 degrees. The effective cohesion ranged from 18 kPa to 24 kPa with an average of 21 kPa.

4.6 Glacial Till

Silt-rich and gravel-rich diamictons that may represent glacial till or clastic erosional debris were encountered sporadically within the wetland valley. The material is typically less than two meters in thickness and is underlain by dolomite bedrock. This unit is overlain by the lower clay unit.

A total of six SPTs were conducted on the till. The SPT results range from 3 (soft) to 97 (hard) with an average 45 blows per 0.3 meters, indicating a hard unit. The field results are summarized in Table 9.

A total of nine laboratory tests were conducted on till samples including Atterberg limits, moisture content, unit weight, and grain size analysis. The laboratory results are presented in Appendix H summarized in Table 10.

The grain size distribution results ranged from silt and well graded sand with some clay and trace fine gravel (ML/SW), to silt with some clay and some fine-coarse sand and trace fine gravel (ML).

The liquid limit, plastic limit, and plasticity index of the sample was 19%, 11%, and 9%, respectively. The liquid limit plasticity classification indicated the samples exhibit a low plasticity; and the plasticity chart indicated the sample behavior is comparable to low plasticity clay (CL).

Moisture contents ranged from 11% to 30%, averaging 15%. The unit weight of the material was 23 kN/m3.

4.7 Dolomite Bedrock

The dolomite is generally fine grained with some shell and crinoid stem fossil fragments. In FTWR-11BR the bedrock is highly weathered to 1.2 meters below the subcrop surface grading to moderately weathered with depth. The weathered dolomite is generally Grade R2, weak rock with poor to fair quality. The grade increased to R3 or a medium strong rock as the weathering intensity decreased. The drill core is moderately jointed with very rough joint surfaces and wavy bedding. RDQ ranged from 26.3% to 88.8% (poor to good quality).

In FTWR-16BR the dolomite bedrock is slightly weathered with a Grade R3 indicating a medium strong rock. Joints observed were generally widely spaced with very rough joint surfaces and wavy bedding. RQDs ranged from 34.4% to 100% with most of the core falling into the category of excellent quality.

Dolomite bedrock was encountered between 0.6 meters and 24.7 meters below grade in two drill holes (FTWR-11BR and FTWR-16BR) and most of the test pits. Figures 10, 11, and 12 show the thickness of unconsolidated material overlying the bedrock surface.

Two field hydraulic conductivity tests were conducted in the dolomite using an inflatable packer and "Lugeon" methodology. The tests were conducted over an approximate 4-meter interval within boreholes FTWR-11BR and FTWR-16BR. The field results ranged from 10^{-4} cm/s to 10^{-5} cm/s indicating an equivalent permeability that would be characteristic of sandy silt to silt soil. The field results are summarized in Table 11.

4.8 Remoulded Clay

Clay samples collected from Test Pit FCD11 at depths of 2 meters and 6.1 meters, Test Pit VNEE02 at a depth of 3.5 meters and Test Pit VNWE03 at a depth of 4.2 meters were remoulded to approximately 93 percent of Standard Proctor Density at the appropriate moisture content for that density in order to run consolidation, hydraulic conductivity, standard proctor and triaxial compression tests.

The test results will assist in determining the workability of the clays that will be utilized in the planning of the test fill sections and as part of the overall usage of the clays as liner materials in the TWRMF. The testing was completed at Golder's Missisauga geotechnical laboratory and the results are presented in Appendix H and summarized in Table 12.

5 Groundwater Conditions

5.1 General

A total of eight observation wells were installed in the clay overburden, and two observation wells in the dolomite bedrock. The dolomite bedrock wells were nested with two of the clay overburden observation wells. Groundwater level measurements were collected from the observation wells on February 7, 2012 and April 26, 2012. In addition, groundwater levels observed in open test pits were recorded in March 2012. The water level measurements are summarized in Table 12.

Figure 18 is a hydrograph of groundwater elevation for the observation wells and test pits. The groundwater hydrograph shows an upward trend for all of the observations wells, with the exception of FTWR16U. This may suggest that the groundwater elevations measured in February following well construction may not have been fully equilibrated to static conditions. The upward trend was most pronounced in FTWR16BR, potentially suggesting a slow recharge rate from the dolomite bedrock. Additional measurements will be required to confirm this trend. Also, in April the groundwater was frozen at observation wells FPP14, FTWR12, and FTWR11U, and the water level meter became stuck at FTWR16U, possibly the cause of the anomalous trend at FTWR16U.

5.2 Confining Conditions

Relatively high piezometric heads were observed in the two dolomite bedrock observation wells FTWR16BR and FTWR11BR; located on the east ridge and west ridge, respectively. The groundwater elevation observed in the bedrock observation wells was generally above the elevation of the dolomite bedrock unit. This observation may indicate that the bedrock unit is in a confined or semi-confined condition. During the April monitoring event, the groundwater elevations were within less than 0.01 meter and 0.07 meter of ground surface in FTWR16BR and FTWR11BR, respectively. With only one bedrock observation well on each ridge and limited data, the presence of groundwater mounding cannot be proved. Additional observation wells along the dolomite ridges should be considered to establish the presence and persistence of groundwater mounding, and to further explore the potential for dynamic containment as a design consideration.

There is some evidence of the clay acting as a confining layer separating an upper aquifer from a bedrock aquifer in the test pit investigations. During both the Victory Nickel test pit investigation (2008) and the more recent test pit investigation performed by Foth, a number of the excavations observed inflowing of groundwater to the pit once the bedrock surface was exposed. Flow was measured at Victory Nickel TP17 and the groundwater filled the trench to a depth of 1 meter in about 8 minutes. Test pits VNWE01-TP07 and VNWE02-TP02 both indicated percolating groundwater when the bedrock surface was exposed. Test pit VNWE02-TP03 documented heavy groundwater flow at the bedrock/soil interface.

5.3 Vertical Gradient

Two overburden observation wells FTWR11U and FTWR16U were nested with the bedrock wells FTWR11BR and FTWR16BR, respectively. The nested groundwater observations wells were installed to determine if vertical gradients are present between the dolomite bedrock and clay layer. The groundwater elevations in the nested observations wells are shown in Table 13.

The vertical gradient in February was likely misleading as the groundwater elevations may not have been fully equilibrated to static conditions. In April 2012, both nests exhibited an upward vertical gradient, however, as noted above, FTWR11U was frozen and the water level meter became stuck at FTWR16U. In May 2013, the FTWR11 nest exhibited a downward gradient. At this point there is presumptive evidence of upward vertical gradients in the dolomite ridges, but not conclusive. Additional measurements should be collected to establish the definitive presence and/or seasonal fluctuation of vertical gradients within the dolomite bedrock.

Figure 19 is a scatter plot of groundwater elevation vs. ground surface elevation measured in April at each overburden observation well. The observed trend indicates that the groundwater elevation correlates with topographic elevation for the overburden observation wells, with the exception of FTWR16U and FTWR11U. As noted above, FTWR11U was frozen in April 2012. This trend reflects the correlection between the topography of the overburden aquifer and that of the surface, resulting in flow direction within overburden groundwater that mimic flow directions on the ground surface. The groundwater elevation was generally measured approximately 1 to 2 meters below the ground surface.

6 Conclusions and Recommendations

6.1 Conclusions

During geotechnical drilling, field data was collected from overburden formations and dolomite bedrock. Following geotechnical drilling and test pit excavations and the completion of geotechnical laboratory testing, geotechnical cross-sections were interpreted from the subsurface data. The geotechnical drilling subsurface data was interpreted along an axial and longitudinal transect of the TWRMF. The transect basemap and geotechnical cross-sections from the geotechnical drilling are shown on Figures 5, 6, and 7. The test pit subsurface data was interpreted into multiple transects along the east dolomite bedrock ridge and west dolomite bedrock ridge. The transect basemap and geotechnical cross-sections from the test pit excavations are shown on Figures 8 and 9.

The following discussion generally describes the geotechnical profile depicted on the cross-sections. The peat is comprised of fine to coarse organic material, typically 1 to 3 meters thick, and grades laterally into a thin organic soil on the edge of the wetland valley and up onto the bedrock ridges. The colluvium is comprised of clastic sediments including silty sand with locally abundant gravel and cobbles, approximately 3 meters thick, and occurs beneath the organic soil on the ridges. Glacial lacustrine clays, typically 3-20 meters thick, occur beneath the peat and thin rapidly near the bedrock ridges. The lacustrine clays were divided into three geotechnical units based on stratigraphy and physical/mechanical properties including an upper clay (typically 2 meters thick), an intermediate clay (typically 5 meters thick), and lower clay (typically 13 meters thick).

These units exhibit the following general distribution of key properties derived from both in-situ and laboratory tests:

- The geotechnical profile by SPT (Figure 13) exhibits a relatively lower SPT in the peat and upper clay, a relative SPT increase in the intermediate clay, and a modest to substantial decrease with depth in the lower clay. The geotechnical profile by pocket penetrometer (Figure 14) exhibits a similar distribution of strength as the SPT.

- The geotechnical profile determined by shear vanes (Figure 15) exhibits a similar distribution of strength as the pocket penetrometer and SPT profiles. The shear vane results were normalized for vertical lithostatic stress, which are provided on Figure 16.

- The geotechnical profile by moisture content (Figure 17) exhibits extreme moisture content in the peat, a relatively low moisture content in the upper clay and intermediate clay, and a relatively high moisture content in the lower firm clay.

With regard to the conditions at the two flanks to the valleys, uncertainty exists with regard to the thickness, consistency, and condition of the clay.

6.2 Recommendations

The existing Site Investigation is assumed to be appropriate for a feasibility level study. Any shortcomings in the scope or extent of the data will become apparent at the start of the future studies. At that time specific recommendations as to further Site Investigation should be advised to Victory Nickel, to better characterize the geotechnical and hydrogeologic conditions along the valley and dolomite ridges.

The initial decision to evaluate this location for the T&WRMF and PP was based on the assumption that a natural clay seal was present along the floor of the valley and the overall profile. This investigation has confirmed the presence of a significant thickness of clay to provide a seal to the valley floor.

7 References

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Golder, 2009b. Hydrogeologic Investigations of Dewatering Requirements for the Proposed Open Pit, Minago, Manitoba, Version 2. Report No. 08-1428-0001/7000. June 4, 2009.

Wardrop, 2010. Feasibility Study – Minago Nickel Mine. Report No. 0951330400-REP-R0001-02. March 4, 2010.

Tables

Table 1
Results of Peat Field Tests
Minago Nickel Mine
Victory Nickel Inc.

Borehole Number	Depth (m)	SPT (N)	Consistency Based on SPT
FPP12	1.52	1	Very Soft
FPP12	2.29	7	Firm
FPP14	1.52	2	Soft
FPP4	1.52	5	Firm
FTWR11	0.76	1	Very Soft
FTWR11	1.52	2	Soft
FTWR14	0.76	1	Very Soft
FTWR30	0.76	3	Soft
	Average	**3**	**Soft**
	Median	**2**	**Soft**
	Range	**1 - 7**	

Prepared by: BMS2
Checked by: MJV2

Table 2
Results of Peat Laboratory Tests
Minago Nickel Mine
Victory Nickel Inc.

				Atterberg Limits								1-D Consolidation				
Borehole Number	**Sample ID**	**Start Depth (m)**	**End Depth (m)**	**Liquid Limit**	**Plastic Limit**	**Plasticity Index**	**Moisture (%)**	**Hydraulic Conductivity (m/s)**	**Specific Gravity**	**Plasticity Chart USCS Symbol**	**Plasticity Classification**	**Overburden (kPa)**	**Preconsolidation (kPa)**	**Over Consolidation Ratio**	**Swell Index (Cs)**	**Compression Index (Cc)**
FPP12	SS2	1.5	2.0				614.4									
FPP12	SS3	2.3	2.7				42.6									
FPP14	SH1	0.0	0.8				1184.4									
FPP14	SS3	1.5	2.0	305.3	269.3	36	461.7				High					
FPP4	SS1	1.5	2.0													
FTWR11	SS1	0.8	1.4	435.8	347	88.7	626.3				High					
FTWR11	SS2	1.5	2.0				442.3									
FTWR12	SH1	0.8	1.2					3.26E-07	1.65			27	-	-	0.88	2.1
FTWR14	SS1	0.8	1.2				493.1									
FTWR16	SS1	0.0	0.6				481									
FTWR30	SS1	0.8	1.2	65	35.8	29.2	73.9			MH / OH	High					
			Average	**268.7**	**217.4**	**51.3**	**491.1**				**High**					
			Median	**305.3**	**269.3**	**36.0**	**481.0**				**High**					
			Range	**65 - 435.8**	**35.8 - 347**	**29.2 - 88.7**	**42.6 - 1184.4**									

Prepared by: BMS2
Checked by: MJV2

Table 3
Results of Upper Clay Field Tests
Minago Nickel Mine
Victory Nickel Inc.

Borehole Number	Depth (m)	SPT (N)	Consistency Based on SPT	Undrained Shear Strength-Pocket Penetrometer (kPa)	Consistency Based on Pocket Penetrometer	Undrained Shear Strength-Initial Vane (kPa)	Undrained Shear Strength-Remoulded Vane (kPa)	Sensitivity	Sensitivity Classification
FPP14	2.29	4	Firm	96	Stiff				
FTWR11	2.29	6	Firm	24	Soft				
FTWR12	1.52	5	Firm	72	Stiff				
FTWR14	1.52			72	Stiff				
FTWR16	0.76	4	Firm						
FTWR30	3.51					57	11	5	Low
FTWR6	0.76	3	Soft	48	Firm				
	Average	**4**	**Firm**	**62**	**Stiff**	**57**	**11**	**5**	Low
	Median	**4**	**Firm**	**72**	**Stiff**	**57**	**11**	**5**	Low
	Range	**3 - 6**		**24 - 96**		**57 - 57**	**11 - 11**	**5 - 5**	

Prepared by: BMS2
Checked by: MJV2

Table 4
Results of Upper Clay Laboratory Tests
Minago Nickel Mine
Victory Nickel Inc.

Borehole Number	Sample ID	Start Depth (m)	End Depth (m)	Moisture (%)	Specific Gravity	1-D Consolidation Overburden (kPa)	Preconsolidation (kPa)	Over Consolidation Ratio	Swell Index (Cs)	Compression Index (Cc)
FPP14	SS4	2.29	2.74	26.7						
FTWR11	SS3	2.29	2.74	30.2						
FTWR12	SS2	1.52	1.98	38.2						
FTWR14	SH2	1.52	2.13	27.9						
FTWR16	SS2	0.76	1.22	22.7						
FTWR30	SH3	3.51	4.11		2.68	75	250	3.3	0.04	0.16
FTWR6	SS2	0.76	1.22	22.5						
			Average	**28.0**	**2.68**	**75**	**250**	**3.3**	**0.04**	**0.16**
			Median	**27.3**	**2.68**	**75**	**250**	**3.3**	**0.04**	**0.16**
			Range	**22.5 - 38.2**	**2.7 - 2.7**	**75 - 75**	**250 - 250**	**3.3 - 3.3**	**0.04**	**0.16 - 0.16**

Prepared by: BMS2
Checked by: MJV2

Table 5

Results of Intermediate Clay Field Tests

Minago Nickel Mine

Victory Nickel Inc.

Borehole Number	Depth (m)	SPT (N)	Consistency Based on SPT	Undrained Shear Strength-Pocket Penetrometer (kPa)	Consistency Based on Pocket Penetrometer	Undrained Shear Strength-Initial Vane (kPa)	Undrained Shear Strength-Remoulded Vane (kPa)	Sensitivity	Sensitivity Classification
FPP12	2.29			96	Stiff				
FPP12	3.05	11	Stiff						
FPP12	3.81	21	Very Stiff						
FPP12	4.57	17	Very Stiff	335	Hard				
FPP14	3.05	15	Very Stiff	383	Hard				
FPP14	4.57	16	Very Stiff	335	Hard				
FPP4	2.29	4	Firm						
FPP4	3.05	14	Stiff	431	Hard				
FPP4	4.57	18	Very Stiff	359	Hard				
FPP4	6.10			192	Very Stiff				
FPP4	8.08					29	15	2	Low
FTWR11	3.05			359	Hard				
FTWR11	4.11					76	8	10	Medium
FTWR12	2.29	9	Stiff	192	Very Stiff				
FTWR12	3.05	14	Stiff	383	Hard				
FTWR12	3.81	10	Stiff	287	Hard				
FTWR14	2.29	4	Firm	120	Very Stiff				
FTWR14	3.05	10	Stiff	192	Very Stiff				
FTWR14	3.81	18	Very Stiff	383	Hard				
FTWR14	4.57	12	Stiff	383	Hard				
FTWR16	1.52	9	Stiff						
FTWR16	2.29			239	Hard				
FTWR16	3.05	13	Stiff	144	Very Stiff				
FTWR16	3.81	17	Very Stiff	287	Hard				
FTWR16	4.57	10	Stiff						
FTWR16	6.10	7	Firm						
FTWR30	0.91			0	Very Soft				
FTWR30	1.52	4	Firm	96	Stiff				
FTWR30	2.29	9	Stiff	335	Hard				
FTWR6	1.52	10	Stiff	287	Hard				
FTWR6	2.29	18	Very Stiff	383	Hard				
FTWR6	3.05	19	Very Stiff	431	Hard				
FTWR6	3.81	20	Very Stiff						
FTWR8	0.76	3	Soft	48	Firm				
FTWR8	1.52	13	Stiff	263	Hard				
FTWR8	2.29	18	Very Stiff	335	Hard				
FTWR8	3.05	20	Very Stiff						
FTWR8	3.81	14	Stiff	263	Hard				
	Average	**12.8**	**Stiff**	**269**	**Hard**	**53**	**11**	**6**	**Low**
	Median	**13.0**	**Stiff**	**287**	**Hard**	**53**	**11**	**6**	**Low**
	Range	**3 - 21**		**0 - 431**		**29 - 76**	**8 - 15**	**2 - 10**	

Prepared by: BMS2
Checked by: MJV2

Table 6
Results of Intermediate Clay Laboratory Tests
Minago Nickel Mine
Victory Nickel Inc.

				Atterberg Limits										1-D Consolidation						Triaxial Consolidation	
Borehole Number	Sample ID	Start Depth (m)	End Depth (m)	Liquid Limit	Plastic Limit	Plasticity Index	Unit Wt (kN/m^3)	Moisture (%)	Hydraulic Conductivity (m/s)	Grain Size USCS Symbol	Specific Gravity	Plasticity Chart USCS Symbol	Plasticity Classification	Overburden (kPa)	Preconsolidation (kPa)	Over Consolidation Ratio	Swell Index (Cs)	Compression Index (Cc)		Effective Internal Friction Angle (degrees)	Effective Cohesion (kPa)
FPP12	SS4	3.05	3.51					25.9													
FPP12	SS5	3.81	4.27					21.2		CL-ML											
FPP12	SS6	4.57	5.03					24.3													
FPP14	SS5	3.05	3.51					18.6													
FPP14	SS7	4.57	5.03	39.7	16.6	23.1	20.92	19.5		CL-ML		CL	Medium								
FPP4	SS2	2.29	2.74																		
FPP4	SS3	3.05	3.51					23.7													
FPP4	SS4	4.57	5.03					19.5													
FPP4	SH1	6.10	6.71							CL-ML	2.65			131.5	530	4.0	0.05	0.19		30	6
FTWR11	SH4	3.05	3.66						5.10E-11	CL	2.67			68	280	4.1	0.06	0.15		28	21
FTWR12	SS3	2.29	2.74					25.1													
FTWR12	SS4	3.05	3.51	46.8	18.7	28.1	19.66	24.3		CL		CL	Medium								
FTWR12	SS5	3.81	4.27					21.1													
FTWR14	SS6	2.29	2.74	42	17.8	24.2		26		CL		CL	Medium								
FTWR14	SS7	3.05	3.51					25.5													
FTWR14	SS8	3.81	4.27					21.4													
FTWR14	SS9	4.57	5.03					24.5													
FTWR16	SS3	1.52	1.98					24.6													
FTWR16	SH4	2.29	2.90																		
FTWR16	SS5	3.05	3.51					18.6													
FTWR16	SS6	3.81	4.27	47.5	20	27.5	19.89	17.6		CL		CL	Medium								
FTWR16	SS7	4.57	5.03					28.1													
FTWR16	SH9	7.62	8.23	36.2	13.4	22.8	19.38	30.1	1.21E-10	CL		CL	Medium								
FTWR30	SS2	1.52	1.98	41.9	18	23.9	19.68	29.8		CL-ML		CL	Medium								
FTWR30	SS10	2.29	2.74					27													
FTWR6	SS3	1.52	1.98					21.4													
FTWR6	SS4	2.29	2.74					47.8													
FTWR6	SS5	3.05	3.51	45	15.9	29.1		20.1		ML		CL	Medium								
FTWR8	SS2	0.76	1.22					27.6													
FTWR8	SS3	1.52	1.98					18.6		CL-ML											
FTWR8	SS4	2.29	2.74					24.1													
FTWR8	SS5	3.05	3.51					19.5													
FTWR8	SS6	3.81	4.27					27.3													
			Average	**42.7**	**17.2**	**25.5**	**19.9**	**24.2**			**2.66**		**Medium**	**100**	**405**	**4.1**	**0.06**	**0.17**		**29**	**14**
			Median	**42.0**	**17.8**	**24.2**	**19.7**	**24.3**			**2.66**		**Medium**	**100**	**405**	**4.1**	**0.06**	**0.17**		**29**	**14**
			Range	**36.2 - 47.5**	**13.4 - 20**	**22.8 - 29.1**	**19.4 - 20.9**	**17.6 - 47.8**			**2.7 - 2.7**			**68 - 131.5**	**280 - 530**	**4.1 - 4.1**	**0.1 - 0.1**	**0.2 - 0.2**	**0 - (**	**28 - 30**	**6 - 21**

Prepared by: BMS2
Checked by: MJV2

Table 7

Results of the Lower Clay Field Tests

Minago Nickel Mine

Victory Nickel Inc.

Borehole Number	Depth (m)	SPT (N)	Consistency Based on SPT	Undrained Shear Strength-Pocket Penetrometer (kPa)	Consistency Based on Pocket Penetrometer	Undrained Shear Strength-Initial Vane (kPa)	Undrained Shear Strength-Remoulded Vane (kPa)	Sensitivity	Sensitivity Classification
FPP12	6.10	8	Stiff	287	Hard				
FPP12	7.62	4	Firm	24	Soft				
FPP12	9.45					4	0.02	162	High
FPP12	10.67			24	Soft				
FPP12	12.19	3	Soft	0	Very Soft				
FPP12	13.72	2	Soft	0	Very Soft				
FPP14	3.81	16	Very Stiff						
FPP14	6.10	9	Stiff	287	Hard				
FPP14	7.77			24	Soft	24	11	2	Low
FPP14	9.14	5	Firm						
FPP14	12.19	5	Firm	0	Very Soft				
FPP14	13.72	4	Firm	0	Very Soft				
FPP14	15.24	5	Firm						
FPP14	16.76	6	Firm						
FPP4	9.14	2	Soft	0	Very Soft				
FPP4	12.19			24	Soft				
FTWR11	4.57	11	Stiff						
FTWR11	6.10	27	Very Stiff						
FTWR12	4.57	9	Stiff	263	Hard				
FTWR12	6.10	4	Firm	24	Soft				
FTWR12	7.62	2	Soft	0	Very Soft				
FTWR12	9.14	4	Firm	0	Very Soft				
FTWR14	6.10	12	Stiff	383	Hard				
FTWR14	7.62	9	Stiff						
FTWR14	7.62			359	Hard				
FTWR14	9.14			72	Stiff				
FTWR14	10.67					17	11	2	Low
FTWR14	13.72	1	Very Soft	0	Very Soft				
FTWR14	16.76	6	Firm	24	Soft				
FTWR14	19.81			48	Firm				
FTWR16	7.62			38	Firm				
FTWR30	3.81			192	Very Stiff				
FTWR30	4.57	8	Stiff	192	Very Stiff				
FTWR30	6.10	4	Firm	96	Stiff				
FTWR30	7.62	4	Firm	0	Very Soft				
FTWR30	8.53			48	Firm				
FTWR30	9.60					4	hit center rod		
FTWR30	11.13					1	0.02	37	Medium
FTWR30	13.72	6	Firm	0	Very Soft				
FTWR6	4.57	22	Very Stiff	431	Hard				
FTWR6	6.10	10	Stiff	120	Very Stiff				
FTWR6	7.62	7	Firm	24	Soft				
FTWR8	4.57	5	Firm	239	Hard				
FTWR8	7.62			10	Very Soft				
FTWR8	9.14			10	Very Soft				
FTWR8	12.19	3	Soft	0	Very Soft				
	Average	**7**	**Firm**	**93**	**Stiff**	**10**	**6**	**51**	**High**
	Median	**5**	**Firm**	**24**	**Soft**	**4**	**6**	**20**	**Medium**
	Range	**1 - 27**		**0 - 431**		**1 - 24**	**0 - 11**	**2 - 162**	

Prepared by: BMS2
Checked by: MJV2

Table 8
Results of the Lower Clay Laboratory Tests
Minago Nickel Mine
Victory Nickel Inc.

				Atterberg Limits									1-D Consolidation					Triaxial Consolidation	
Borehole Number	Sample ID	Start Depth (m)	End Depth (m)	Liquid Limit	Plastic Limit	Plasticity Index	Unit Wt (kN/m^3)	Moisture (%)	Grain Size USCS Symbol	Specific Gravity	Plasticity Chart USCS User Symbol	Plasticity Classification	Overburden (kPa)	Preconsolidation (kPa)	Over Consolidation Ratio	Swell Index (Cs)	Compression Index (Cc)	Effective Internal Friction Angle (degrees)	Effective Cohesion (kPa)
FPP12	SS7	6.10	6.55					24.2											
FPP12	SS8	7.62	8.08					40											
FPP12	SH9	10.67	11.28															20	12
FPP12	SS10	12.19	12.65																
FPP12	SS11	13.72	14.17					54.4											
FPP14	SS6	3.81	4.27					20.4											
FPP14	SS8	6.10	6.55					25											
FPP14	SS9	9.14	9.60																
FPP14	SH10	10.67	11.28						CH									24	7
FPP14	SS11	12.19	12.65	51.9	19.8	32.1		38.9			CH	High							
FPP14	SS12	13.72	14.17																
FPP14	SS13	15.24	15.70					43.6											
FPP14	SS14	16.76	17.22					60.5											
FPP4	SS5	9.14	9.60					43.8											
FPP4	SH2	12.19	12.80	68.2	23.5	44.7			CH		CH	High						16	18
FTWR11	SS5	4.57	5.03					25.3	CH										
FTWR11	SS6	6.10	6.55					35.8											
FTWR12	SS6	4.57	5.03	52.1	19.5	32.6	18.96	26.4	CH		CH	High							
FTWR12	SS7	6.10	6.55					39.5											
FTWR12	SS8	7.62	8.08					47.3											
FTWR12	SS9	9.14	9.60					46.6											
FTWR14	SS3	6.10	6.55					21.9											
FTWR14	SS4	7.62	8.08				20.09	23.9											
FTWR14	SH5	9.14	9.75					35.9											
FTWR14	SS10	13.72	14.17					43.7											
FTWR14	SS11	16.76	17.22					46.7											
FTWR14	SH6	19.81	20.42							2.67			342	-	-	0.15	0.51		
FTWR30	SS4	4.57	5.03					25.9											
FTWR30	SS5	6.10	6.55																
FTWR30	SS6	7.62	8.08					27.1											
FTWR30	SH7	8.53	9.14						CH	2.67			166	220	1.3	0.07	0.29	25	11
FTWR30	SS8	13.72	14.17	57.4	20	37.4	17.73	46.3			CH	High							
FTWR30	SH9	16.76	17.37					57.3											
FTWR6	SS7	4.57	5.03					17.2											
FTWR6	SS8	6.10	6.55				19.11	27.6	CH										
FTWR6	SS9	7.62	8.08					28.1											
FTWR8	SH8	6.10	6.71					35.8											
FTWR8	SS9	7.62	8.08	53.4	20.1	33.3		40.5	CH		CH	High							
FTWR8	SH10	9.14	9.75					21.2											
FTWR8	SS11	12.19	12.65					51											
FTWR8	SS12	15.24	15.70					7.4											
			Average	**56.6**	**20.6**	**36.0**	**19.0**	**35.3**		**2.67**		**High**	**254.0**	**220.0**	**1.3**	**0.11**	**0.40**	**21**	**12**
			Median	**53.4**	**20.0**	**33.3**	**19.0**	**35.9**		**2.67**		**High**	**254.0**	**220.0**	**1.3**	**0.11**	**0.40**	**22**	**12**
			Range	**51.9 - 68.2**	**19.5 - 23.5**	**32.1 - 44.7**	**17.7 - 20.1**	**7.4 - 60.5**		**2.67 - 2.67**			**166 - 342**	**220 - 220**	**1.3 - 1.3**	**0.07 - 0.15**	**0.29 - 0.51**	**16 - 25**	**7 - 18**

Prepared by: BMS2
Checked by: MJV2

Table 9

Results of Till Field Tests

Minago Nickel Mine

Victory Nickel Inc.

Borehole Number	Depth (m)	SPT (N)	Consistency Based on SPT
FPP12	15.24	39	Hard
FPP12	16.76	76	Hard
FPP4	15.24	3	Soft
FTWR12	10.67	30	Hard
FTWR6	9.14	25	Very Stiff
FTWR8	15.24	97	Hard
	Average	**45**	**Hard**
	Median	**35**	**Hard**
	Range	**3 - 97**	

Prepared by: BMS2
Checked by: MJV2

Table 10
Results of Till Laboratory Tests
Minago Nickel Mine
Victory Nickel Inc.

Borehole Number	Sample ID	Start Depth (m)	End Depth (m)	Atterberg Limits Liquid Limit	Atterberg Limits Plastic Limit	Atterberg Limits Plasticity Index	Unit Wt (kN/m^3)	Moisture (%)	Grain Size USCS Symbol	Plasticity Chart USCS Symbol	Plasticity Classification
FPP12	SS12	15.2	15.7					13.3	ML		
FPP12	SS13	16.8	17.2					11.3			
FPP4	SS6	15.2	15.7								
FTWR12	SS10	10.7	11.1					10.6			
FTWR6	SS10	9.1	9.6	19.4	10.7	8.7	23.25	11.1	ML/SW	CL	Low
FTWR8	SS7	4.6	5.0					30.1			
			Average	**19.4**	**10.7**	**8.7**	**23.3**	**15.3**			**Low**
			Median	**19.4**	**10.7**	**8.7**	**23.3**	**11.3**			**Low**
			Range	**19.4 - 19.4**	**10.7 - 10.7**	**8.7 - 8.7**	**23.3 - 23.3**	**10.6 - 30.1**			

Prepared by: BMS2
Checked by: MJV2

Table 11
Results of Dolomite Field Tests
Minago Nickel Mine
Victory Nickel Inc.

Borehole Number	Start Depth (m)	End Depth (m)	Hydraulic Conductivity (cm/s)	Strength	Strength Designation	RQD %	RQD Designation
FTWR11BR	8.5	12.2	4E-04				
FTWR11BR	6.1	7.62		R2	Weak	26.3	Poor Quality
FTWR11BR	7.62	9.14		R2	Weak	57.2	Fair Quality
FTWR11BR	9.14	10.67		R2	Weak	54.9	Fair Quality
FTWR11BR	10.67	12.19		R2 - R3	Weak to Medium Strong	88.8	Good Quality
FTWR16BR	8.5	12.5	3E-04				
FTWR16BR	6.48	7.87		R3	Medium Strong	34.5	Poor Quality
FTWR16BR	7.87	9.37		R3	Medium Strong	100.0	Excellent Quality
FTWR16BR	9.37	10.97		R3	Medium Strong	93.1	Excellent Quality
FTWR16BR	10.97	12.5		R3	Medium Strong	98.7	Excellent Quality
		Average	**3.5E-04**			**69.2**	
		Median	**3.5E-04**			**73.0**	
		Range	**3E-04 - 4E-04**			**26.3 - 100**	

Prepared by:BMS2
Checked by: MJV2

Table 12
Results of Remoulded Clay Laboratory Tests
Minago Nickel Mine
Victory Nickel Inc.

				Atterberg Limits										1-D Consolidation					Triaxial Consolidation		Standard Proctor	
Borehole Number	Sample ID	Start Depth (m)	End Depth (m)	Liquid Limit	Plastic Limit	Plasticity Index	Unit Wt (kN/m^3)	Moisture (%)	Hydraulic Conductivity (cm/s)	Grain Size USCS Symbol	Specific Gravity	Plasticity Chart USCS Symbol	Plasticity Classification	Overburden (kPa)	Preconsolidation (kPa)	Over Consolidation Ratio	Swell Index (Cs)	Compression Index (Cc)	Effective Internal Friction Angle (degrees)	Effective Cohesion (kPa)	Maximum Dry Density (Mg/m^3)	Optimum Water Content (%)
FCD11	BS01	2.00	2.00	39.7	15.2	24.5	19.81	18.5 19.9 18.8 16.9 19	1.1E-08 5.8E-09	CL	2.76	CL	Medium	16	52	3.3	0.04	0.08	27	8	1.726	18.6
FCD11	BS02	6.10	6.10	38.8	14.7	24.1	20.68	18.1 19.5 20.8 18.8 22.1	1.1E-08 4.5E-09	CL/ML	2.78	CL	Medium	94	97	1.0	0.05	0.22	22	0	1.692	20.5
VNWE03	BS01	4.20	4.20																		1.616	28.1
VNEE02	BS01	3.50	3.50	38.3	13.6	24.7		14.4 20 18.5 20.1		CL											1.726	19.6
			Average **Median** **Range**	**38.9** **38.8** **38.3 - 39.7**	**14.5** **14.7** **13.6 - 15.2**	**24.4** **24.5** **24.1 - 24.7**	**20.25** **20.25** **19.8 - 20.7**	**19.0** **18.8** **14.4 - 22.1**	**7.50E-09** **8.40E-09** **5.8E-09 - 1.1E-08**		**2.77** **2.77** **2.8 - 2.8**			**55** **55** **16 - 94**	**75** **75** **52 - 97**	**3.3** **3.3** **3.3 - 3.3**	**0.05** **0.05** **0.04 - 0.04**	**0.15** **0.15** **0.08 - 0.22**			**1.69** **1.71** **1.62 - 1.73**	**21.70** **20.05** **18.6 - 28.1**

Prepared by: BMS2
Checked by: MJV2

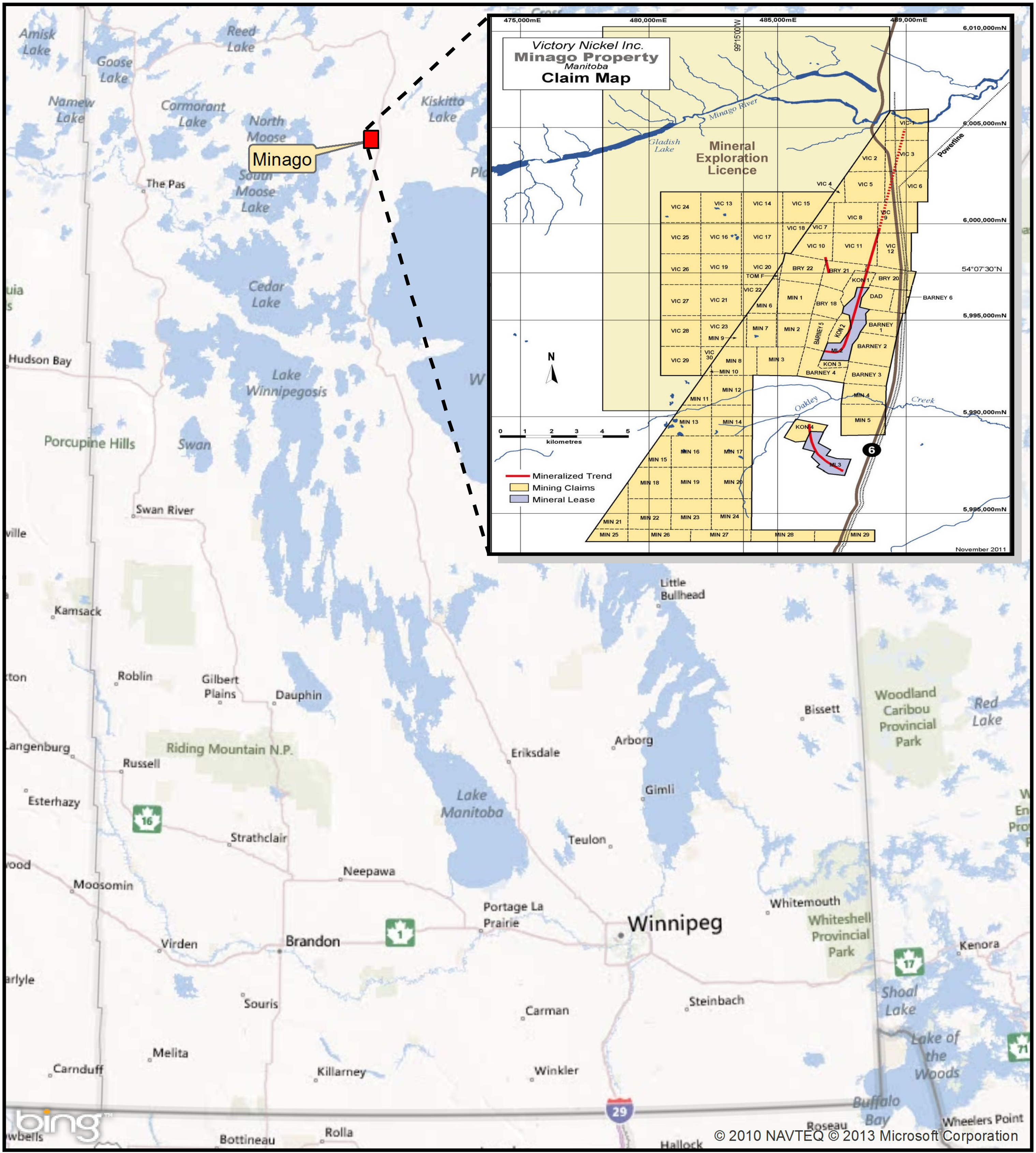
Table 13
Groundwater Level Measurements
Minago Nickel Mine
Victory Nickel Inc.

Borehole Number		Surface Elevation (m amsl)	Groundwater Elevation measured 02/07/12 (m amsl)	Groundwater Elevation measured 03/20/12 (m amsl)	Groundwater Elevation measured 04/26/12 (m amsl)	Groundwater Elevation measured 05/28/13 (m amsl)
Piezometer	FPP14	253.44	251.34	-	253.24	253.47
	FPP4	251.90	249.69	-	251.56	251.85
	FTWR11BR	258.28	257.12	-	258.21	256.86
	FTWR11U*	258.34	254.65	-	258.03	258.29
	FTWR12	256.04	253.58	-	255.88	256.06
	FTWR14	255.34	253.63	-	255.27	255.48
	FTWR16	256.73	252.43	-	254.20	253.83
	FTWR16BR	257.70	249.48	-	257.71	256.68
	FTWR16U	257.88	256.22	-	255.72	254.35
	FTWR30	257.11	255.22	-	257.13	257.03
Open Hole	VNWE01 TP05	256.27	-	254.47	-	-
	VNWE01 TP06	256.00	-	254.30	-	-
	VNWE02 TP02	262.30	-	259.90	-	-
	VNWE03 log 3	259.14	-	255.14	-	-
	Highest	251.90	249.48	254.30	251.56	251.85
	Lowest	262.30	257.12	259.90	258.21	258.29
	Average	256.89	253.34	255.95	255.70	255.39

*Water level meter consistently gets stuck at this location. Readings may be anomolous.

Prepared by: BMS2
Checked by: MJV2

Figures



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REVISED	DATE	BY	DESCRIPTION

CHECKED BY: MJV2	DATE: JUL. '13
APPROVED BY: SVD1	DATE: JUL. '13
APPROVED BY:	DATE:

VICTORY NICKEL INC.

FIGURE 1

SITE LOCATION

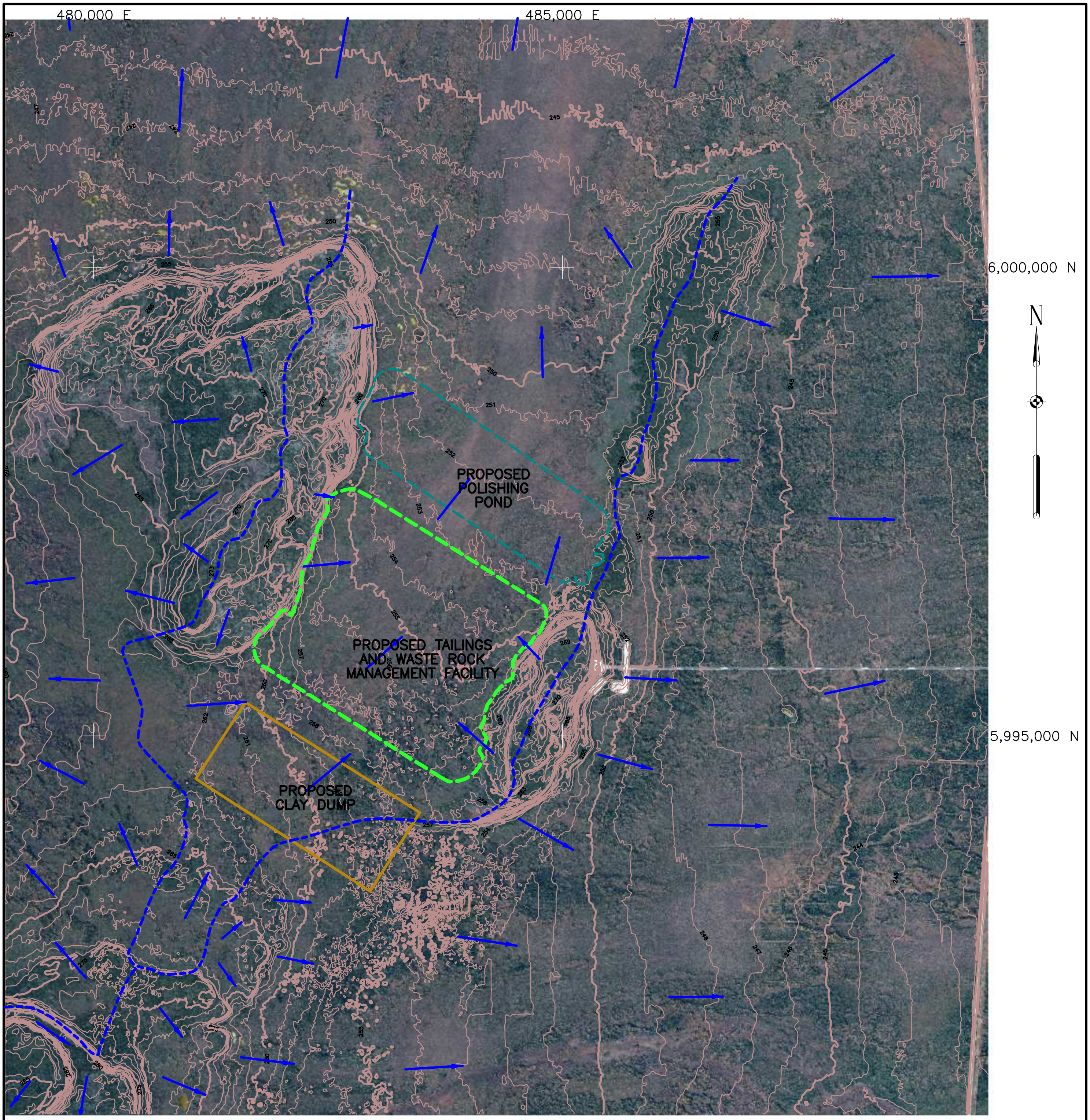
Scale: 0 40 80 Km

Date: JULY 2013

Prepared by: DAT

Project No: 11V777

Path: X:\GB\IE\2011\11V777\GIS\mxd\July2013\Figure 1.mxd Date: 7/15/2013



LEGEND

250 EXISTING CONTOUR

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CHECKED BY: JSL/MRV2 DATE: JULY '13
APPROVED BY: SVD1 DATE: JULY '13
APPROVED BY: DATE:

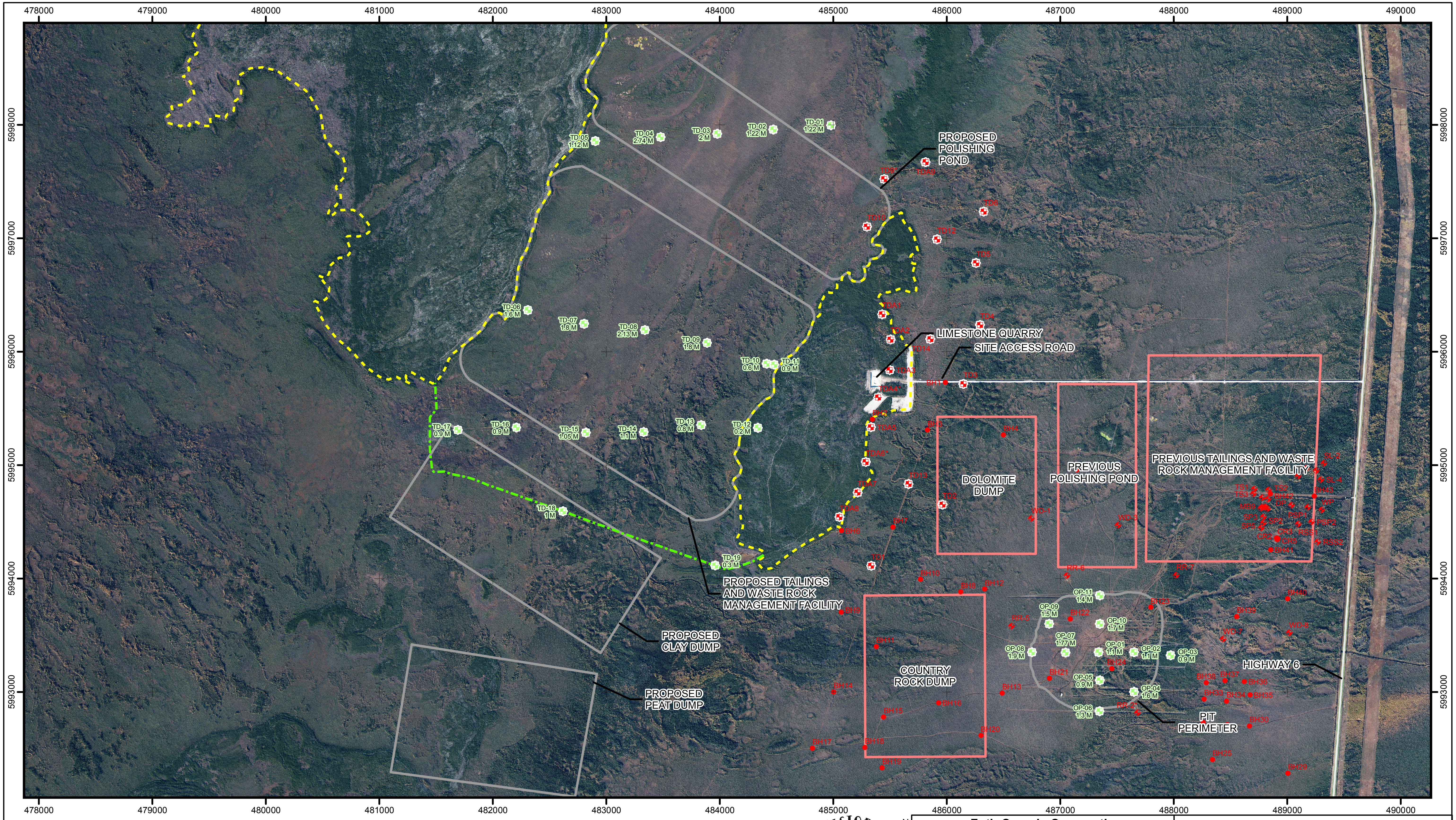
VICTORY NICKEL INC.

FIGURE 2

SITE TOPOGRAPHY AND DRAINAGE

Scale: 0 750m 1,500m
Date: MAY, 2013
Prepared By: JOW
Project No. 11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 2 existing conditions.dgn
7/15/2013 JOW



NOTES

1. Digital orthophoto imagery provided by Victory Nickel. Reference to Survey Data (ATLIS in 2011)
2. Horizontal datum based on WGS 1984. Horizontal coordinates based on WGS 84 UTM Zone 14N.
3. All dimensions and coordinates are approximate and are shown in meters unless otherwise noted.
4. 2011 Test Pit locations supplied by Victory Nickel via email.

LEGEND

🟩	Victory Nickel Test Pits (2011)-Note 4
●	Wardrop Boreholes (2007)
⊕	Wardrop Monitoring Wells (2008)
⊞	Wardrop Test Pits (2008)
‐·‐	Trails
▭	Outcrop (Aerial Photo Interpretation)
▭	Previous Facility Boundary
▭	Proposed Facility Boundary

VICTORY 2007 V Ni NICKEL INC.

Foth

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REVISED	DATE	BY	DESCRIPTION
1	JAN. '12	AZ	SCOPE CHANGE

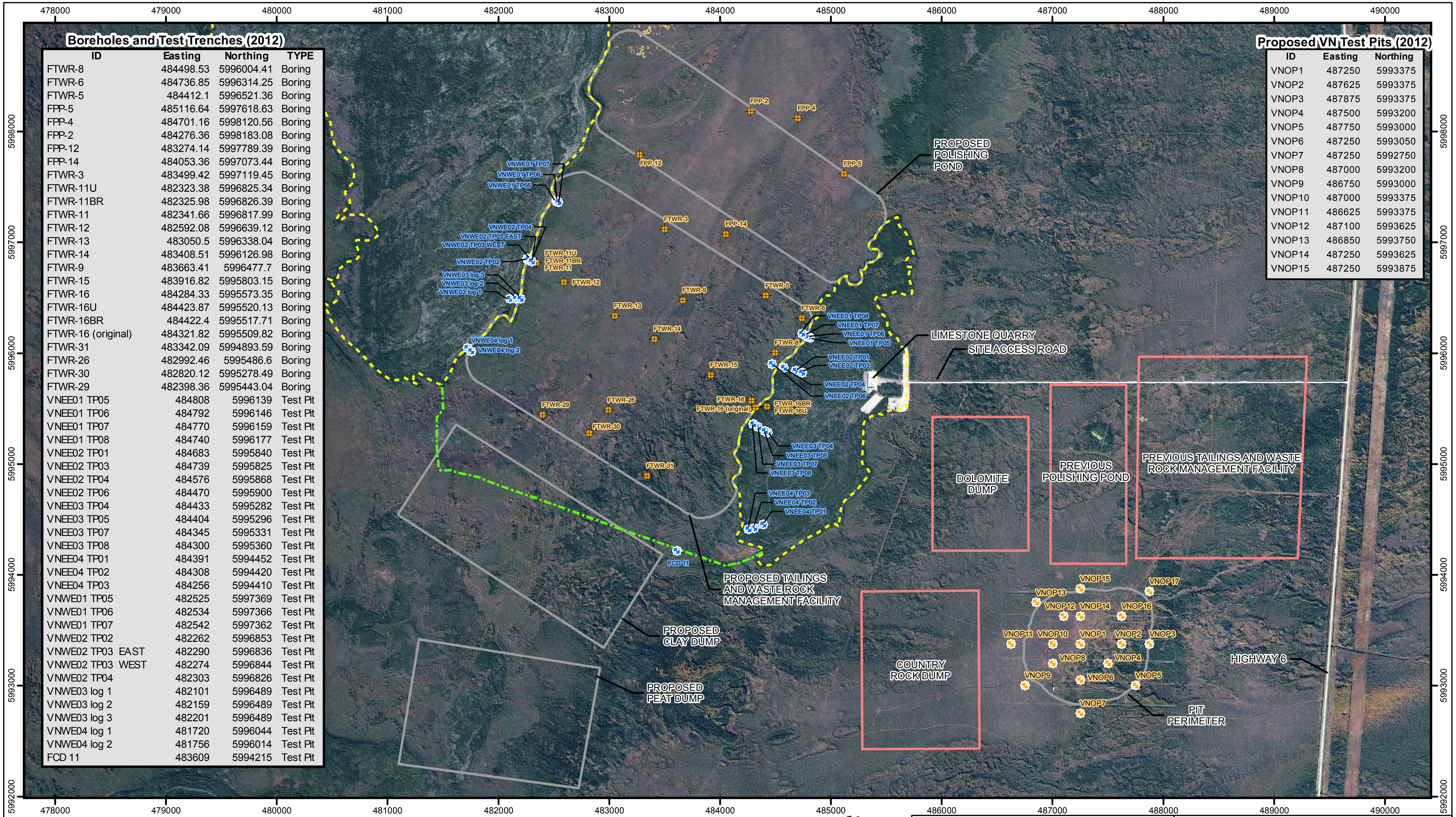
CHECKED BY: MJV2 DATE: JUL. '13
APPROVED BY: SVD1 DATE: JUL. '13
APPROVED BY: DATE:

VICTORY NICKEL INC.

FIGURE 3
MINAGO FEASIBILITY STUDY UPDATE
HISTORIC BOREHOLE AND
TEST PIT INVESTIGATION PLAN

Scale: 0 400 800 Meters
Date: JULY 2013
Prepared by: DAT
Project No: 11V777

Path: X:\GB\IE\2011\11V777\GIS\mxd\July2013\Figure 3.mxd Date: 7/15/2013



Boreholes and Test Trenches (2012)

ID	Easting	Northing	TYPE
FTWR-8	484498.53	5996004.41	Boring
FTWR-6	484736.85	5996314.25	Boring
FTWR-5	484412.1	5996521.36	Boring
FPP-5	485116.64	5997618.63	Boring
FPP-4	484701.16	5998120.56	Boring
FPP-2	484276.36	5998183.08	Boring
FPP-12	483274.14	5997789.39	Boring
FPP-14	484053.36	5997073.44	Boring
FTWR-3	483499.42	5997119.45	Boring
FTWR-11U	482323.38	5996825.34	Boring
FTWR-11BR	482325.98	5996826.39	Boring
FTWR-11	482341.66	5996817.99	Boring
FTWR-12	482592.08	5996639.12	Boring
FTWR-13	483050.5	5996338.04	Boring
FTWR-14	483408.51	5996126.98	Boring
FTWR-9	483663.41	5996477.7	Boring
FTWR-15	483916.82	5995803.15	Boring
FTWR-16	484284.33	5995573.35	Boring
FTWR-16U	484423.87	5995520.13	Boring
FTWR-16BR	484422.4	5995517.71	Boring
FTWR-16 (original)	484321.82	5995509.82	Boring
FTWR-31	483342.09	5994893.59	Boring
FTWR-26	482992.46	5995486.6	Boring
FTWR-30	482820.12	5995278.49	Boring
FTWR-29	482398.36	5995443.04	Boring
VNEE01 TP05	484808	5996139	Test Pit
VNEE01 TP06	484792	5996146	Test Pit
VNEE01 TP07	484770	5996159	Test Pit
VNEE01 TP08	484740	5996177	Test Pit
VNEE02 TP01	484683	5995840	Test Pit
VNEE02 TP03	484739	5995825	Test Pit
VNEE02 TP04	484576	5995868	Test Pit
VNEE02 TP06	484470	5995900	Test Pit
VNEE03 TP04	484433	5995282	Test Pit
VNEE03 TP05	484404	5995296	Test Pit
VNEE03 TP07	484345	5995331	Test Pit
VNEE03 TP08	484300	5995360	Test Pit
VNEE04 TP01	484391	5994452	Test Pit
VNEE04 TP02	484308	5994420	Test Pit
VNEE04 TP03	484256	5994410	Test Pit
VNWE01 TP05	482525	5997369	Test Pit
VNWE01 TP06	482534	5997366	Test Pit
VNWE01 TP07	482542	5997362	Test Pit
VNWE02 TP02	482262	5996853	Test Pit
VNWE02 TP03 EAST	482290	5996836	Test Pit
VNWE02 TP03 WEST	482274	5996844	Test Pit
VNWE02 TP04	482303	5996826	Test Pit
VNWE03 log 1	482101	5996489	Test Pit
VNWE03 log 2	482159	5996489	Test Pit
VNWE03 log 3	482201	5996489	Test Pit
VNWE04 log 1	481720	5996044	Test Pit
VNWE04 log 2	481756	5996014	Test Pit
FCD 11	483609	5994215	Test Pit

Proposed VN Test Pits (2012)

ID	Easting	Northing
VNOP1	487250	5993375
VNOP2	487625	5993375
VNOP3	487875	5993375
VNOP4	487500	5993200
VNOP5	487750	5993000
VNOP6	487250	5993050
VNOP7	487250	5992750
VNOP8	487000	5993200
VNOP9	486750	5993000
VNOP10	487000	5993375
VNOP11	486625	5993375
VNOP12	487100	5993625
VNOP13	486850	5993750
VNOP14	487250	5993625
VNOP15	487250	5993875

NOTES

1. Digital orthophoto imagery provided by Victory Nickel.
   Reference to Survey Data (ATLIS in 2011)
2. Horizontal datum based on WGS 1984.
   Horizontal coordinates based on WGS 84 UTM Zone 14N.
3. All dimensions and coordinates are approximate and are shown in meters unless otherwise noted.
4. Locations proposed by Victory Nickel.

LEGEND

⊕	Boring
✚	Test Pit
✚	Proposed Open Pit Test Pits (VN 2012)-Note 4
‐·‐	Trails
▭	Outcrop (Aerial Photo Interpretation)
▭	Previous Facility Boundary
▭	Proposed Facility Boundary

Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION
1	JAN. '12	AZ	SCOPE CHANGE

CHECKED BY: MJV2 DATE: JUL. '13
APPROVED BY: SVD1 DATE: JUL. '13
APPROVED BY: DATE:

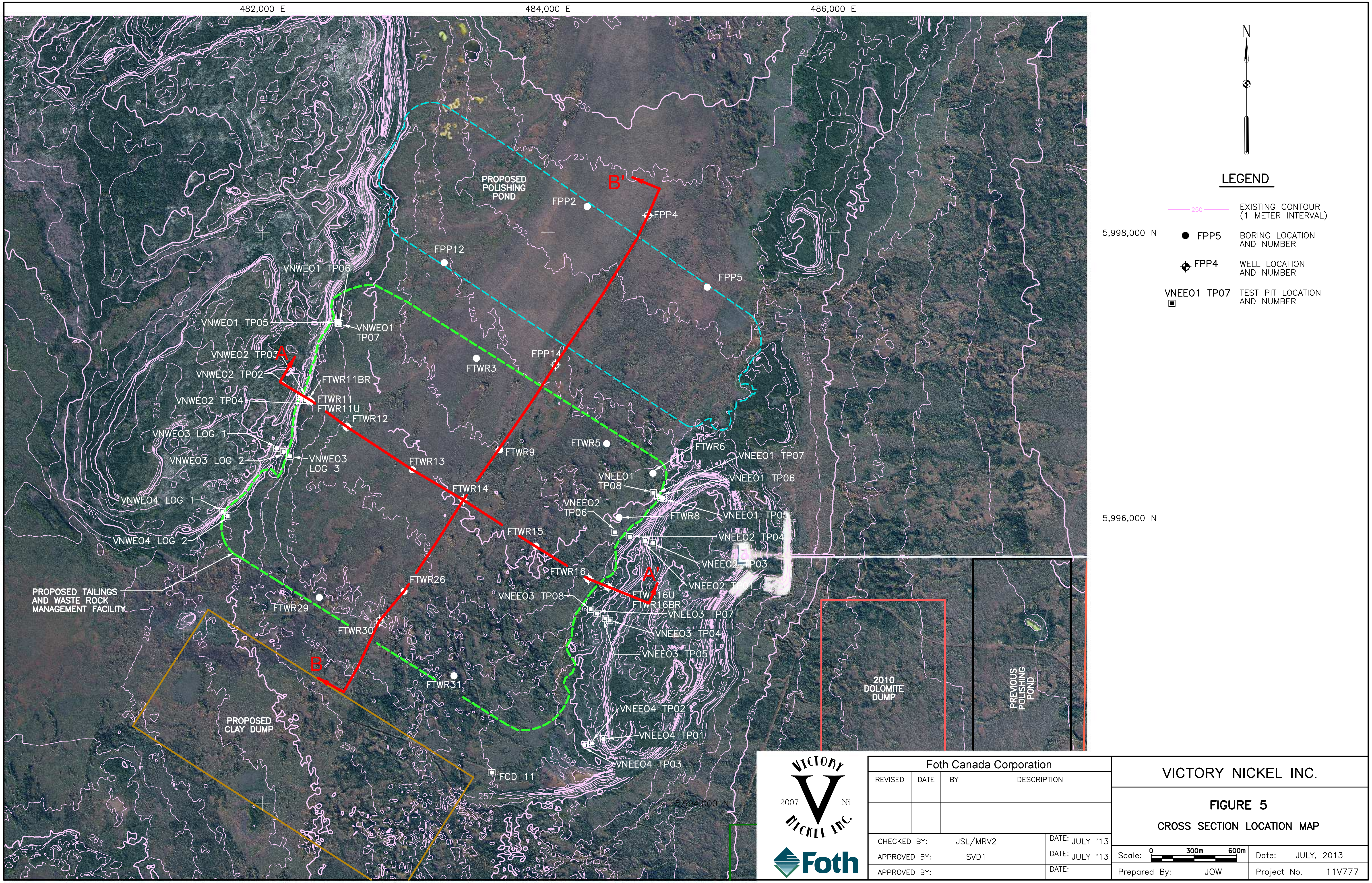
VICTORY NICKEL INC.

FIGURE 4

MINAGO FEASIBILITY STUDY UPDATE
BOREHOLE AND TEST PIT INVESTIGATION PLAN

Scale: 0 400 800 Meters
Date: JULY 2013
Prepared by: DAT
Project No: 11V777

Path: X:\GB\IE\2011\11V777\GIS\mxd\July2013\Figure 4.mxd Date: 7/15/2013



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CHECKED BY:	JSL/MRV2	DATE:	JULY '13
APPROVED BY:	SVD1	DATE:	JULY '13
APPROVED BY:		DATE:	

VICTORY NICKEL INC.

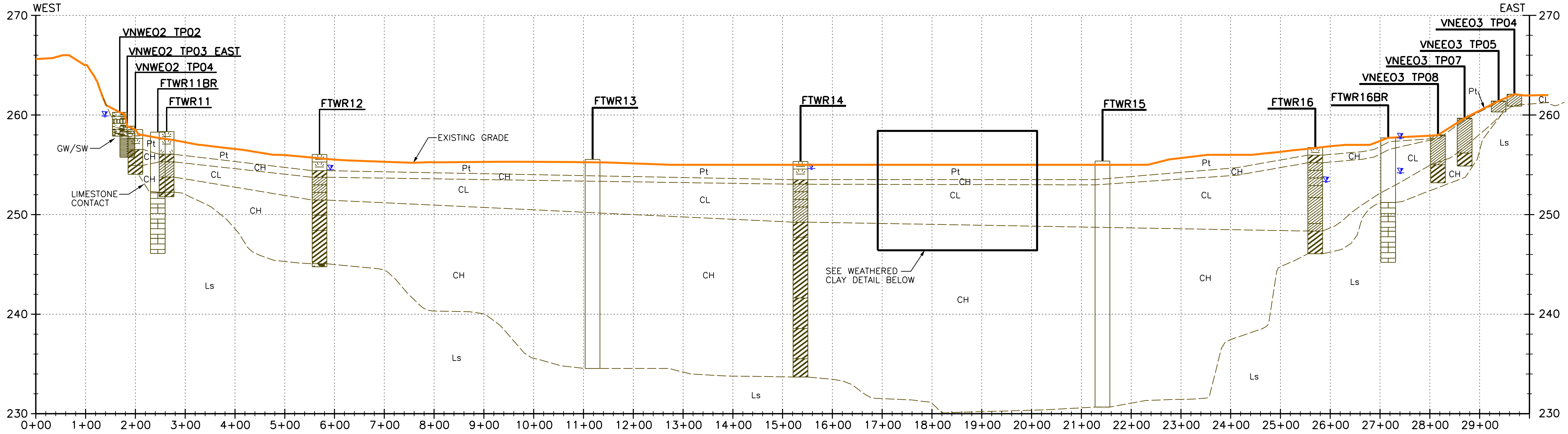
FIGURE 5

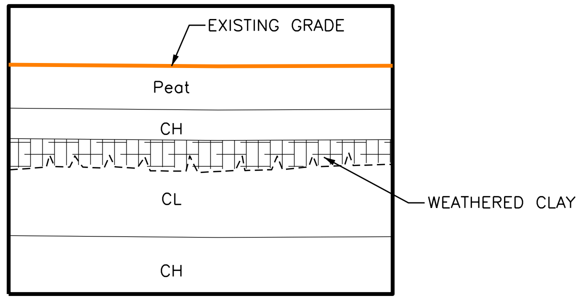
CROSS SECTION LOCATION MAP

Scale:	0 300m 600m	Date:	JULY, 2013
Prepared By:	JOW	Project No.	11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 5 Cross Sections Location Map.dgn
7/15/2013 JOW

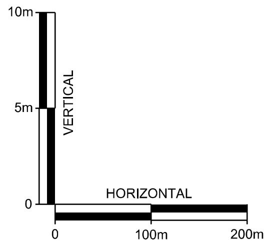
SECTION A - A'





WEATHERED CLAY DETAIL

NOT TO SCALE



BAR SCALE

LEGEND

Pt – PEAT
ML – SILT
CL – MEDIUM PLASTICITY CLAY
CH – HIGH PLASTICITY CLAY
Ls – LIMESTONE
GW/SW – WELL GRADED SAND/GRAVEL
▽ WATER ELEVATION
– – – CONTACT LINE
—— EXISTING GRADE

Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION

CHECKED BY: JSL/MRV2 DATE: JULY '13
APPROVED BY: SVD1 DATE: JULY '13
APPROVED BY: DATE:

VICTORY NICKEL INC.

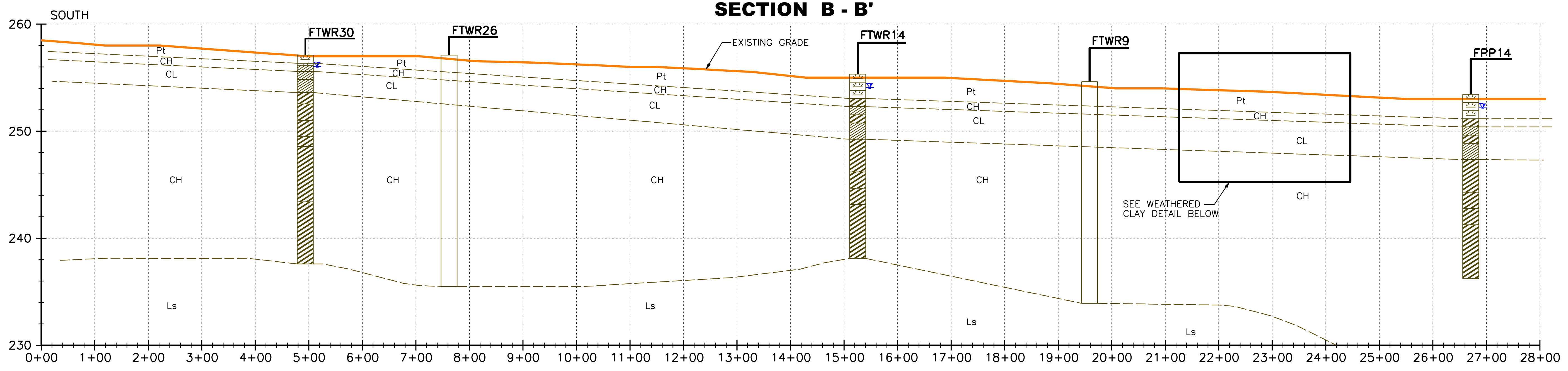
FIGURE 6

CROSS SECTION A–A'

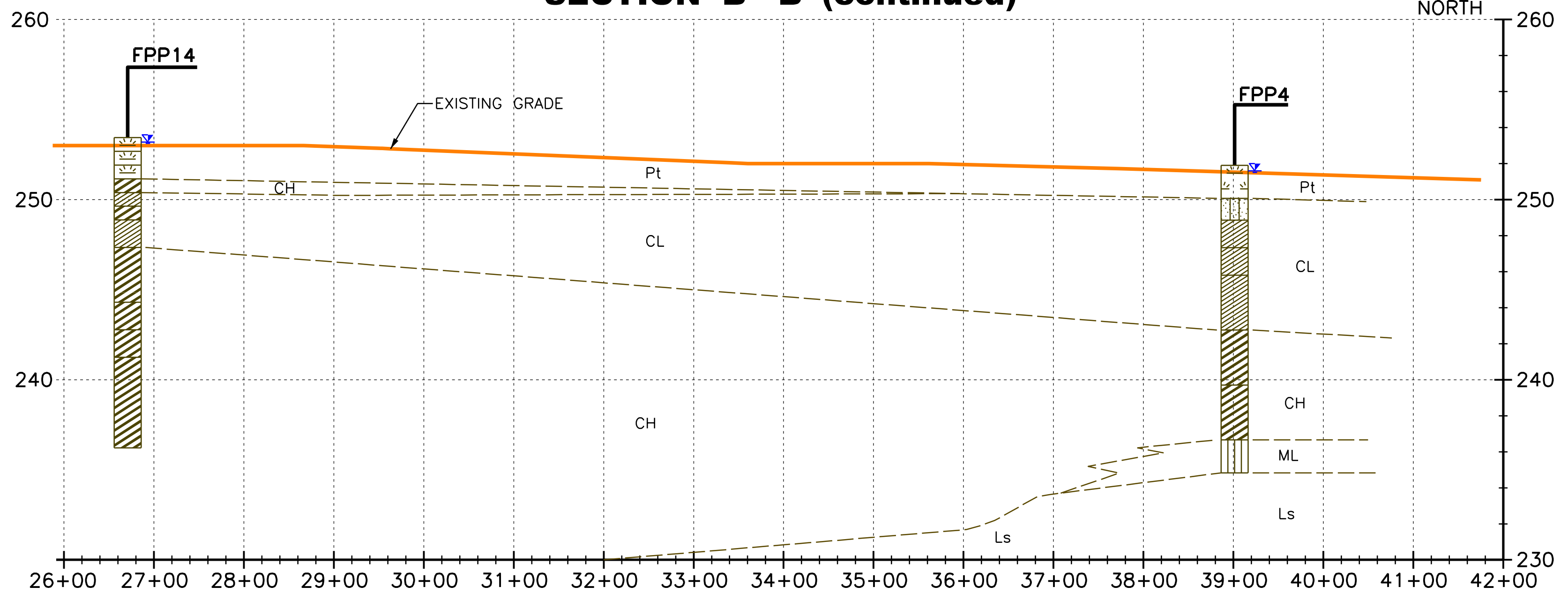
Scale: AS SHOWN
Date: JULY, 2013
Prepared By: JOW
Project No. 11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 6 Cross Sections.dgn
7/15/2013 JOW

SECTION B - B'

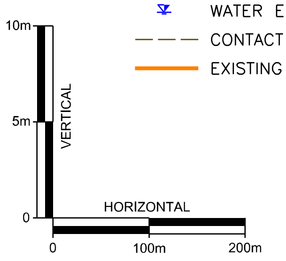


SECTION B - B' (continued)

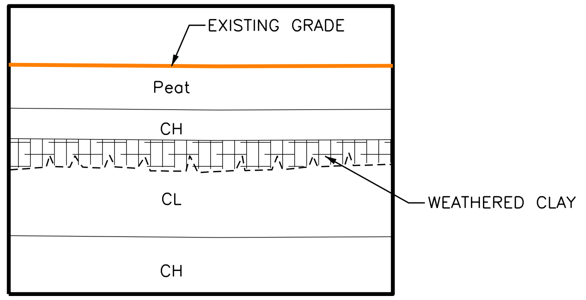


LEGEND

Pt – PEAT
ML – SILT
CL – MEDIUM PLASTICITY CLAY
CH – HIGH PLASTICITY CLAY
Ls – LIMESTONE
GW/SW – WELL GRADED SAND/GRAVEL
▽ WATER ELEVATION
– – – CONTACT LINE
—— EXISTING GRADE



BAR SCALE



WEATHERED CLAY DETAIL
NOT TO SCALE

Foth Canada Corporation

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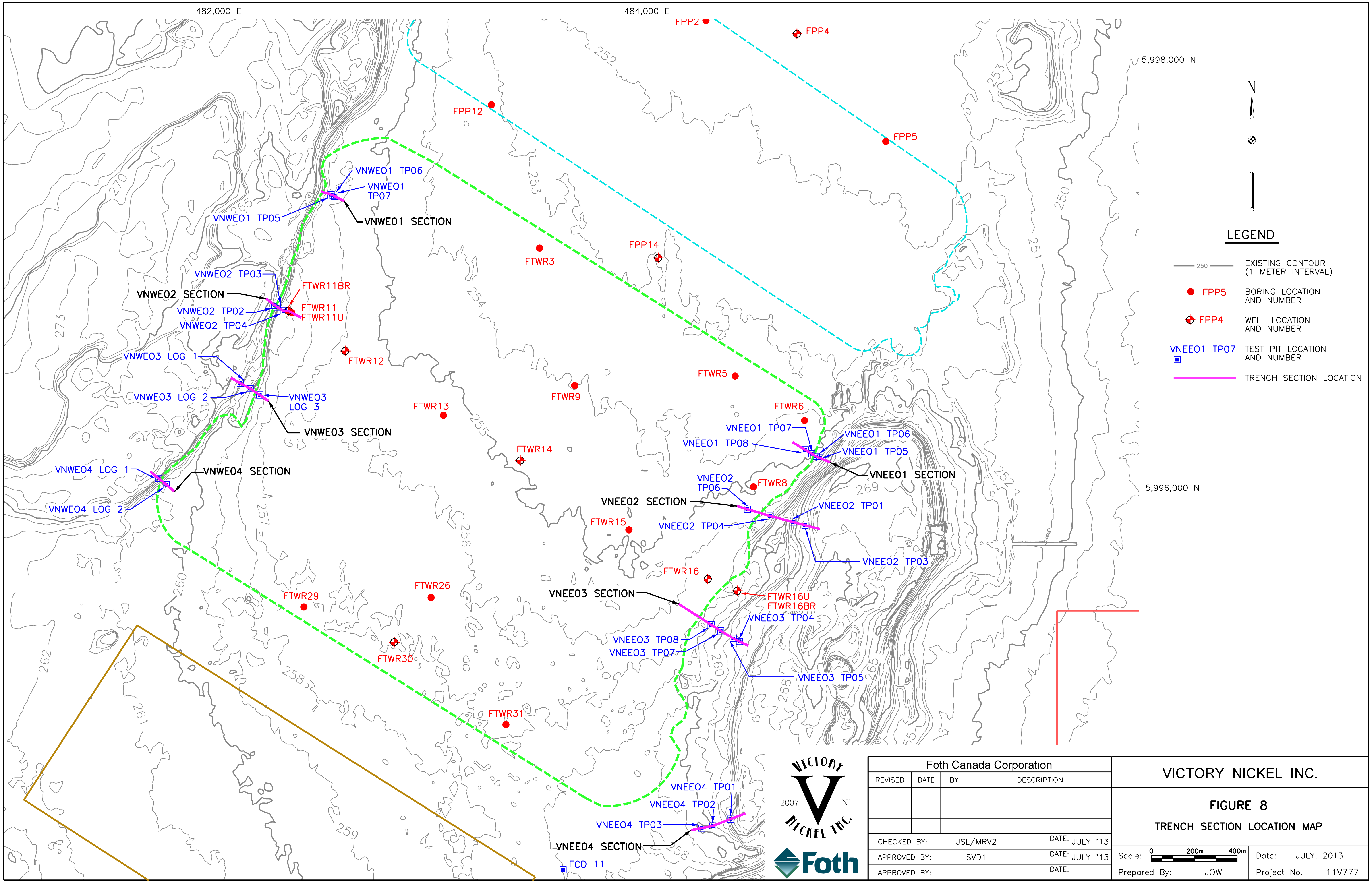
APPROVED BY: SVD1 DATE: JULY '13
APPROVED BY: DATE:

VICTORY NICKEL INC.

FIGURE 7
CROSS SECTION B-B'

Scale: AS SHOWN
Date: JULY, 2013
Prepared By: JOW
Project No. 11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 7 Cross Sections.dgn
7/15/2013 JOW



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APPROVED BY: SVD1 DATE: JULY '13
APPROVED BY: DATE:

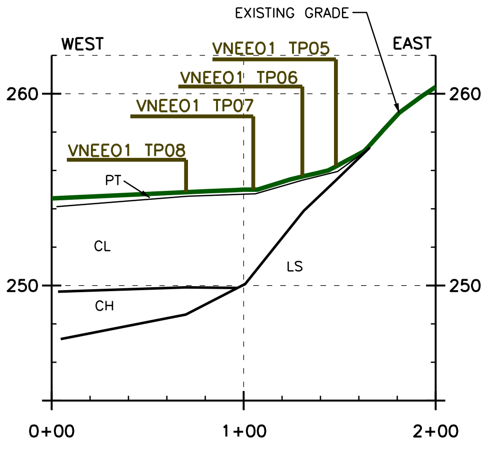
VICTORY NICKEL INC.

FIGURE 8

TRENCH SECTION LOCATION MAP

Scale: 0 200m 400m
Date: JULY, 2013
Prepared By: JOW
Project No. 11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 8 Minago plan view trench locations.dgn
7/15/2013 JOW



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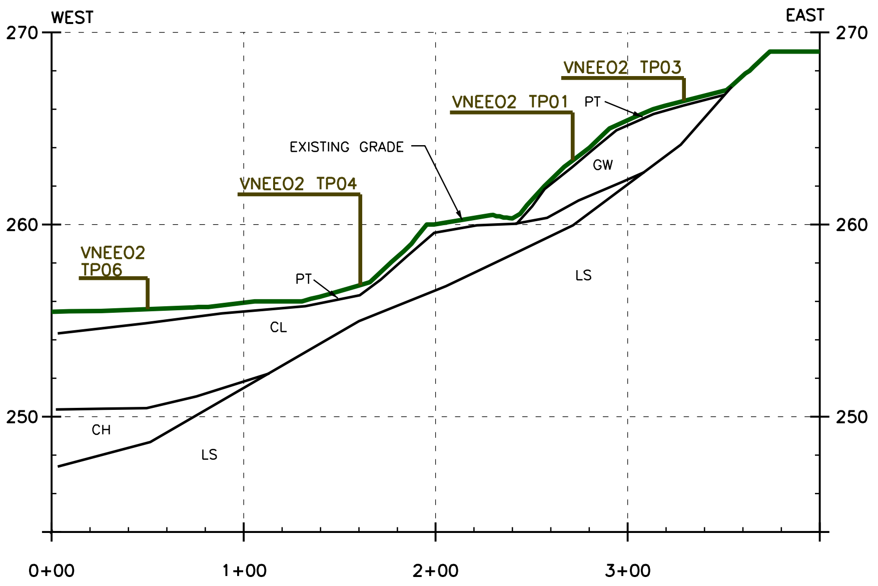
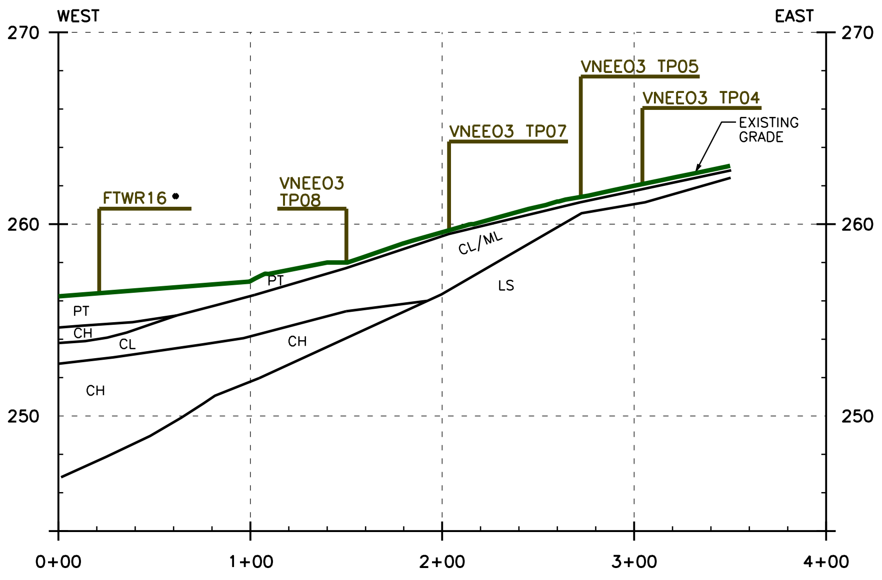
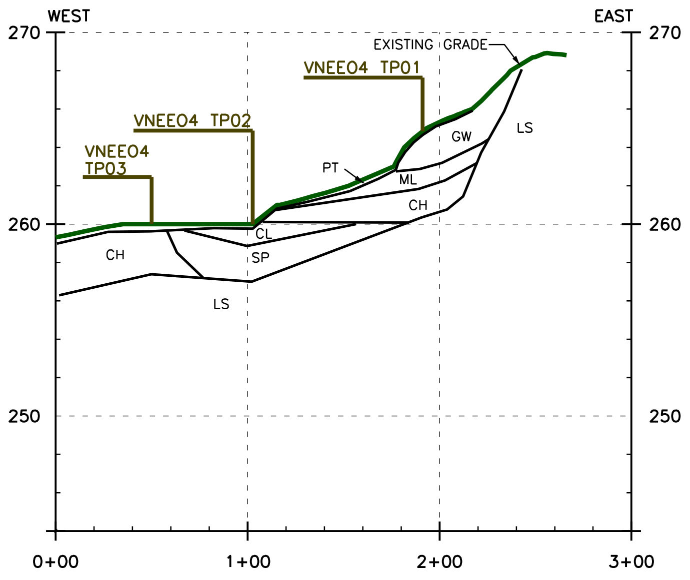


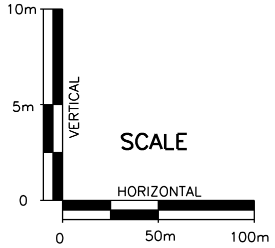
VNEE02 SECTION



VNEE03 SECTION

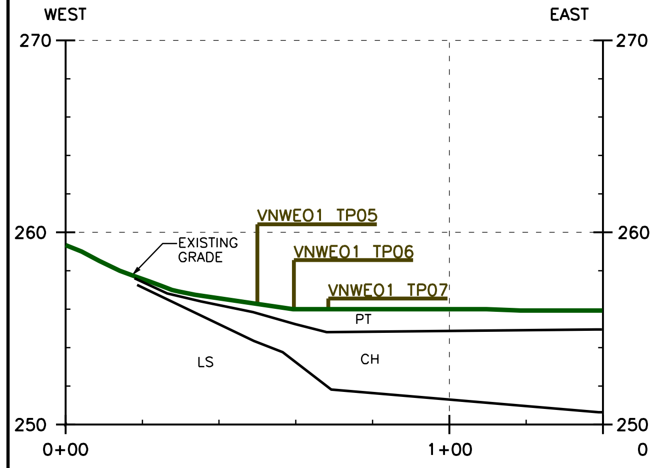


VNEE04 SECTION

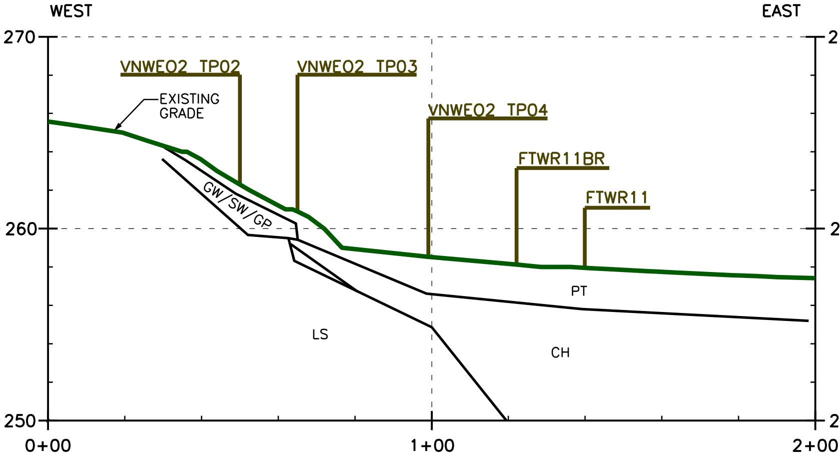


SCALE

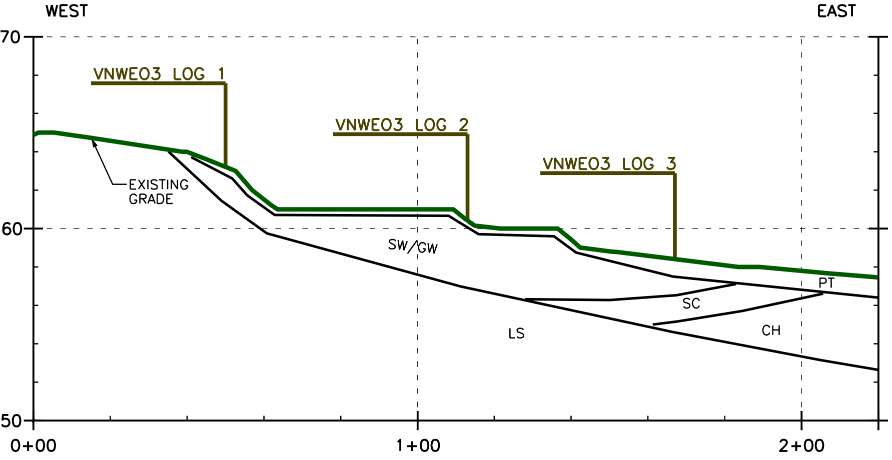
NOTE:
• – PROJECTED TO SECTION



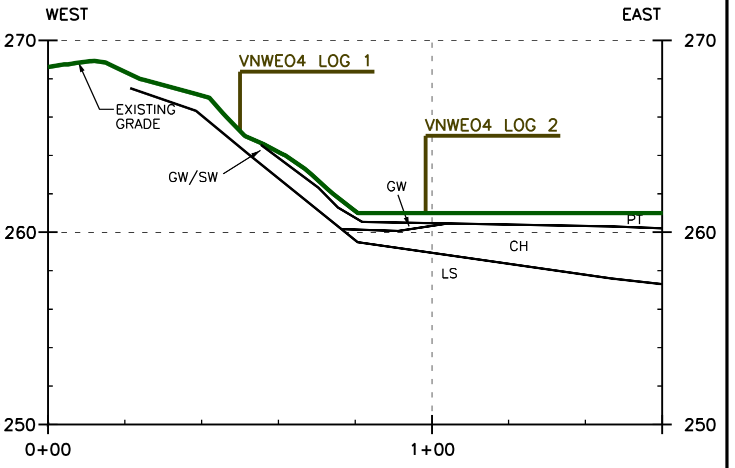
VNWE01 SECTION



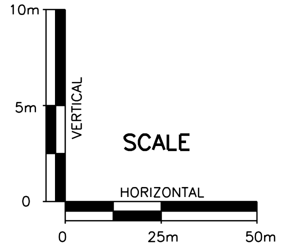
VNWE02 SECTION



VNWE03 SECTION



VNWE04 SECTION



SCALE

VICTORY 2007 Ni NICKEL INC.

Foth

Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION

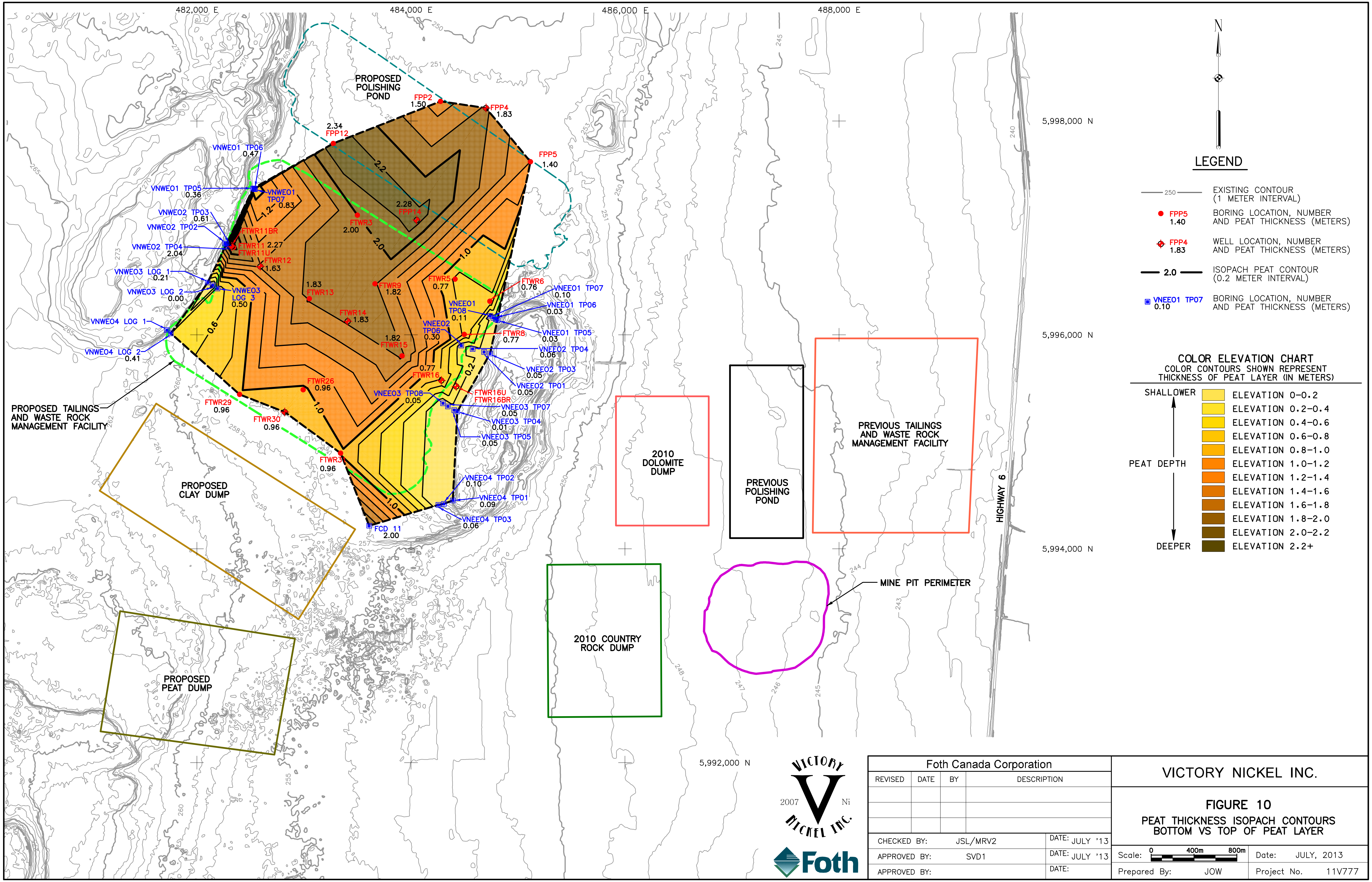
CHECKED BY: JSL/MRV2 DATE: JULY '13
APPROVED BY: SVD1 DATE: JULY '13
APPROVED BY: DATE:

VICTORY NICKEL INC.

FIGURE 9
TRENCH SECTIONS

Scale: AS SHOWN
Date: JULY, 2013
Prepared By: JOW
Project No. 11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 9 Minago trench sections.dgn
7/15/2013 JOW



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CHECKED BY: JSL/MRV2 DATE: JULY '13

APPROVED BY: SVD1 DATE: JULY '13

APPROVED BY: DATE:

VICTORY NICKEL INC.

FIGURE 10

PEAT THICKNESS ISOPACH CONTOURS BOTTOM VS TOP OF PEAT LAYER

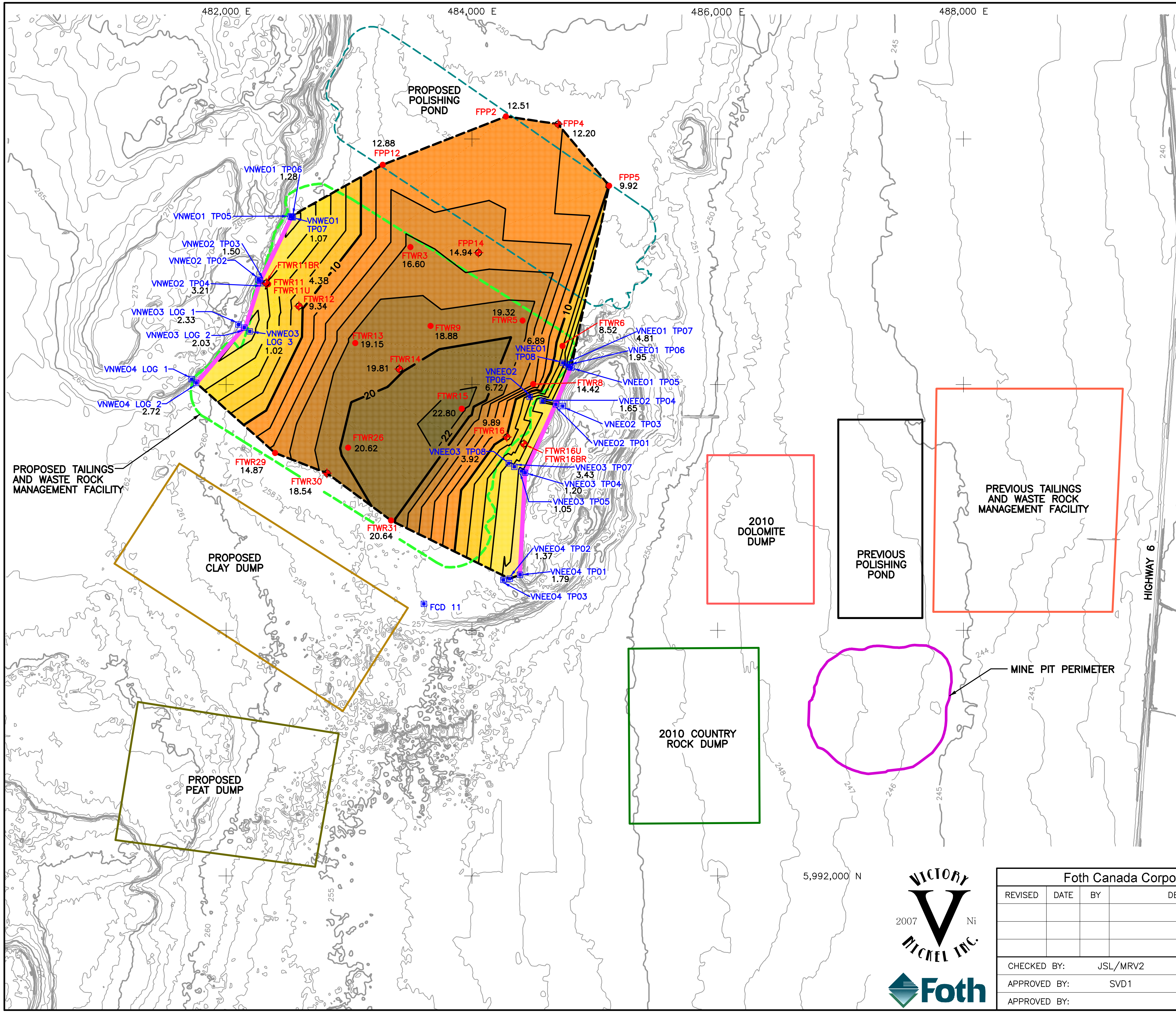
Scale: 0 400m 800m

Date: JULY, 2013

Prepared By: JOW

Project No. 11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 10 Minago Isopach bottom vs top of peat layer.dgn
7/15/2013 JOW



LEGEND

250	EXISTING CONTOUR (1 METER INTERVAL)
● FPP5 9.92	BORING LOCATION, NUMBER AND CLAY THICKNESS (METERS)
◈ FPP4 12.20	WELL LOCATION, NUMBER AND CLAY THICKNESS (METERS)
—10—	ISOPACH CLAY CONTOUR (2 METER INTERVAL)
▣ VNEE01 TP07 4.81	BORING LOCATION, NUMBER AND CLAY THICKNESS (METERS)
▬	LIMIT OF 2 METER CLAY THICKNESS

COLOR CONTOURS SHOWN REPRESENT THICKNESS OF CLAY LAYER (IN METERS)

SHALLOWER
CLAY DEPTH
DEEPER

🟨	ELEVATION 0-2
🟨	ELEVATION 2-4
🟨	ELEVATION 4-6
🟧	ELEVATION 6-8
🟧	ELEVATION 8-10
🟧	ELEVATION 10-12
🟧	ELEVATION 12-14
🟧	ELEVATION 14-16
🟫	ELEVATION 16-18
🟫	ELEVATION 18-20
🟫	ELEVATION 20-22
🟫	ELEVATION 22+

Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION

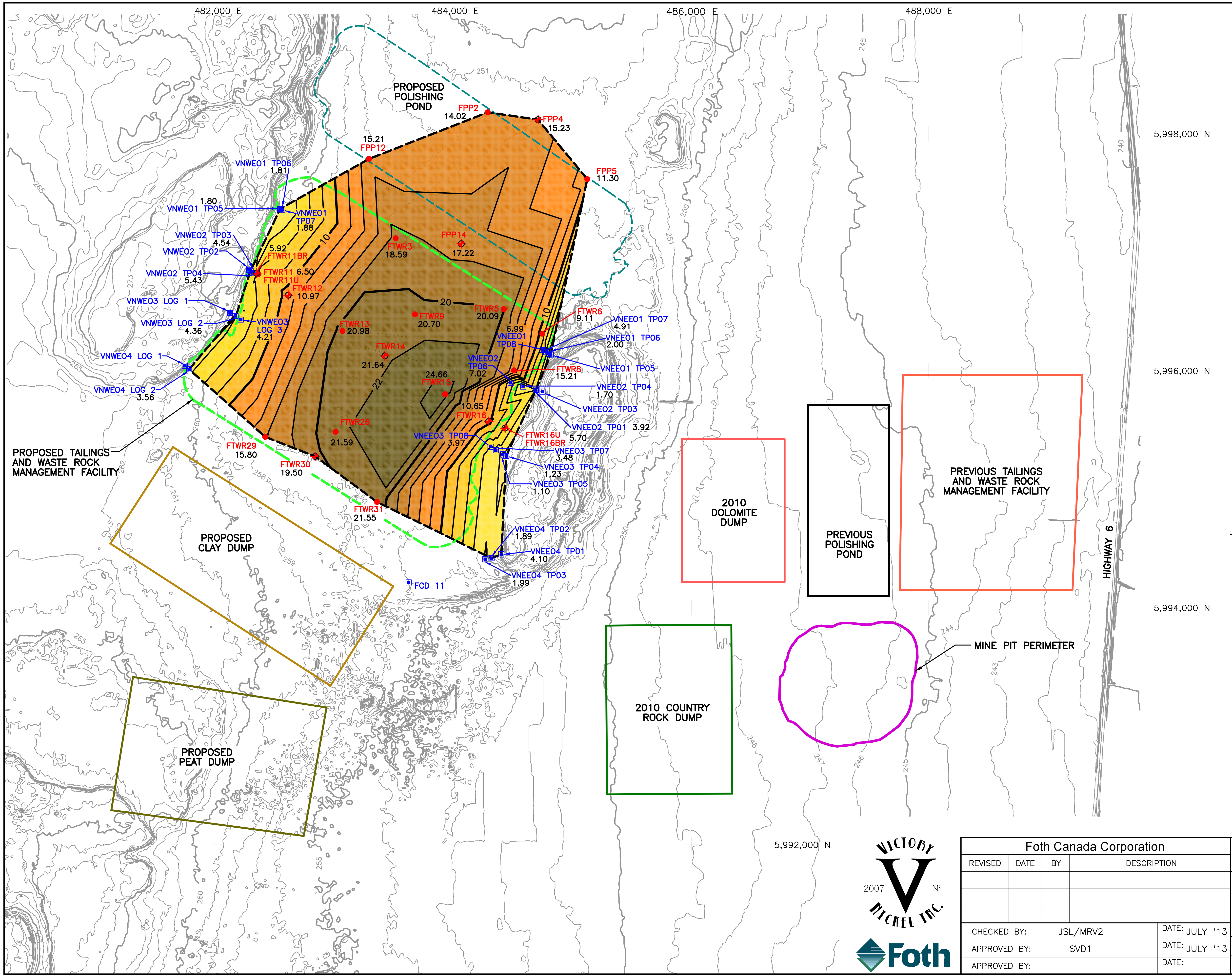
CHECKED BY:	JSL/MRV2	DATE:	JULY '13
APPROVED BY:	SVD1	DATE:	JULY '13
APPROVED BY:		DATE:	

VICTORY NICKEL INC.

FIGURE 11
CLAY THICKNESS ISOPACH CONTOURS BOTTOM VS TOP OF CLAY LAYER

Scale: 0 400m 800m		Date:	JULY, 2013
Prepared By:	JOW	Project No.	11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 11 Minago Isopach bottom vs top of clay layer.dgn
7/15/2013 JOW



LEGEND

—250— EXISTING CONTOUR (1 METER INTERVAL)

● FPP5 11.30 BORING LOCATION, NUMBER AND OVERBURDEN THICKNESS (METERS)

⊕ FPP4 15.23 WELL LOCATION, NUMBER AND OVERBURDEN THICKNESS (METERS)

—10— ISOPACH OVERBURDEN CONTOUR (2 METER INTERVAL)

▣ VNEE01 TP07 4.91 BORING LOCATION, NUMBER AND OVERBURDEN THICKNESS (METERS)

– – – – APPROXIMATE AREA OF OVERBURDEN SOIL VOLUME

COLOR CONTOURS SHOWN REPRESENT THICKNESS OF OVERBURDEN LAYER (IN METERS)

SHALLOWER

OVERBURDEN DEPTH

DEEPER

🟨	ELEVATION 0-2
🟨	ELEVATION 2-4
🟨	ELEVATION 4-6
🟧	ELEVATION 6-8
🟧	ELEVATION 8-10
🟧	ELEVATION 10-12
🟧	ELEVATION 12-14
🟧	ELEVATION 14-16
🟫	ELEVATION 16-18
🟫	ELEVATION 18-20
🟫	ELEVATION 20-22
🟫	ELEVATION 22-24
🟫	ELEVATION 24+

2007 VICTORY Ni NICKEL INC.

Foth

Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION

CHECKED BY: JSL/MRV2 DATE: JULY '13

APPROVED BY: SVD1 DATE: JULY '13

APPROVED BY: DATE:

VICTORY NICKEL INC.

FIGURE 12

OVERBURDEN THICKNESS ISOPACH CONTOURS BOTTOM OF CLAY VS TOP OF PEAT LAYERS

Scale: 0 400m 800m

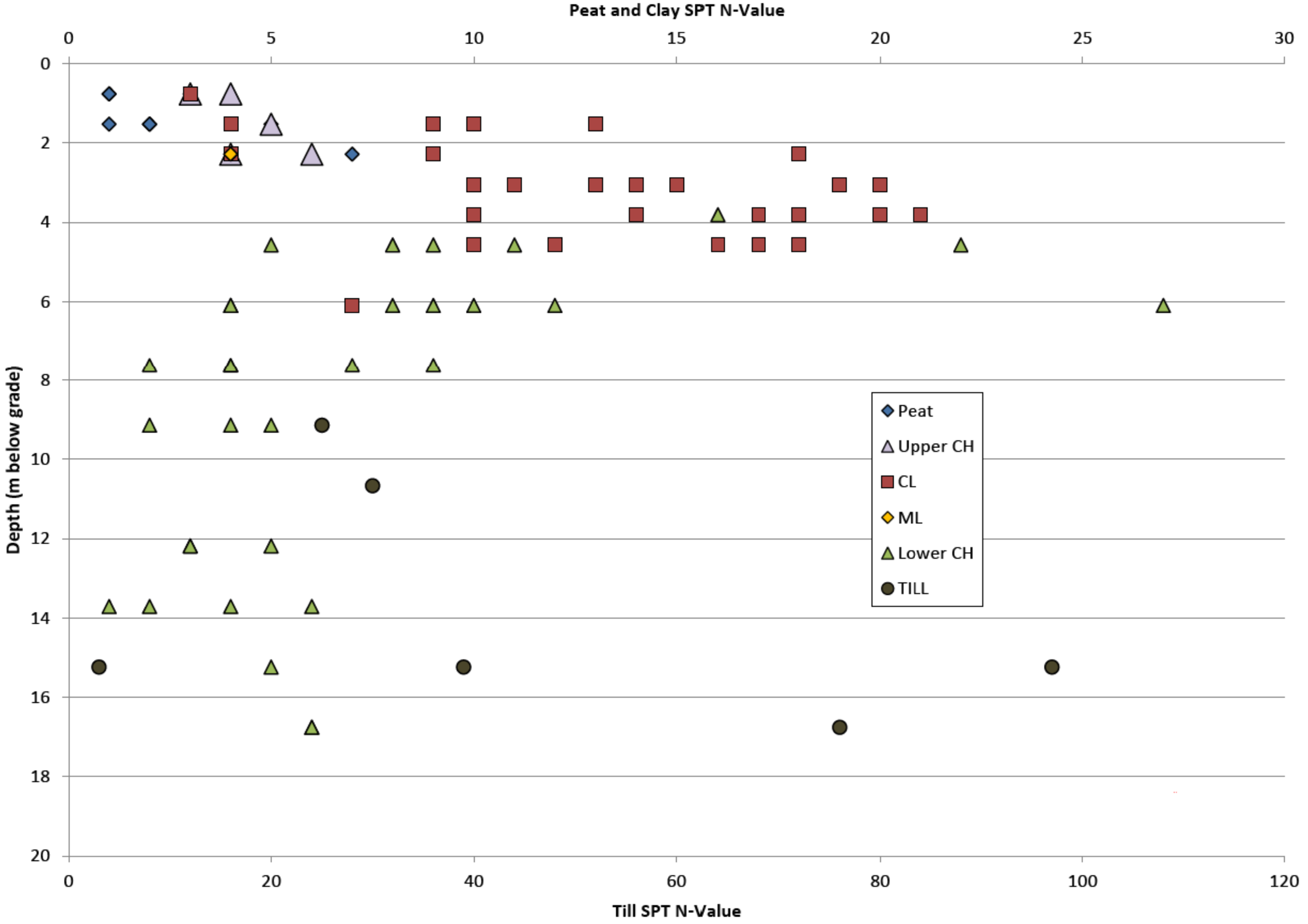
Date: JULY, 2013

Prepared By: JOW

Project No. 11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 12 Minago isopach overburden thickness.dgn
7/15/2013 JOW

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 13.dgn
7/15/2013 JOW



Foth Canada Corporation

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CHECKED BY:	JSL/MRV2	DATE: JULY '13
APPROVED BY:	SVD1	DATE: JULY '13
APPROVED BY:		DATE:

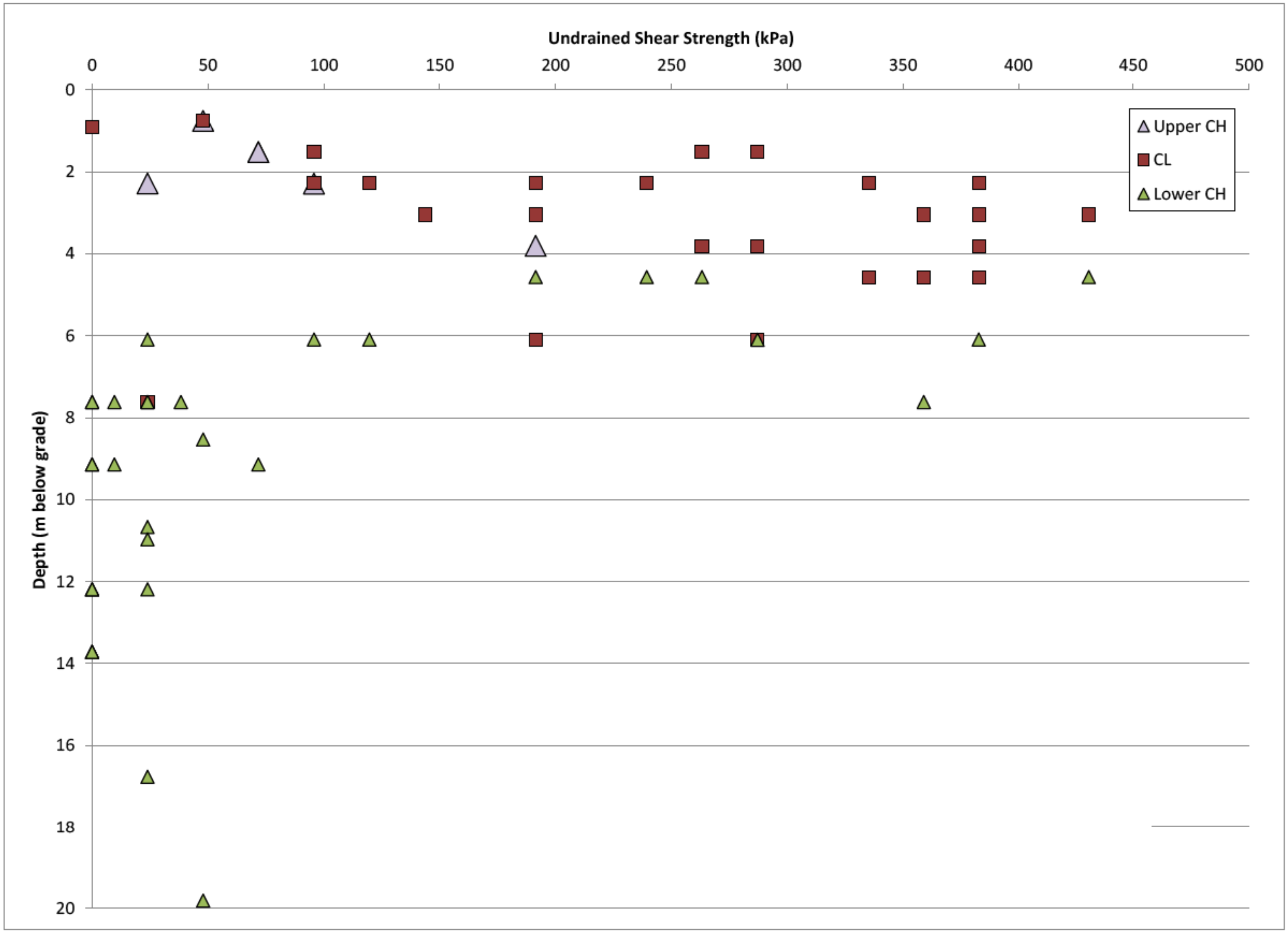
VICTORY NICKEL INC.

FIGURE 13

SPT "N-VALUE" VS. DEPTH

Scale:	AS SHOWN	Date:	JULY, 2013
Prepared By:	JOW	Project No.	11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 14.dgn
7/15/2013 JOW



Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JSL/MRV2	DATE: JULY '13
APPROVED BY:	SVD1	DATE: JULY '13
APPROVED BY:		DATE:

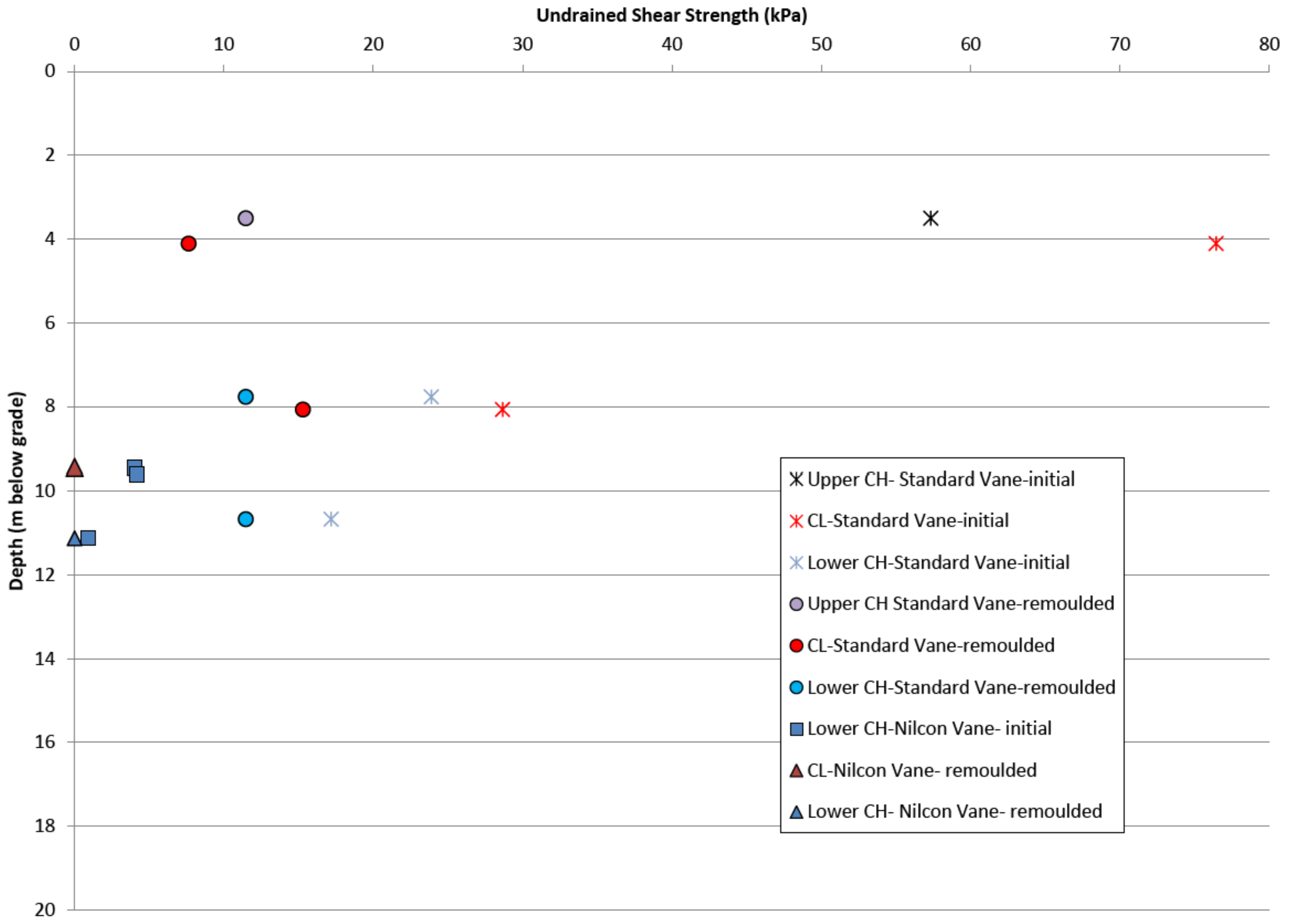
VICTORY NICKEL INC.

FIGURE 14

UNDRAINED SHEAR STRENGTH MEASURED BY PENETROMETER VS. DEPTH

Scale:	AS SHOWN	Date:	JULY, 2013
Prepared By:	JOW	Project No.	11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 15.dgn
7/15/2013 JOW



VICTORY 2007 V Ni NICKEL INC.

Foth

Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION

CHECKED BY: JSL/MRV2 DATE: JULY '13
APPROVED BY: SVD1 DATE: JULY '13
APPROVED BY: DATE:

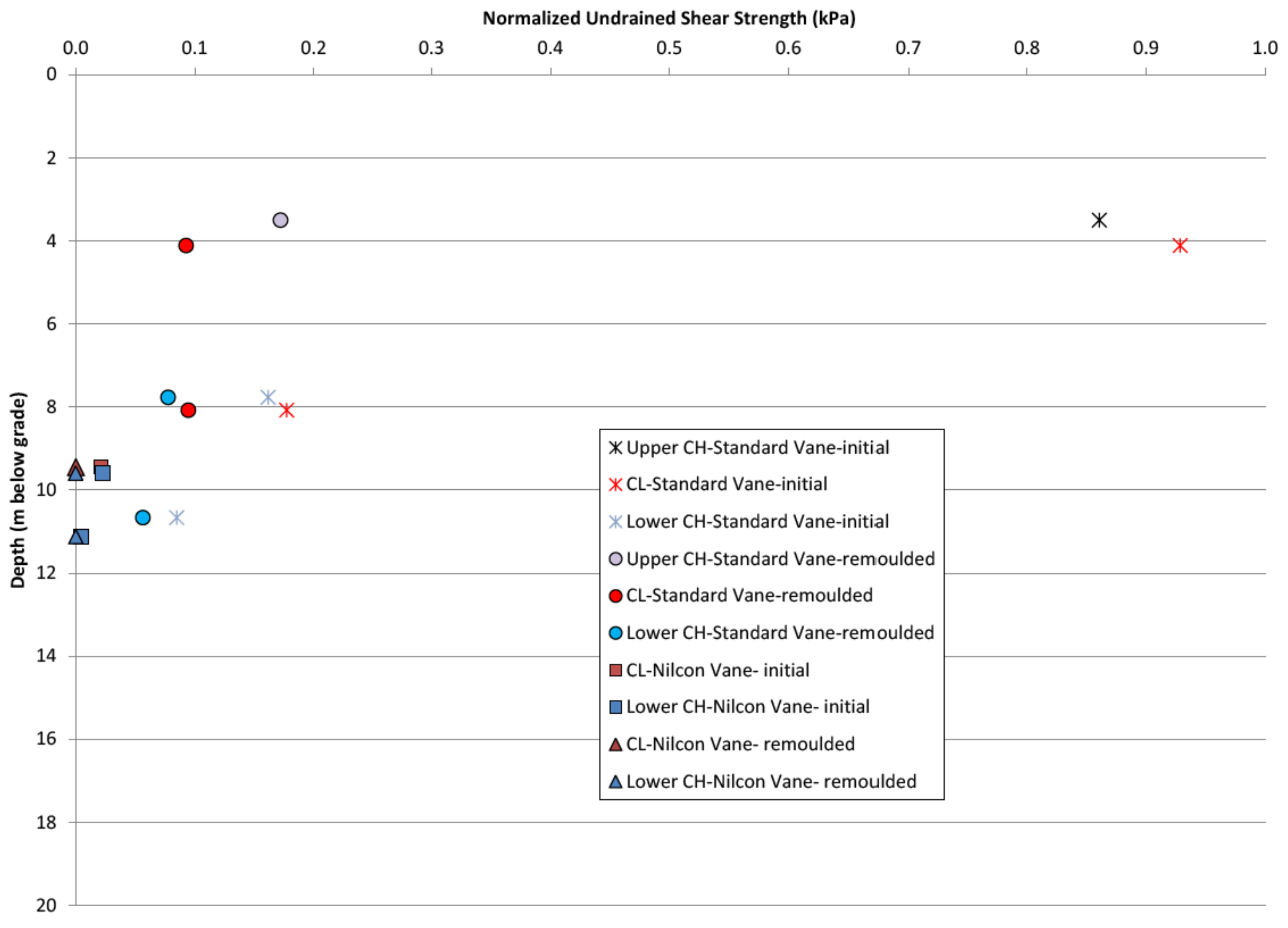
VICTORY NICKEL INC.

FIGURE 15

UNDRAINED SHEAR STRENGTH MEASURED BY SHEAR VANE VS. DEPTH

Scale: AS SHOWN
Date: JULY, 2013
Prepared By: JOW
Project No. 11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 16.dgn
7/15/2013 JOW



Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION

CHECKED BY:	JSL/MRV2	DATE: JULY '13
APPROVED BY:	SVD1	DATE: JULY '13
APPROVED BY:		DATE:

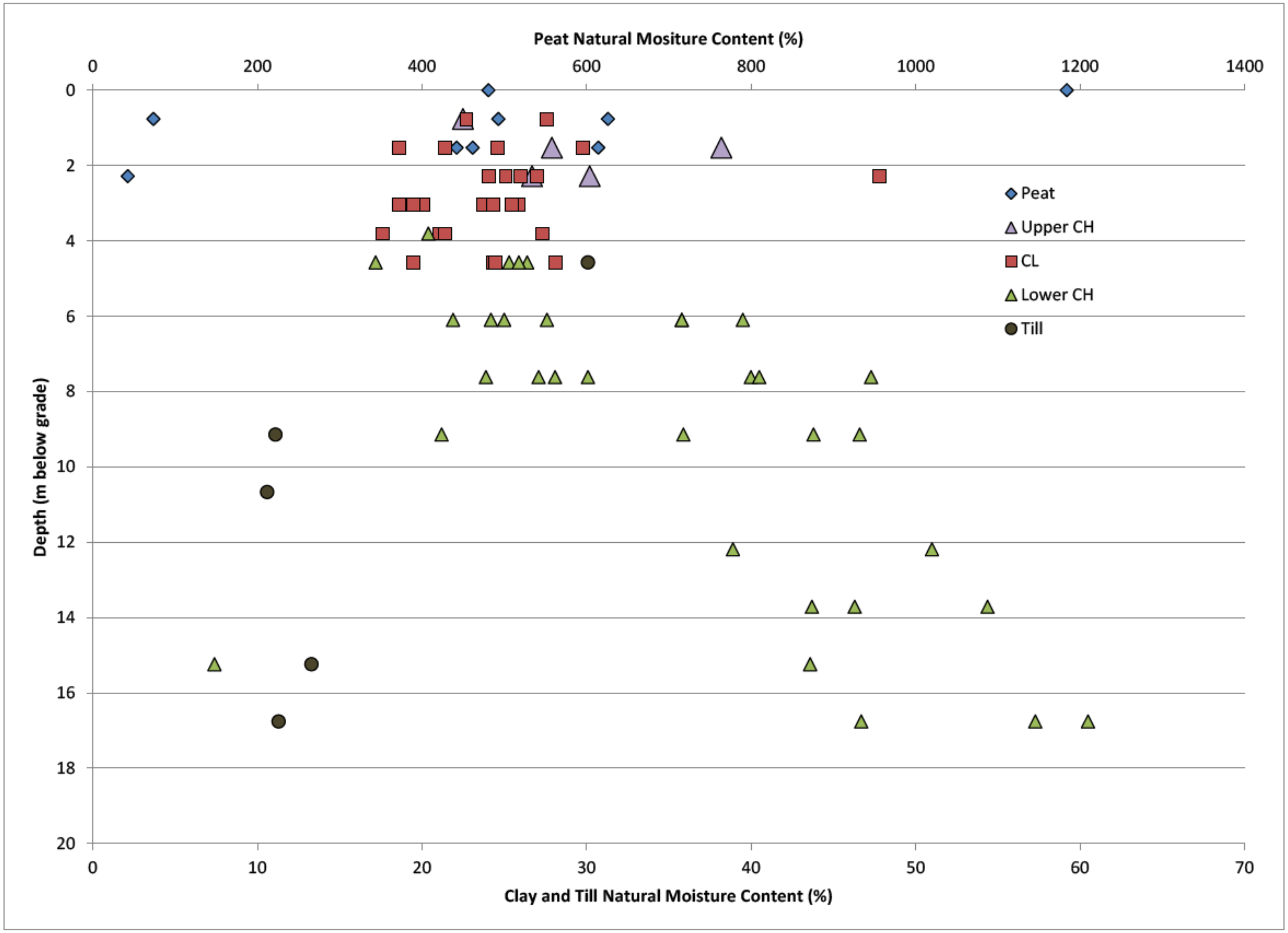
VICTORY NICKEL INC.

FIGURE 16

NORMALIZED UNDRAINED SHEAR STRENGTH
MEASURED BY SHEAR VANE VS. DEPTH

Scale:	AS SHOWN	Date:	JULY, 2013
Prepared By:	JOW	Project No.	11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 17.dgn
7/15/2013 JOW



Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION

CHECKED BY: JSL/MRV2 DATE: JULY '13
APPROVED BY: SVD1 DATE: JULY '13
APPROVED BY: DATE:

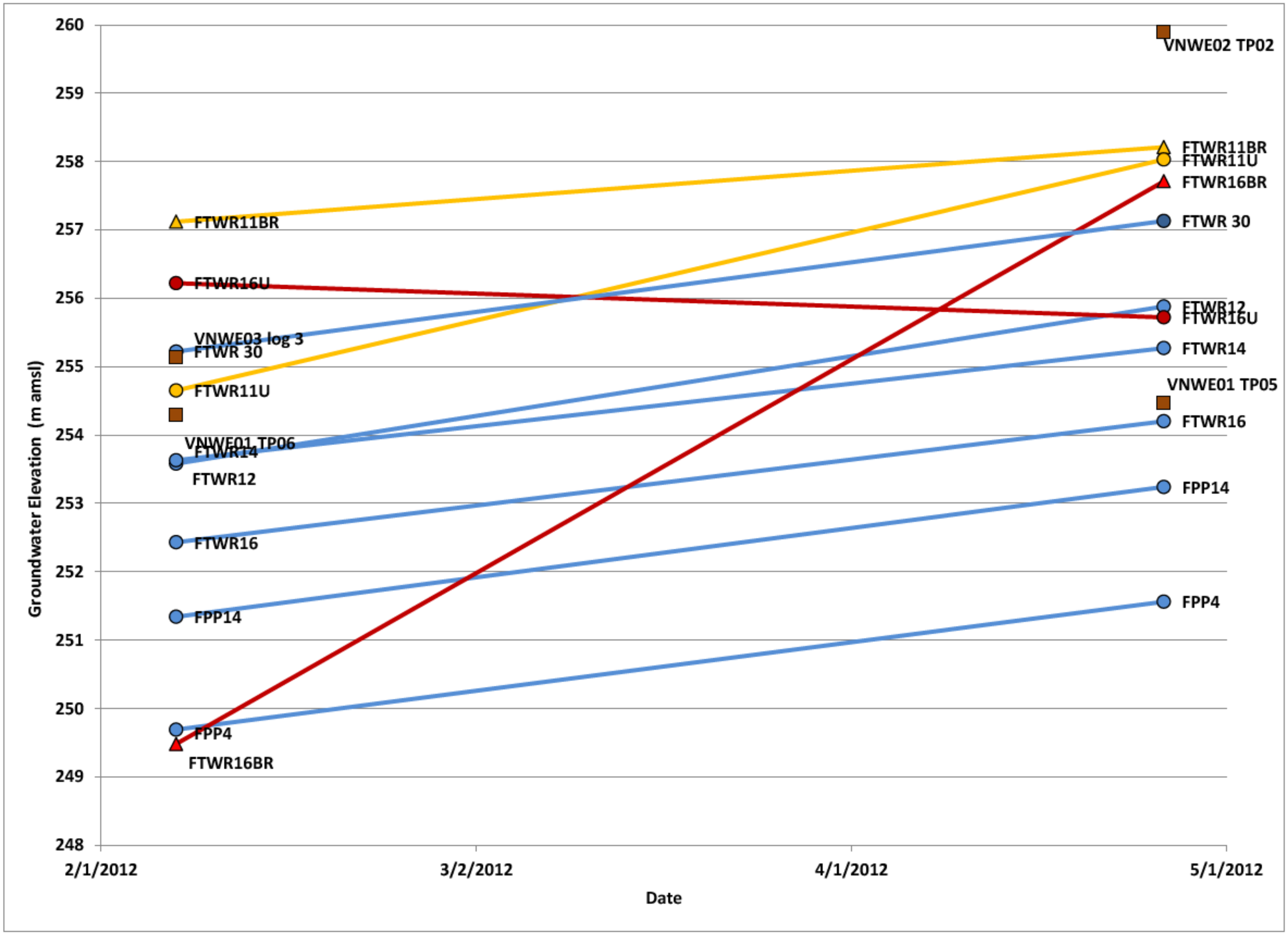
VICTORY NICKEL INC.

FIGURE 17

NATURAL MOISTURE CONTENT VS. DEPTH

Scale: AS SHOWN
Date: JULY, 2013
Prepared By: JOW
Project No. 11V777

X:\GB\IE\2011\11V777\cad\Factual_rpt_2012\Figure 18.dgn
7/15/2013 JOW



Foth Canada Corporation

REVISED	DATE	BY	DESCRIPTION

CHECKED BY: JSL/MRV2 DATE: JULY '13
APPROVED BY: SVD1 DATE: JULY '13
APPROVED BY: DATE:

VICTORY NICKEL INC.

FIGURE 18

GROUNDWATER HYDROGRAPH

Scale: AS SHOWN
Date: JULY, 2013
Prepared By: JOW
Project No. 11V777

Appendix A

Victory Nickel Field Investigations

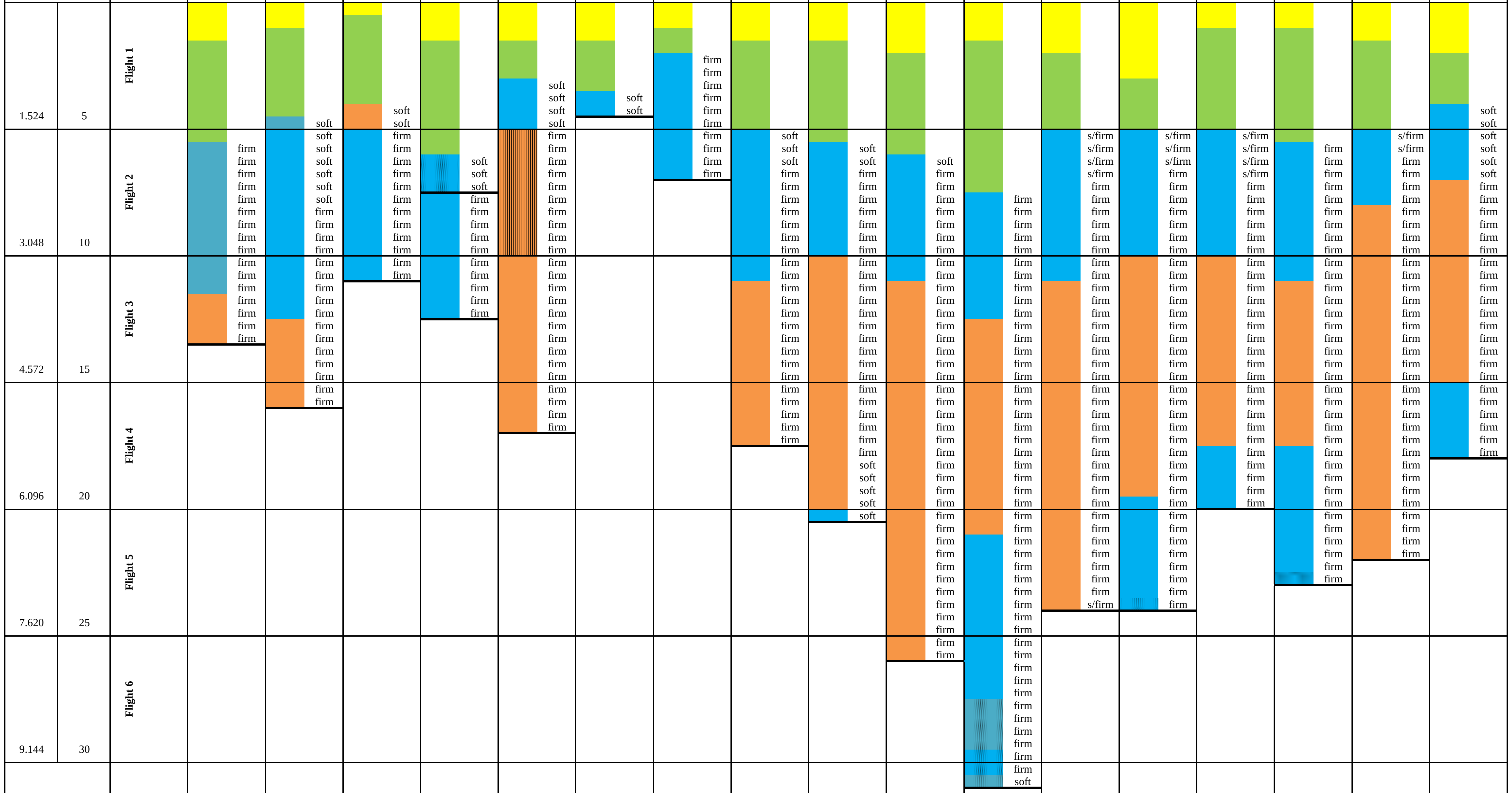
MINAGO VISIT 29, 30, 31 MARCH 2011

Test Pit Results

Hyundai 250LC7A		COORDINATES		PEAT	SOFT ROCK 1						SOFT ROCK 2						ELEVATIONS		COMMENTS
		Northing (m)	Easting (m)	Depth (m)	Type	Depth (m)	Descriptors	Sample	Strength kPa	Depth (m)	Type	Depth (m)	Descriptors	Sample	Strength kPa	Depth (m)	Surface (m)	Base (m)	Comments
Day 1 Tuesday, Herman, Sunny at 0	TD-01	5,997,994	484,979	1.22	Grey Clay	3.68	Moist	1 2	25 250	2.24 3.63	Brown Clay	4.82		3 4	450 450	3.68 4.82	-	4.82	Hole to limit of machine
	TD-02	5,997,957	484,472	1.22	Grey Clay	4.50	Moist	1 2	125 475	1.30 3.30	Brown Clay	5.00		3		4.50	256.50	251.50	Hole to limit of machine
	TD-03	5,997,920	483,978	2.00	Grey Clay	3.70	Moist	1	200	2.40	Brown Clay	5.00		2	4500	4.70	-		Hole to limit of machine
	TD-04	5,997,892	483,477	2.74	Grey Clay	2.00	Wet sand seam	1	175	3.00	Brown Clay	4.10		2	225	3.80	252.00		Hole to limit of machine
	TD-05	5,997,857	482,903	1.12	Brown	tbc	Soft to firm										-		Limestone at base Some water at base probably from limestone
	TD-06	5,996,365	482,307	1.60	Grey Clay	5.50	Soft to firm	1	350	4.50							259.00		Hole to limit of machine
	TD-07	5,996,246	482,805	1.80	Grey Clay	3.50	Water from peat Hole abandoned	1	350	3.50							257.50		Hole abandoned at 3.5 m
	TD-08	5,996,189	483,337	2.13	Grey Clay	4.20		1	150	3.95	Brown Clay	4.40	Very wet clay at base Sandy clay						Hole abandoned
	TD-09	5,996,077	483,888	1.80	Grey Clay	2.50	Water from peat	1	15	3.50							-		Hole abandoned
	TD-10	5,995,892	484,413	0.60	Brown	5.00	Dry, friable	1 2	350 450	3.00 4.40							259.00		Hole to limit of machine
	TD-11	5,995,885	484,478	0.90	Brown	2.15	Friable	1	465	2.15							259.50		Hole abandoned Water in hole
Day 2 Wednesday, Charlie, Overcast +6 C	TD-12	5,995,329	484,335	0.20	Brown Clay	4.90	Light to darker brown Boulders at base	1	475	2.00									Hole to limit of machine Bedrock semed close
	TD-13	5,995,353	483,835	0.80	Brown Clay	5.20	Light to darker brown	1	350	2.90							251.50		Hole to limit of machine
	TD-14	5,995,291	483,328	1.10	Grey Clay	3.00	Moist	1	200	1.25	Brown Clay	5.10	Dry and friable	2	350	3.10	255.50		
	TD-15	5,995,286	482,819	1.05	Grey Clay	2.00		1	150	2.00	Brown Clay	3.25		2	250	3.00	255.00		Hole abandoned Water from peat
	TD-16	5,995,330	482,207	0.90	Grey Clay	2.40	Sandy and silty but dry	1	tba	1.25	Brown Clay	4.90	Dry and friable	2	400	2.60	259.00		Hole to limit of machine
	TD-17	5,995,308	481,690	0.90	Grey Clay	2.40	Light brown Dry and friable	1	450	2.00							261.50		Limestone at base 1 m of water in 12 minutes
	TD-18	5,994,592	482,617	1.00	Grey Clay	1.80	Soft	1		1.00	Brown Clay	5.50	Friable but moist at base	2 3	450 350	2.00 4.80	259.00		Hole to limit of machine
	TD-19	5,994,115	483,959	0.30	Brown Clay	4.90	Light to darker brown Dry and friable	1 2	150 350	1.50 4.50									Hole to limit of machine
Day 3, Thursday, Herman, Overcast +6	OP-01	5,993,349	487,338	1.10	Blue Clay	**3.50**	Firm, friable at depth	1 2	50	2.20 3.00							248.00	244.50	Limestone at base Some water at base probably from limestone
	OP-02	5,993,350	487,650	1.10	Grey Clay	**3.50**	Soft at top Friable and dry at base	1		3.50							246.50	243.00	Limestone at base Some water at base probably from limestone
	OP-03	5,993,321	487,974	0.90	Grey Clay	2.50	Soft then friable with sand	1	none	1.00	Brown Clay	**4.90**	Soft at top Friable and dry at base	2	350	2.50	245.50	241.60	Limestone at base Some water at base probably from limestone
	OP-04	5,993,000	487,650	1.60	Green Clay	1.80	Soft at top Friable at base				Brown Clay	4.50	Friable Boulders at base	1	350	4.50	243.00	238.50	Hole to limit of machine Some inflow of water at base
	OP-05	5,993,100	487,350	0.90	Brown Clay	2.50	Friable and dry at base	1	200	2.00							243.50	241.00	Limestone at base No water
	OP-06	5,992,828	487,347	1.30	Green Clay	2.30	Fraible				Brown Clay	4.80	Friable	1	300	4.80	247.50	242.70	Hole to limit of machine Little water at base
	OP-07	5,993,346	487,046	1.77	Blue Clay	2.80	Soft at top then firm	1	50	1.80	Brown Clay	6.00	Friable	2 3 4	175 300 250	3.30 3.90 5.70	253.00	247.00	Boulders at 3.90 m Hole to limit of machine Some water at base suggesting limestone close
	OP-08	5,993,350	486,750	1.90	Green Clay						Brown Clay	5.50	Friable	1	450	5.50	246.60	241.00	Hole to limit of machine
	OP-09	5,993,600	486,900	1.50	Green Clay	5.50	Friable	1 2	450 400	2.30 5.50							249.00	243.50	Hole to limit of machine
	OP-10	5,993,600	487,350	1.70	Green Clay	2.40	Soft going dry and friable	1		2.40	Brown Clay	5.20	Fraible boulders at base	2	400	5.20	247.00	241.80	Hole to limit of machine Some water at base suggesting limestone close
	OP-11	5,993,850	487,350	1.40	Green Clay	1.70					Brown Clay	**5.50**	Dry at base	1	300	5.20	247.00	241.50	Limestone at base Some water at base probably from limestone

OPEN PIT AREA

Depth		OP 1	OP 2	OP 3	OP 4	OP 5	OP 6	OP 7	OP 8	OP 9	OP 10	OP 11	OP 12	OP 13	OP 14	OP 15	OP 16	OP 17
m ft		T G	T G	T G	T G	T G	T G	T G	T G	T G	T G	T G	T G	T G	T G	T G	T G	T G
Northing	m	5,993,375	5,993,375	5,993,375	5,993,200	5,993,000	5,993,050	5,992,750	5,993,200	5,993,000	5,993,375	5,993,375	5,993,625	5,993,750	5,993,625	5,993,875	5,993,625	5,993,850
Easting	m	487,250	487,625	487,875	487,500	487,750	487,250	487,250	487,000	486,750	487,000	486,625	487,100	486,850	487,250	487,250	487,625	487,875
Grade	m	246.850	246.050	245.650	245.950	245.300	246.600	246.450	247.150	247.400	247.250	247.700	247.050	247.200	246.750	245.750	246.050	245.500
Rock	m	242.735	241.173	242.297	242.140	240.119	245.228	244.317	241.816	241.000	239.326	238.252	239.735	239.885	240.654	238.740	239.345	240.014



		OP 1		OP 2		OP 3		OP 4		OP 5		OP 6		OP 7		OP 8		OP 9		OP 10		OP 11		OP 12		OP 13		OP 14		OP 15		OP 16		OP 17	
Fibrous Peat T		0.457	1.50	0.305	1.00	0.152	0.50	0.457	1.50	0.457	1.50	0.457	1.50	0.305	1.00	0.457	1.50	0.457	1.50	0.610	2.00	0.457	1.50	0.610	2.00	0.914	3.00	0.305	1.00	0.305	1.00	0.457	1.50	0.610	2.00
Spagnium Peat T		1.219	4.00	1.067	3.50	1.067	3.50	1.372	4.50	0.457	1.50	0.610	2.00	0.305	1.00	1.067	3.50	1.372	4.50	1.219	4.00	1.829	6.00	0.610	2.00	0.610	2.00	1.219	4.00	1.372	4.50	1.067	3.50	0.610	2.00
Grey&Brown Clay T		2.438	8.00	3.505	11.50	2.133	7.00	1.981	6.50	4.267	14.00	0.305	1.00	1.524	5.00	3.810	12.50	4.572	15.00	6.096	20.00	7.162	23.50	6.096	20.00	5.791	19.00	4.572	15.00	5.334	17.50	5.181	17.00	4.267	14.00
Rock Depth		4.115	13.50	4.877	16.00	3.353	11.00	3.810	12.50	5.181	17.00	1.372	4.50	2.133	7.00	5.334	17.50	6.400	21.00	7.924	26.00	9.448	31.00	7.315	24.00	7.315	24.00	6.096	20.00	7.010	23.00	6.705	22.00	5.486	18.00

Ave. Fibrous Peat T	m	0.457
Ave. Spagnium Peat T	m	1.004
Ave. Grey&Brown Clay T	m	4.061
Ave. Rock Depth	m	5.522

🟨	Fibrous Peat
🟩	Spagnium Peat
▨	Grey Clay
🟧	Brown Clay
🟦	Silty Grey Clay
▥	Swelling Brown Clay

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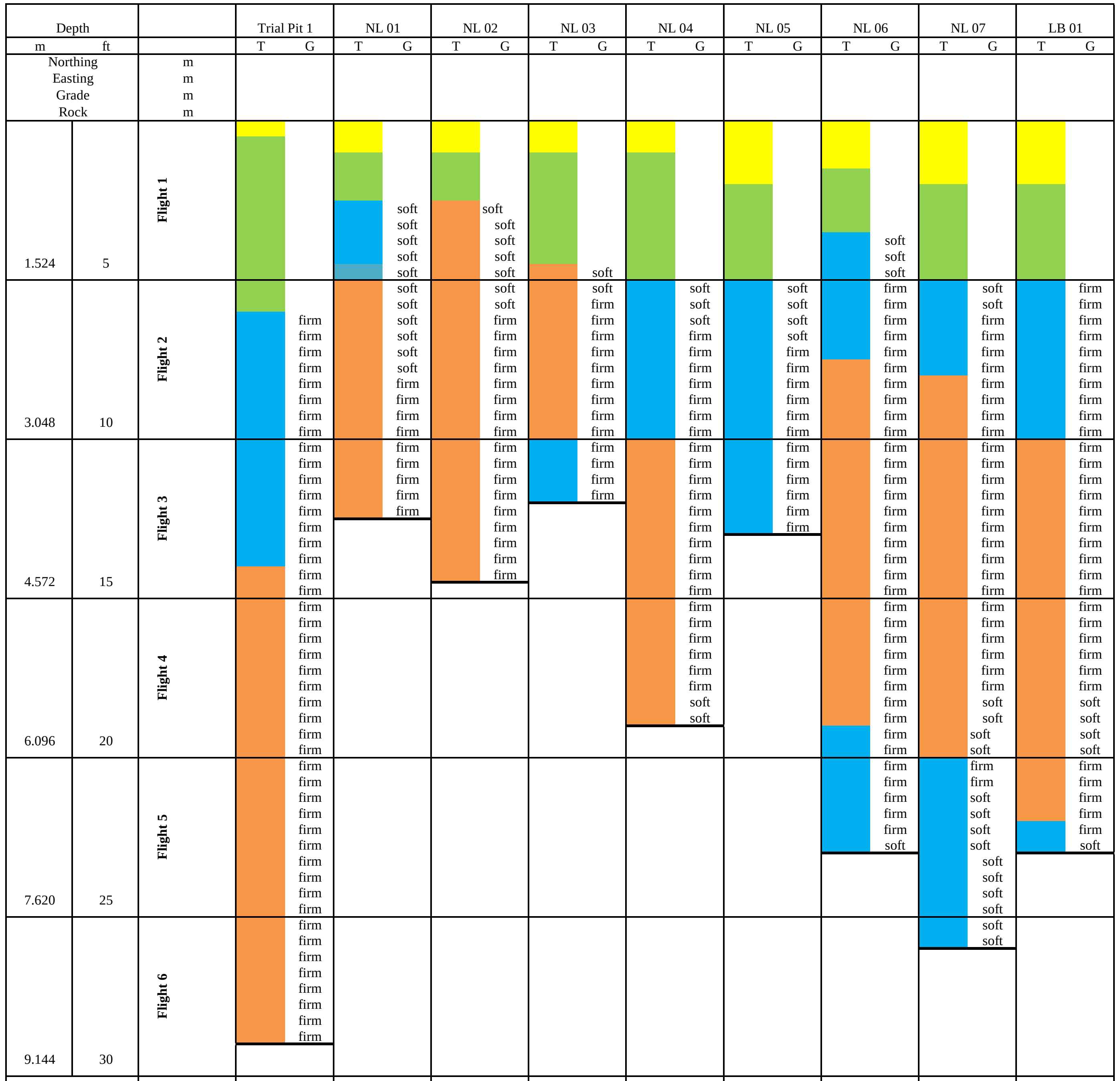
MISCELLANEOUS AREAS



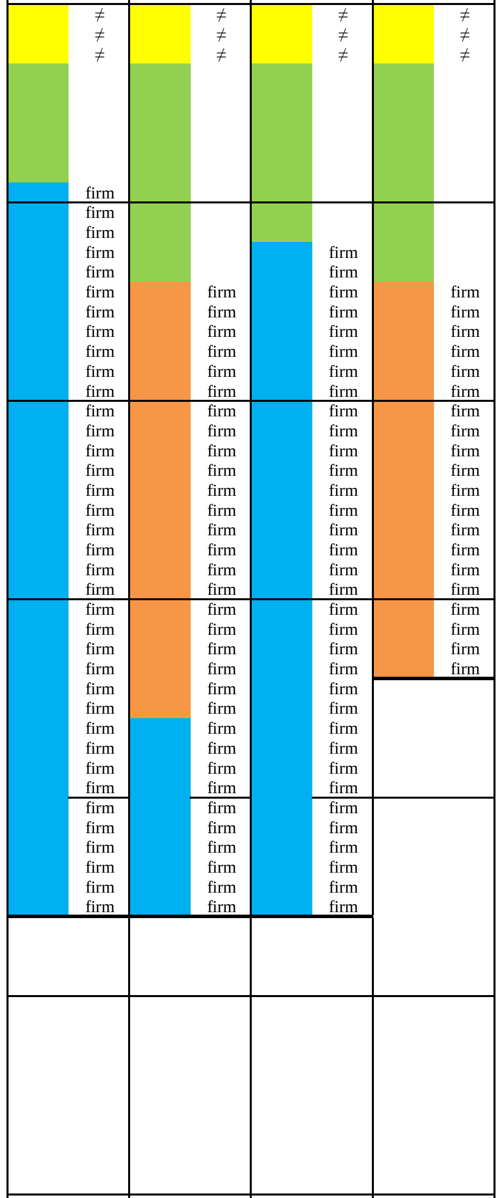
Fibrous Peat T	0.152	0.50	0.305	1.00	0.305	1.00	0.305	1.00	0.305	1.00	0.610	2.00	0.457	1.50	0.610	2.00	0.610	2.00
Spagnium Peat T	1.676	5.50	0.457	1.50	0.457	1.50	1.067	3.50	1.219	4.00	0.914	3.00	0.610	2.00	0.914	3.00	0.914	3.00
Grey&Brown Clay T	7.010	23.00	3.048	10.00	3.657	12.00	2.286	7.50	4.267	14.00	2.438	8.00	5.943	19.50	6.400	21.00	3.962	13.00
Rock Depth	8.839	29.00	3.810	12.50	4.419	14.50	3.657	12.00	5.791	19.00	3.962	13.00	7.010	23.00	7.924	26.00	5.486	18.00
	Trail		NL 01		NL 02		NL 03		NL 04		NL 05		NL 06		NL 07		LB 01	

Ave. Fibrous Peat T	m	0.406
Ave. Spagnium Peat T	m	0.914
Ave. Grey&Brown Clay T	m	4.335
Ave. Rock Depth	m	5.655

🟨	Fibrous Peat
🟩	Spagnium Peat
🟦	Grey Clay
🟧	Brown Clay
🟦	Silty Grey Clay
▥	Swelling Brown Clay

2007 DRILLING

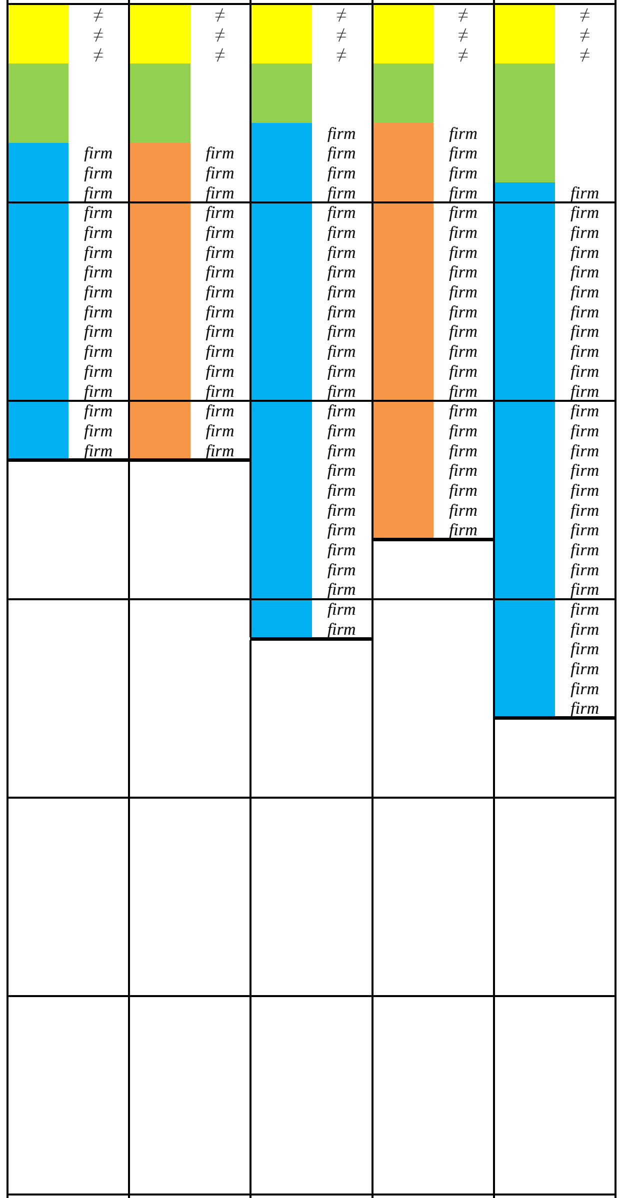
BH 21		BH 22		BH 23		BH 24	
T	G	T	G	T	G	T	G
5,993,118		5,993,642		5,993,745		5,993,205	
486,904		487,089		487,796		487,454	
247.300		247.050		245.750		246.050	
240.290		240.040		238.740		240.869	



0.457	1.50	0.457	1.50	0.457	1.50	0.457	1.50
0.914	3.00	1.676	5.50	1.372	4.50	1.676	5.50
5.639	18.50	4.877	16.00	5.181	17.00	3.048	10.00
7.010	23.00	7.010	23.00	7.010	23.00	5.181	17.00
BH 21		BH 22		BH 23		BH 24	

2011 TEST PITS

OP 01		*OP 02*		*OP 03*		*OP 05*		*OP 11*	
T	*G*	*T*	*G*	*T*	*G*	*T*	*G*	*T*	*G*
5,993,349		*5,993,350*		*5,993,321*		*5,993,100*		*5,993,850*	
487,338		*487,650*		*487,974*		*487,300*		*487,300*	
246.750		*245.950*		*245.250*		*246.550*		*246.650*	
243.245		*242.445*		*240.373*		*243.959*		*241.164*	



0.457	*1.50*	*0.457*	*1.50*	*0.457*	*1.50*	*0.457*	*1.50*	*0.457*	*1.50*
0.610	*2.00*	*0.610*	*2.00*	*0.457*	*1.50*	*0.457*	*1.50*	*0.914*	*3.00*
2.438	*8.00*	*2.438*	*8.00*	*3.962*	*13.00*	*1.676*	*5.50*	*4.115*	*13.50*
3.505	*11.50*	*3.505*	*11.50*	*4.877*	*16.00*	*2.591*	*8.50*	*5.486*	*18.00*
OP 01		*OP 02*		*OP 03*		*OP 05*		*OP 11*	

Ave. Fibrous Peat T	m	0.457
Ave. Spagnium Peat T	m	0.965
Ave. Grey&Brown Clay T	m	3.708
Ave. Rock Depth	m	5.131

🟨	Fibrous Peat
🟩	Spagnium Peat
🟦	Grey Clay
🟧	Brown Clay
🟦	Silty Grey Clay
▨	Swelling Brown Clay

Appendix B

Borehole and Test Pit Locations and Stratigraphy

Borehole and Test Pit Locations and Stratigraphy

Borehole / Test Pit Number		Location Description	Northing	Easting	Ground Surface Elevation (m)	Peat	Sand and Gravel		Clay		Bedrock
						Thickness (m)	Depth to the Surface (Below Grade) (m)	Thickness (m)	Depth to the Surface (Below Grade) (m)	Thickness (m)	Depth to the Surface (Below Grade) (m)
Test Pits	VNEE01 TP05	Tailings and Waste Rock Area East	5996139	484808	256.21	0.05			0.05	0.6	0.6
	VNEE01 TP06	Tailings and Waste Rock Area East	5996146	484792	255.68	0.03			0.03	2.0	2.0
	VNEE01 TP07	Tailings and Waste Rock Area East	5996159	484770	255	0.10			0.10	4.9	5.0
	VNEE01 TP08	Tailings and Waste Rock Area East	5996177	484740	254.86	0.10			0.10	6.9	7.0
	VNEE02 TP01	Tailings and Waste Rock Area East	5995840	484683	263.34	0.05	0.05	0.16	2.10	1.8	3.9
	VNEE02 TP03	Tailings and Waste Rock Area East	5995825	484739	266.44	0.05	0.05	1.95			2.0
	VNEE02 TP04	Tailings and Waste Rock Area East	5995868	484576	256.85	0.05			0.05	1.7	1.7
	VNEE02 TP06	Tailings and Waste Rock Area East	5995900	484470	255.59	0.30			0.30	6.7	7.0
	VNEE03 TP04	Tailings and Waste Rock Area East	5995282	484433	262.09	0.01			0.01	1.2	1.2
	VNEE03 TP05	Tailings and Waste Rock Area East	5995296	484404	261.41	0.05			0.05	1.1	1.1
	VNEE03 TP07	Tailings and Waste Rock Area East	5995331	484345	259.68	0.05			0.05	3.5	>4.8
	VNEE03 TP08	Tailings and Waste Rock Area East	5995360	484300	258	0.05			0.05	>4.8	>4.8
	VNEE04 TP01	Tailings and Waste Rock Area East	5994452	484391	264.89	0.10	0.10	1.60	2.40	1.8	4.2
	VNEE04 TP02	Tailings and Waste Rock Area East	5994420	484308	260	0.10	0.70	3.70			4.4
	VNEE04 TP03	Tailings and Waste Rock Area East	5994410	484256	260	0.05			0.05	>2.6	>2.6
	VNWE01 TP05	Tailings and Waste Rock Area West	5997369	482525	256.27	0.30			0.30	1.5	1.8
	VNWE01 TP06	Tailings and Waste Rock Area West	5997366	482534	256	0.40			0.40	1.3	1.7
	VNWE01 TP07	Tailings and Waste Rock Area West	5997362	482542	256	0.90			0.90	>3.0	>3.9
	VNWE02 TP02	Tailings and Waste Rock Area West	5996853	482262	262.30		0.00	2.40			2.4
	VNWE02 TP03 EAST	Tailings and Waste Rock Area West	5996836	482290	258.87	0.50	0.50	2.60			3.1
	VNWE02 TP03 WEST	Tailings and Waste Rock Area West	5996844	482274	260.90	1.50			1.50	1.6	3.1
	VNWE02 TP04	Tailings and Waste Rock Area West	5996826	482303	258.54	2.00			2.00	2.5	4.5
	VNWE03 log 1	Tailings and Waste Rock Area West	5996489	482101	263.22	0.20	0.20	1.00			1.2
	VNWE03 log 2	Tailings and Waste Rock Area West	5996489	482159	261	0.30	0.30	2.10	2.40	1.9	4.3
	VNWE03 log 3	Tailings and Waste Rock Area West	5996489	482201	259.14	0.50	0.50	2.70	3.20	1.0	4.2
	VNWE04 log 1	Tailings and Waste Rock Area West	5996044	481720	257.35		0.00	1.20		0.0	1.2
	VNWE04 log 2	Tailings and Waste Rock Area West	5996014	481756	257	0.40	0.40	0.40	0.80	2.7	3.5
	FCD 11	Southeast of Tailings and Waste Rock Area	5994215	483609	258.00	2.00			2.00	>5.6	>5.6

Borehole and Test Pit Locations and Stratigraphy

Borehole / Test Pit Number		Location Description	Northing	Easting	Ground Surface Elevation (m)	Peat	Sand and Gravel		Clay		Bedrock
						Thickness (m)	Depth to the Surface (Below Grade) (m)	Thickness (m)	Depth to the Surface (Below Grade) (m)	Thickness (m)	Depth to the Surface (Below Grade) (m)
Boreholes	FTWR-8	Tailings and Waste Rock Area East	5996004.412	484498.530	255.420	0.762			0.762	14.478	16.0
	FTWR-6	Tailings and Waste Rock Area Northeast	5996314.245	484736.846	254.252	0.762			0.762	8.382	9.6
	FTWR-5	Tailings and Waste Rock Area East	5996521.356	484412.096	253.431						20.1
	FPP-5	Polishing Pond North	5997618.633	485116.637	252.031						11.3
	FPP-4 Well	Polishing Pond North	5998120.563	484701.161	251.901	1.829			3.048	12.192	17.1
	FPP-4 Well Pipe Top	Polishing Pond North	5998120.594	484701.303	252.902						
	FPP-2	Polishing Pond North	5998183.076	484276.363	251.755						14.0
	FPP-12	Polishing Pond Southwest	5997789.392	483274.139	253.621	2.347			2.347	12.893	17.2
	FPP-14 Well	Polishing Pond South	5997073.442	484053.357	253.441	2.286			2.286	14.934	17.2
	FPP-14 Well Pipe Top	Polishing Pond South	5997073.300	484053.300	254.340						
	FTWR-3	Polishing Pond North	5997119.446	483499.417	253.673						18.6
	FTWR-11U Well	Tailings and Waste Rock Area West	5996825.343	482323.382	258.344						
	FTWR-11BR Well	Tailings and Waste Rock Area West	5996826.395	482325.981	258.282						6.1
	FTWR-11BR Well Pipe Top	Tailings and Waste Rock Area West	5996826.343	482325.974	259.297						
	FTWR-11U Well Pipe Top	Tailings and Waste Rock Area West	5996825.268	482323.331	259.330						
	FTWR-11	Tailings and Waste Rock Area West	5996817.986	482341.665	258.339	2.286			2.286	4.267	6.6
	FTWR-12 Well	Tailings and Waste Rock Area West	5996639.115	482592.080	256.035	1.625			1.625	9.345	11.3
	FTWR-12 Well Pipe Top	Tailings and Waste Rock Area West	5996639.036	482592.174	256.997						
	FTWR-13	Tailings and Waste Rock Area Center	5996338.035	483050.504	255.546						21.0
	FTWR-14 Well	Tailings and Waste Rock Area Center	5996126.981	483408.514	255.335	1.829			1.829	19.811	21.6
	FTWR-14 Well Pipe Top	Tailings and Waste Rock Area Center	5996127.037	483408.573	256.373						
	FTWR-9	Tailings and Waste Rock Area Center	5996477.701	483663.407	254.623						
	FTWR-15	Tailings and Waste Rock Area East	5995803.148	483916.820	255.371						24.7
	FTWR-16 Well	Tailings and Waste Rock Area East	5995573.346	484284.330	256.731	0.762			0.762	9.908	10.7
	FTWR-16 Well Pipe Top	Tailings and Waste Rock Area East	5995573.377	484284.118	257.703						
	FTWR-16U Well	Tailings and Waste Rock Area East	5995520.131	484423.874	257.880						
	FTWR-16BR Well	Tailings and Waste Rock Area East	5995517.713	484422.401	257.704						6.5
	FTWR-16BR Well Pipe Top	Tailings and Waste Rock Area East	5995517.704	484422.356	258.815						
	FTWR-16U Well Pipe Top	Tailings and Waste Rock Area East	5995520.206	484423.939	259.572						
	FTWR-16 (original location)	Tailings and Waste Rock Area East	5995509.816	484321.820	257.218						
	FTWR-31	Tailings and Waste Rock Area South	5994893.592	483342.090	257.487						21.6
	FTWR-26	Tailings and Waste Rock Area South	5995486.600	482992.457	257.102						21.6
	FTWR-30 Well	Tailings and Waste Rock Area South	5995278.491	482820.120	257.106	0.962			0.962	18.548	19.5
	FTWR-30 Well Pipe Top	Tailings and Waste Rock Area South	5995278.492	482819.963	257.990						
	FTWR-29	Tailings and Waste Rock Area South	5995443.038	482398.357	257.662						15.8

Prepared by: JOE
Checked by: BMS

Appendix C

Borehole Logs

RECORD OF BOREHOLE No. FPP-12

FIGURE NO. 1
SHEET 1 OF 2

PROJECT Victory Nickel - Minago Geotechnical Investigation			**ENGINEER**
PROJECT NO. 11V777	**DRILLER** Paddock Drilling	**BORING METHOD** Hollow Stem Auger	**LOGGED BY** JSL
CLIENT Victory Nickel	**LOCATION** Polishing Pond Southwest	**DATUM** MSL	**COMPILED BY** JOE
ELEVATION 253.62m	**COORD.** N: 5,997,789.39m, E: 483,274.14m	**BORING DATE** 15 Jan 12	**CHECKED BY** JSL

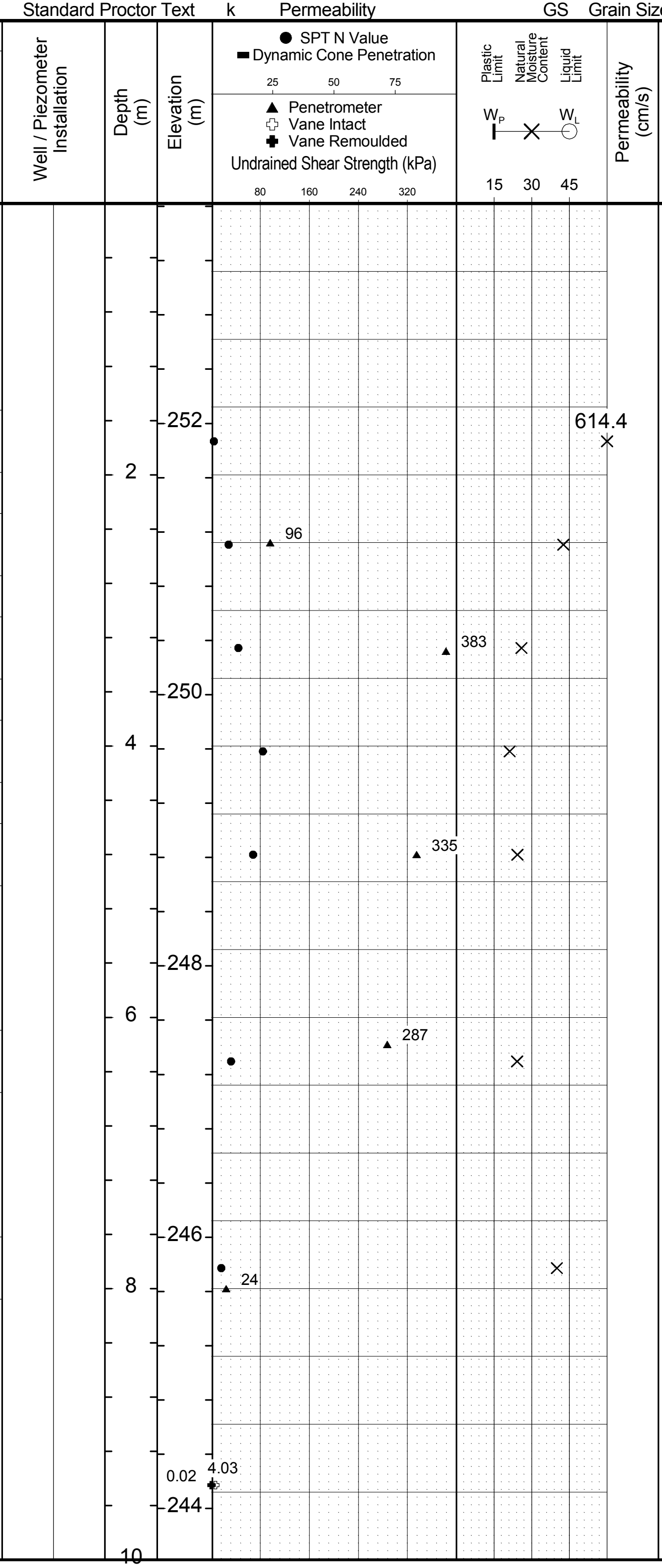
SAMPLE TYPES

		RC	Rock Core
AU	Auger	SS	Split Spoon
BU	Bulk	TW(SH)	Thin-Walled Open (Shelby)
GB	Grab Sample	VA	Vane
PS	Piston Sampler	WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Remarks
	Ground Surface					
	Peat, very soft to firm, woody, non woody, amorphous, granular (6), fibrous (14).	SH	1			Helper left caps in tube failed sp1.
		SS	2	15.3	1	Took cuttings from auger.
251.27 2.35	(CL) Clay, stiff to very stiff, grey to brown, medium plasticity, moist. Rare 2cm subangular limestone pebble. Laboratory observation suggests evidence of clay weathering (mottled, trace organics, friable, fissured) decreasing with depth over the entire CL interval, approximately 3 meters thick.	SS	3	65.6	7	
		SS	4	76.6	11	Fissures
		SS	5	87.5	21	GS Fissures
		SS	6	100.0	17	Fissures
248.06 5.56	(CH) Clay, stiff, brown, high plasticity, moist, trace limestone clasts up to 1cm.	SS	7	135.6	8	Fissures
246.53 7.09	(CL) Clay, firm, grey-brown, medium plasticity, moist.	SS	8		4	
244.25 9.37	(CH) Clay, soft, grey, high plasticity, high sensitivity, moist.	VA				9.45m Nilcon vane tapered



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RECORD OF BOREHOLE No. FPP-12

FIGURE NO. 1
SHEET 2 OF 2

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger **LOGGED BY** JSL
CLIENT Victory Nickel **LOCATION** Polishing Pond Southwest **DATUM** MSL **COMPILED BY** JOE
ELEVATION 253.62m **COORD.** N: 5,997,789.39m, E: 483,274.14m **BORING DATE** 15 Jan 12 **CHECKED BY** JSL

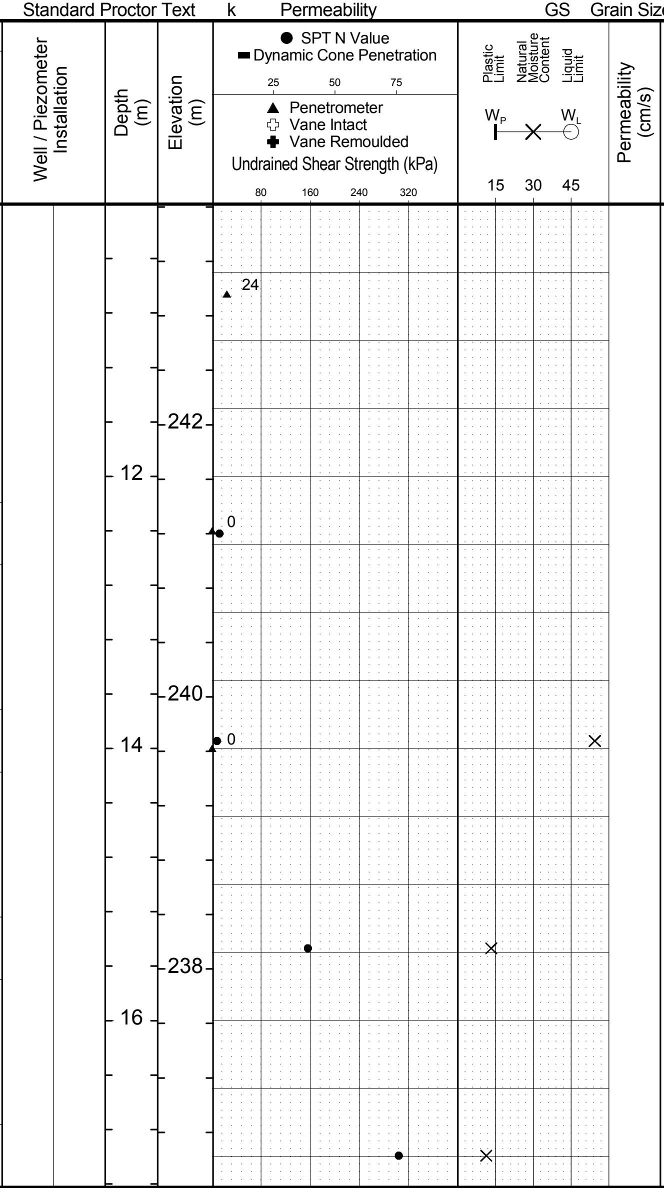
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Remarks
	(CH) Clay, soft, grey, high plasticity, high sensitivity, moist. *(continued)*					large vane.
		SH	9			CU
		SS	10	135.6	3	
		SS	11		2	
238.92 14.70	(ML) Silt with trace fine gravel, hard, light grey, low plasticity, wet.					
		SS	12	48.1	39	GS
237.39 16.23	(GW-GM) well graded gravel with sand and silt, very dense, angular to subangular limestone frags up to 2cm. Broken limestone at bottom of spoon.	SS	13		76	
236.40 17.22	END OF THE HOLE					



RECORD OF BOREHOLE No. FPP-14

FIGURE NO. 1
SHEET 1 OF 2

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger **LOGGED BY** JSL
CLIENT Victory Nickel **LOCATION** Polishing Pond South **DATUM** MSL **COMPILED BY** JOE
ELEVATION 253.44m **COORD.** N: 5,997,073.44m, E: 484,053.36m **BORING DATE** 13 Jan 12 **CHECKED BY** JSL

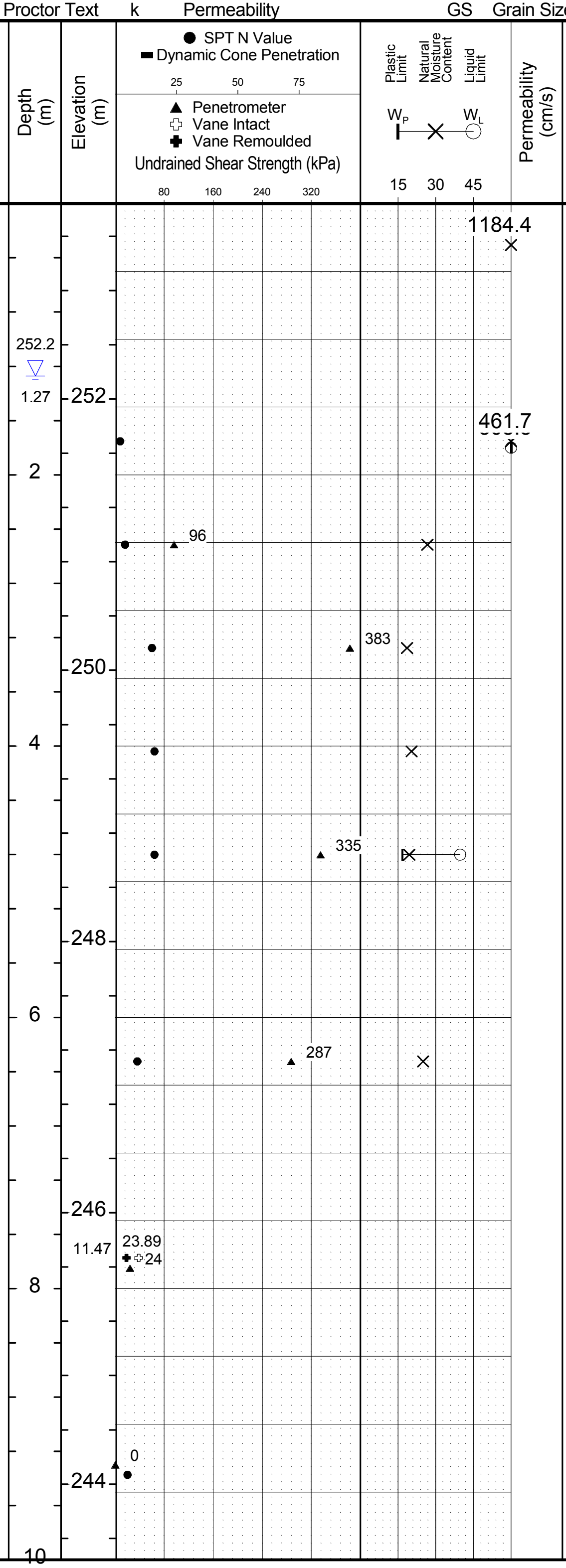
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Remarks
	Ground Surface					
	Peat, woody and non woody fibrous, held in coarse fibrous to granular framework (14).	SH	1	70.5		
		SH	2			
251.92 1.52	Peat, soft, predominantly amorphous granular containing woody fibers (4).	SS	3	43.7	2	
251.31 2.13	(CH) Clay, firm, grey-brown, high plasticity, moist.	SS	4	61.2	4	
250.55 2.90	(CL) Clay, very stiff, brown to dark brown-grey, low plasticity, moist.	SS	5	65.6	15	
249.74 3.70	Laboratory observation suggests evidence of clay weathering (mottled, trace organics, friable, micro-fissures, blocky) decreasing with depth over the CL interval, approximately 2 meters thick.	SS	6	61.2	16	Fissures
		SS	7	85.3	16	Fissures GS
247.88 5.56	(CH) Clay, soft to stiff, light brown to light grey, high plasticity, low sensitivity, moist to wet.	SS	8	80.9	9	Shelby tube didn't pick up pound spoon.
		VA				7.77m Standard vane test small vane tapered.
		SH	9	122.5	5	



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RECORD OF BOREHOLE No. FPP-14

FIGURE NO. 1
SHEET 2 OF 2

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger **LOGGED BY** JSL
CLIENT Victory Nickel **LOCATION** Polishing Pond South **DATUM** MSL **COMPILED BY** JOE
ELEVATION 253.44m **COORD.** N: 5,997,073.44m, E: 484,053.36m **BORING DATE** 13 Jan 12 **CHECKED BY** JSL

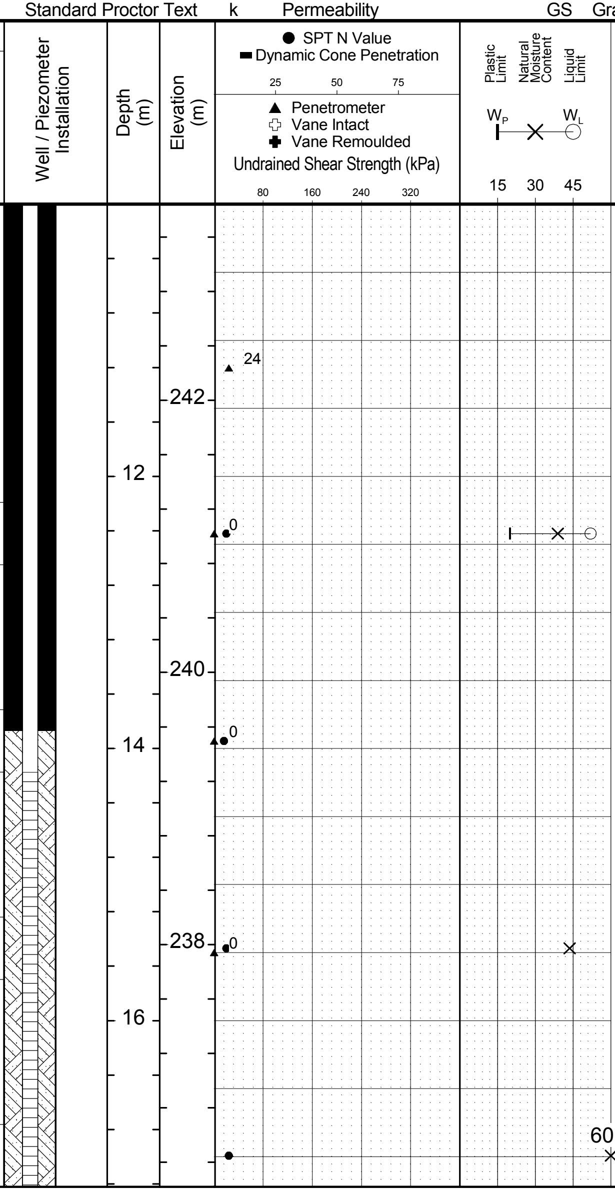
SAMPLE TYPES

		RC	Rock Core
AU	Auger	SS	Split Spoon
BU	Bulk	TW(SH)	Thin-Walled Open (Shelby)
GB	Grab Sample	VA	Vane
PS	Piston Sampler	WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	Description	Type	Number	Recovery (%)	SPT "N" Values or RQD	Remarks
	(CH) Clay, soft to stiff, light brown to light grey, high plasticity, low sensitivity, moist to wet. *(continued)*					
		SH	10	100.0		GS CU grinding noted while augering 11.28-11.89m.
		SS	11	135.6	5	GS
		SS	12	135.6	4	
		SS	13	135.6	5	
236.22		SS	14		6	
17.22	END OF THE HOLE					



RECORD OF BOREHOLE No. FPP-2

FIGURE NO. 1
SHEET 1 OF 1

PROJECT	Victory Nickel - Minago Geotechnical Investigation					**ENGINEER**	
PROJECT NO.	11V777	**DRILLER**	Paddock Drilling	**BORING METHOD**	Hollow Stem Auger	**LOGGED BY**	JSL
CLIENT	Victory Nickel	**LOCATION**	Polishing Pond North	**DATUM**	MSL	**COMPILED BY**	JOE
ELEVATION	251.76m	**COORD.**	N: 5,998,183.08m, E: 484,276.36m	**BORING DATE**		**CHECKED BY**	JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✚ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit / Natural Moisture Content / Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Overburden. Blind drilled to auger refusal. No recovery.							2 4 6 8 10 12 14	250 248 246 244 242 240 238				
237.76 14.00	END OF THE HOLE												

RECORD OF BOREHOLE No. FPP-4

FIGURE NO. 1
SHEET 1 OF 2

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger **LOGGED BY** JSL

CLIENT Victory Nickel **LOCATION** Polishing Pond North **DATUM** MSL **COMPILED BY** JOE

ELEVATION 251.90m **COORD.** N: 5,998,120.56m, E: 484,701.16m **BORING DATE** 20 Jan 12 **CHECKED BY** JSL

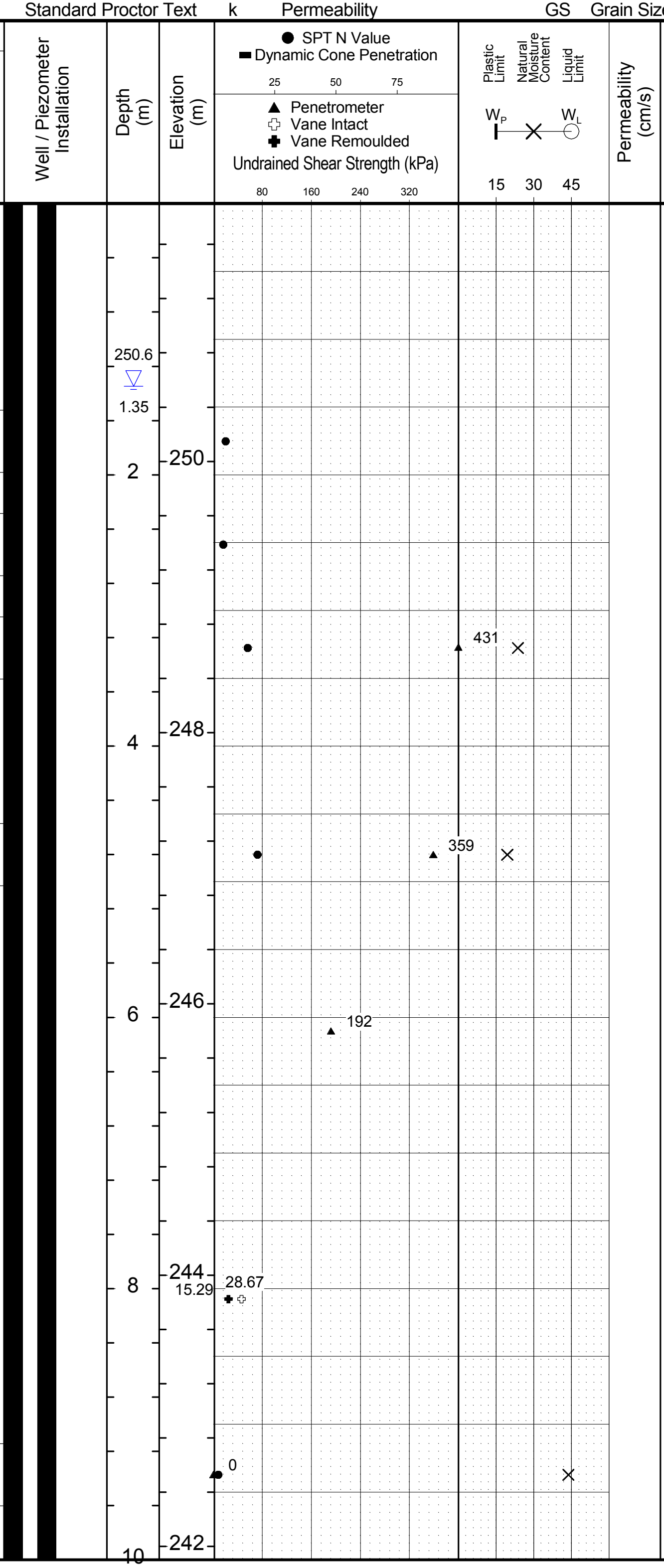
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Remarks
	Ground Surface						
	Peat, firm, woody (14), non-woody, fibrous. Amorphous, granular (6) to 1.8m.		SS	1	39.4	5	
250.07 1.83	(SM) Silt, firm, grey, medium dilatency.		SS	2	43.7	4	
249.01 2.90	(CL) Clay, firm to verry stiff, brown, low to medium plasticty, moist.		SS	3	45.9	14	
			SS	4	100.0	18	
			SH	1	91.9		GS C
243.98 7.92	(CH) Clay, soft, grey, high plasticity, low sensitivity, moist.		VA				8.0772m- Standard Vane.
			SS	5		2	



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RECORD OF BOREHOLE No. FPP-4

FIGURE NO. 1
SHEET 2 OF 2

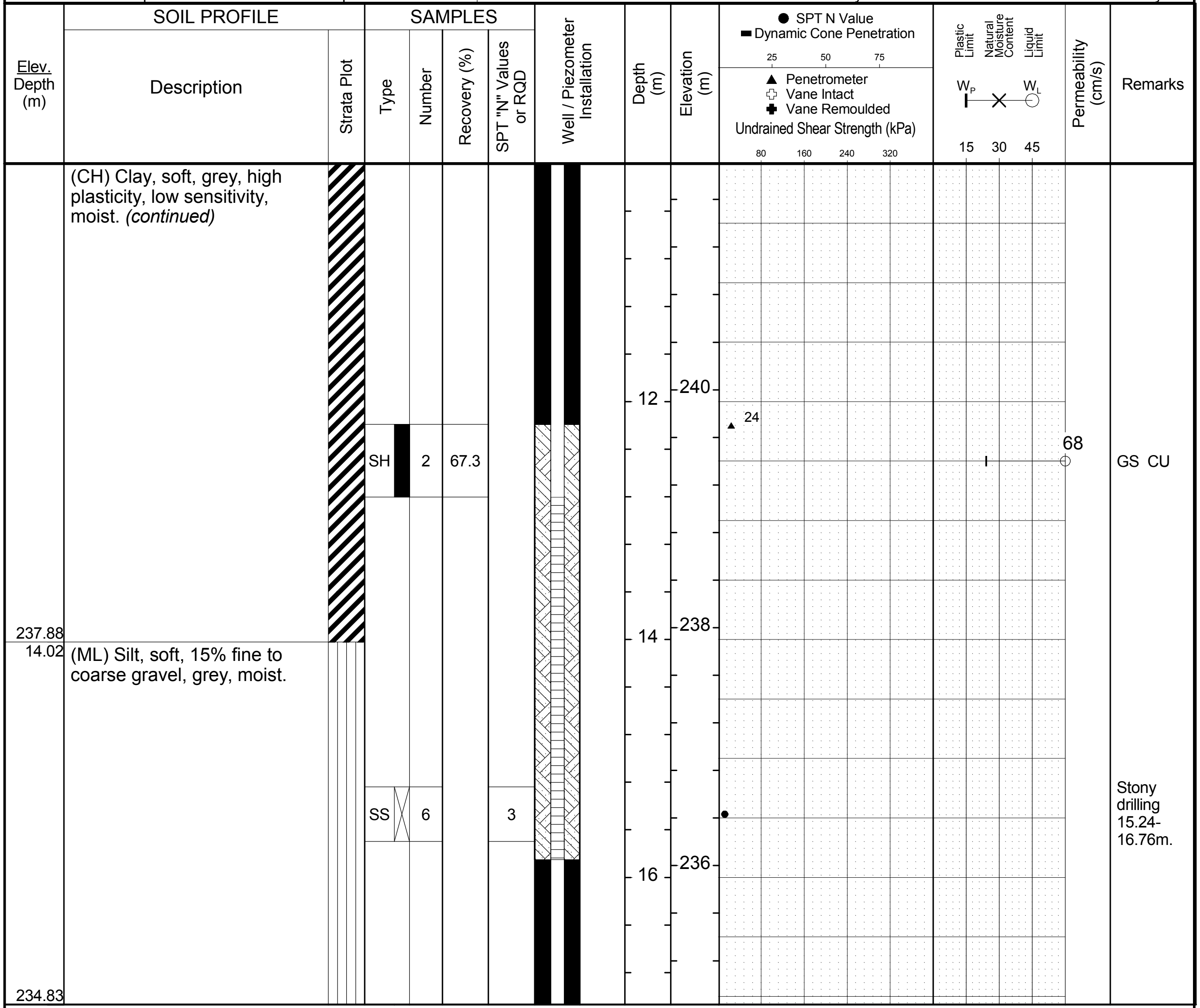
PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger
LOGGED BY JSL
CLIENT Victory Nickel **LOCATION** Polishing Pond North **DATUM** MSL
COMPILED BY JOE
ELEVATION 251.90m **COORD.** N: 5,998,120.56m, E: 484,701.16m **BORING DATE** 20 Jan 12
CHECKED BY JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		



Elev. Depth (m)	Description	Type	Number	Recovery (%)	SPT "N" Values or RQD	Remarks
	(CH) Clay, soft, grey, high plasticity, low sensitivity, moist. *(continued)*					
		SH	2	67.3		GS CU
237.88 14.02	(ML) Silt, soft, 15% fine to coarse gravel, grey, moist.					
		SS	6		3	Stony drilling 15.24-16.76m.
234.83 17.07	END OF THE HOLE					

RECORD OF BOREHOLE No. FPP-5

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger **LOGGED BY** JSL

CLIENT Victory Nickel **LOCATION** Polishing Pond North **DATUM** MSL **COMPILED BY** JOE

ELEVATION 252.03m **COORD.** N: 5,997,618.63m, E: 485,116.64m **BORING DATE** **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✚ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit, Natural Moisture Content, Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Overburden. Blind drilled to auger refusal. No recovery.												
								2	250				
								4	248				
								6	246				
								8	244				
								10	242				
240.73 11.30	END OF THE HOLE												

FOTH BOREHOLE RECORD MINAGO_CONSOLIDATED.GPJ FOTH.GDT 5/11/12

Foth

RECORD OF BOREHOLE No. FTWR-11

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger
LOGGED BY JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL
COMPILED BY JOE
ELEVATION 258.34m **COORD.** N: 5,996,817.99m, E: 482,341.67m **BORING DATE** 16 Jan 12
CHECKED BY JSL

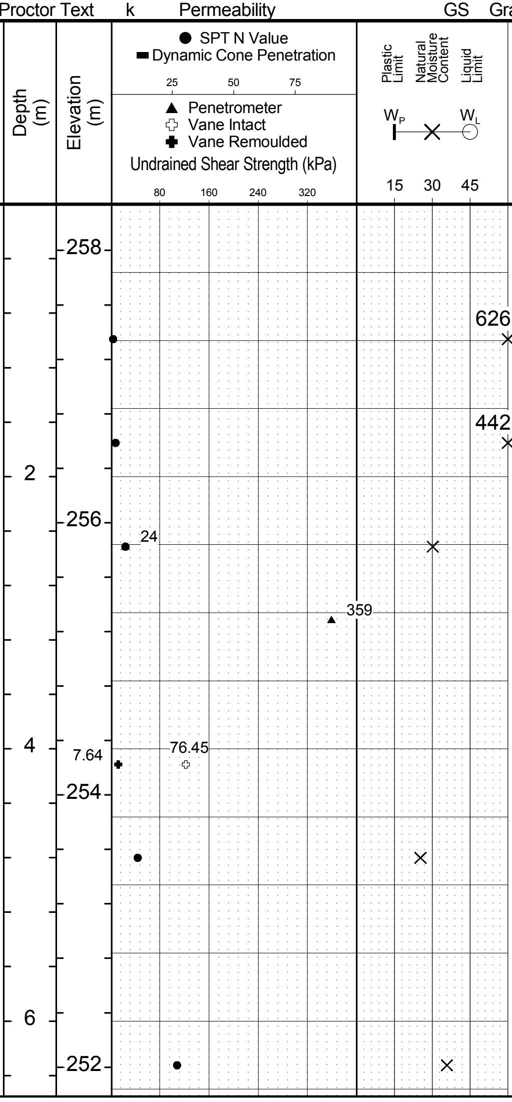
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Permeability (cm/s)	Remarks
	Ground Surface							
	Peat, very soft to soft, woody, non woody (14), fibrous, amorphous, granular (6).	SS SS	1 2	43.7 37.2	1 2			
256.21 2.13	(CH) Clay, firm, brown-grey, high plasticity, moist.	SS	3	52.5	6			
255.44 2.90	(CL) Clay, stiff, brown, low plasticity, moist. Laboratory observation suggests evidence of clay weathering (mottled) decreasing with depth over the entire CL interval, approximately 1 meter thick.	SH VA	4	100.1			1	GS C 4.11m small tapered standard vane. GS
254.22 4.11	(CH) Clay, stiff to very stiff, brown to light grey, ~15% fine to coarse gravel, moist, high plasticity, medium sensitivity. Spoon and auger refusal at 6.55m.	SS SS	5 6	94.1	11 27			
251.79 6.55	END OF THE HOLE							



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RECORD OF BOREHOLE No. FTWR-11BR

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Rock Core **LOGGED BY** JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL **COMPILED BY** JOE
ELEVATION 258.28m **COORD.** N: 5,996,826.40m, E: 482,325.98m **BORING DATE** 26 Jan 12 **CHECKED BY** JSL

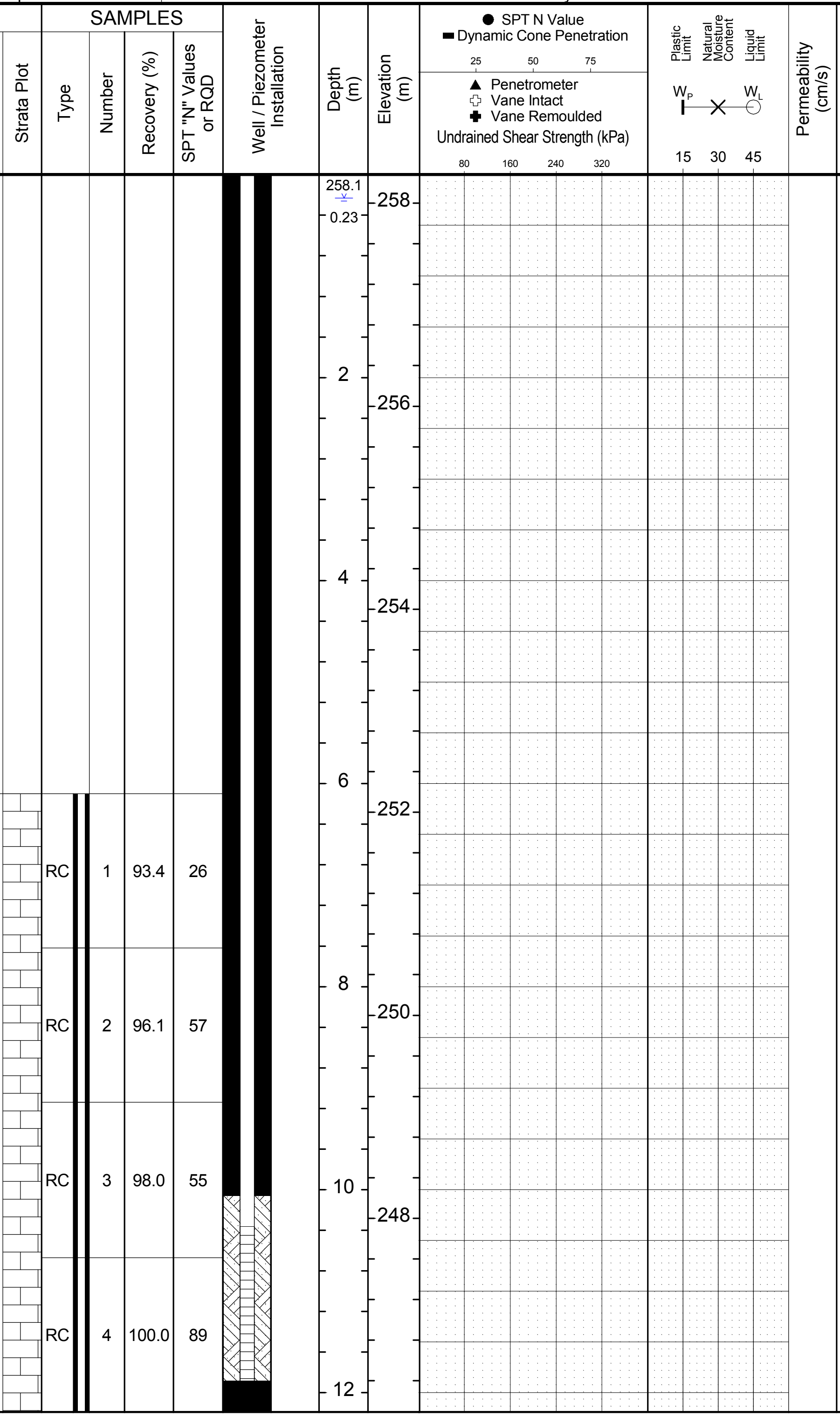
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Type	Number	Recovery (%)	SPT "N" Values or RQD	Remarks
	Ground Surface					
	Overburden. Blind drilled. No recovery.					WLI stuck/ice
252.18 6.10	LIMESTONE: Beige, very fine grained, moderately weathered, weak rock (R2 to R2/R3), poor to good quality, moderately jointed, subhorizontal with very rough surfaces, wavy bedding.	RC	1	93.4	26	
		RC	2	96.1	57	
		RC	3	98.0	55	
		RC	4	100.0	89	
246.09 12.19	END OF THE HOLE					



RECORD OF BOREHOLE No. FTWR-11U

FIGURE NO. 1
SHEET 1 OF 1

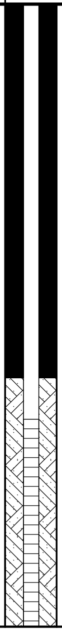
PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777
DRILLER Paddock Drilling
BORING METHOD Hollow Stem Auger
LOGGED BY JSL
CLIENT Victory Nickel
LOCATION Tailings and Waste Rock Area West
DATUM MSL
COMPILED BY JOE
ELEVATION 258.34m
COORD. N: 5,996,825.34m, E: 482,323.38m
BORING DATE 26 Jan 12
CHECKED BY JSL

SAMPLE TYPES

		RC	Rock Core
AU	Auger	SS	Split Spoon
BU	Bulk	TW(SH)	Thin-Walled Open (Shelby)
GB	Grab Sample	VA	Vane
PS	Piston Sampler	WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✜ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit / Natural Moisture Content / Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Overburden. Blind drilled. No recovery.							2 255.5 ▽ 2.80 4	258 256 254				
253.77 4.57	END OF THE HOLE												

RECORD OF BOREHOLE No. FTWR-12

FIGURE NO. 1
SHEET 1 OF 2

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger
LOGGED BY JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL
COMPILED BY JOE
ELEVATION 256.04m **COORD.** N: 5,996,639.12m, E: 482,592.08m **BORING DATE** 16 Jan 12
CHECKED BY JSL

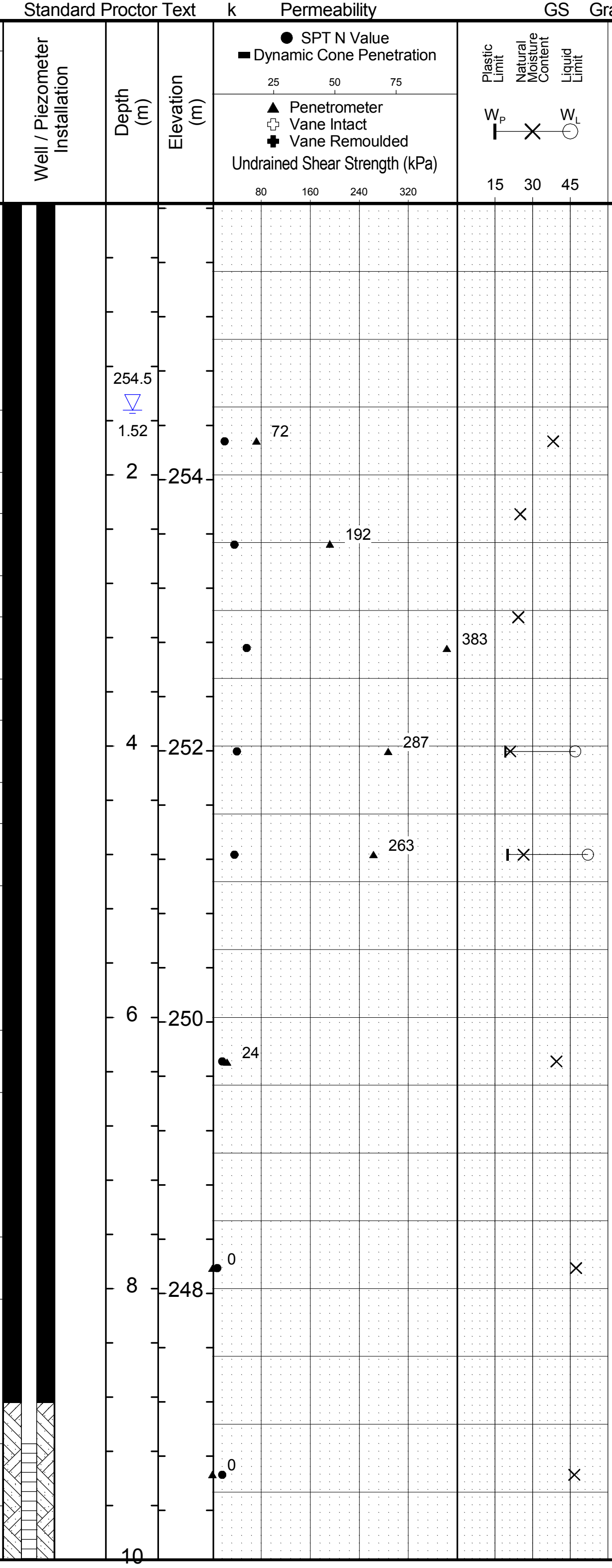
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Elev. Depth (m)	SOIL PROFILE Description	Type	Number	Recovery (%)	SPT "N" Values or RQD	Permeability (cm/s)	Remarks
	Ground Surface						
	Peat, woody, non woody, amorphous, fibrous (14) to granular (6).	SH	1	47.6		1	C
254.41 1.62	(CH) Clay, firm, grey-brown, high plasticity, moist.	SS	2	80.9	5		
253.90 2.13	(CL) Clay, stiff, brown to grey-brown, low to medium plasticity, moist, trace fine to medium gravel.	SS	3	83.1	9		Fissures
	Laboratory observation suggests evidence of clay weathering (trace organics, friable, fissured) decreasing with depth over the entire CL interval, approximately 2 meters thick.	SS	4	100.0	14		GS
		SS	5	76.6	10		
251.62 4.42	(CH) Clay, soft to stiff, grey to grey-brown, high plasticity, moist.	SS	6	91.9	9		GS
		SS	7	135.6	4		
		SS	8	135.6	2		
		SS	9	135.6	4		



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RECORD OF BOREHOLE No. FTWR-12

FIGURE NO. 1
SHEET 2 OF 2

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger
LOGGED BY JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL
COMPILED BY JOE
ELEVATION 256.04m **COORD.** N: 5,996,639.12m, E: 482,592.08m **BORING DATE** 16 Jan 12
CHECKED BY JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

	SOIL PROFILE		SAMPLES										
Elev. Depth (m)	Description	Strata Plot	Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✚ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit Natural Moisture Content Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	(CH) Clay, soft to stiff, grey to grey-brown, high plasticity, moist. *(continued)*		SS	10		30				●	×		
245.06 10.97	(GW-GM) Silt with gravel, dense, angular to subangular limestone fragments in sandy silt. Till.												
244.76 11.28	END OF THE HOLE												

RECORD OF BOREHOLE No. FTWR-13

FIGURE NO. 1
SHEET 1 OF 1

PROJECT	Victory Nickel - Minago Geotechnical Investigation					**ENGINEER**	
PROJECT NO.	11V777	**DRILLER**	Paddock Drilling	**BORING METHOD**	Hollow Stem Auger	**LOGGED BY**	JSL
CLIENT	Victory Nickel	**LOCATION**	Tailings and Waste Rock Area Center	**DATUM**	MSL	**COMPILED BY**	JOE
ELEVATION	255.55m	**COORD.**	N: 5,996,338.04m, E: 483,050.50m	**BORING DATE**		**CHECKED BY**	JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE: Description	Strata Plot	SAMPLES: Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration (25, 50, 75) ▲ Penetrometer ✢ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) (80, 160, 240, 320)	Plastic Limit / Natural Moisture Content / Liquid Limit W_P — W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Overburden. Blind drilled to auger refusal. No recovery.							5 10 15 20	255 250 245 240 235				
234.55 21.00	END OF THE HOLE												

RECORD OF BOREHOLE No. FTWR-14

FIGURE NO. 1
SHEET 1 OF 2

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger **LOGGED BY** JSL

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area Center **DATUM** MSL **COMPILED BY** JOE

ELEVATION 255.34m **COORD.** N: 5,996,126.98m, E: 483,408.51m **BORING DATE** 17 Jan 12 **CHECKED BY** JSL

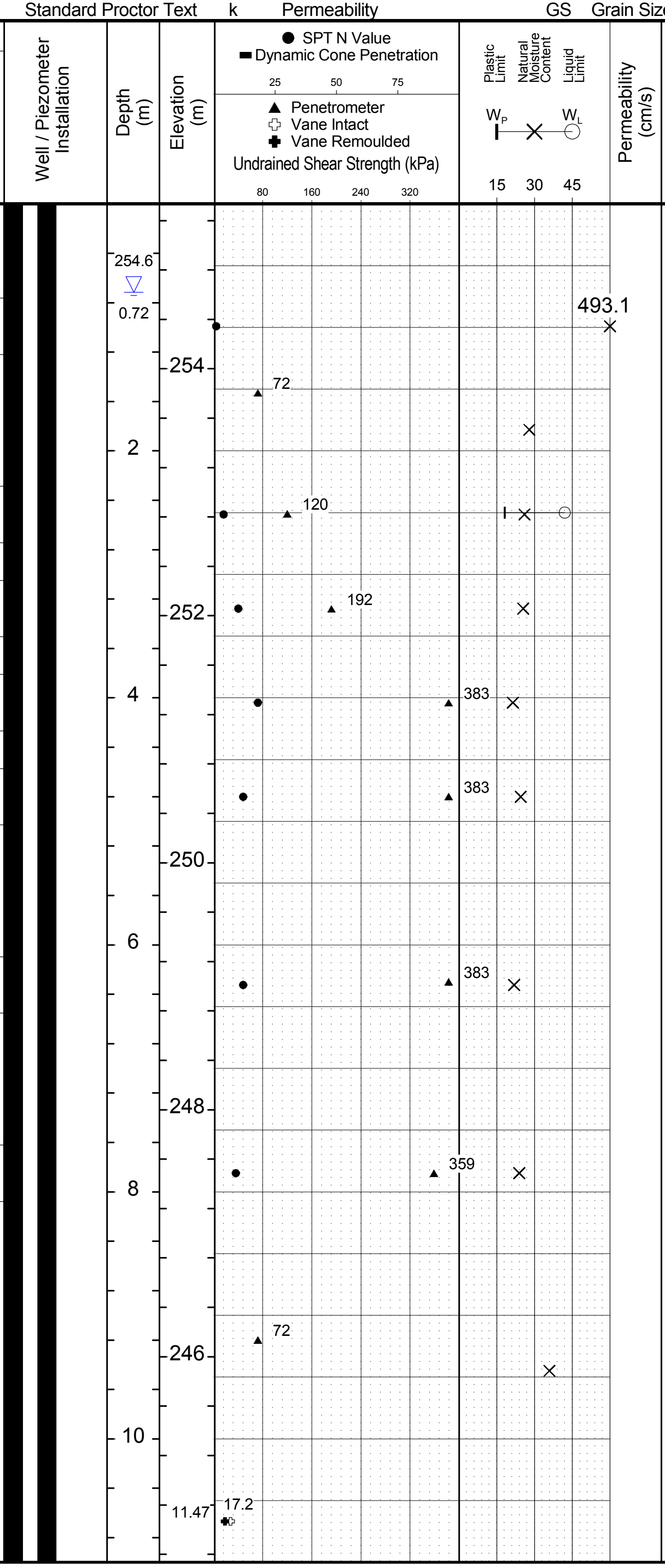
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Elev. Depth (m)	SOIL PROFILE Description	Type	Number	Recovery (%)	SPT "N" Values or RQD	Remarks
	Ground Surface					
	Peat, very soft, woody to non-woody, amorphous, fibrous (14), granular (6).					
		SS	1	32.8	1	
		SH	2	82.0		
253.51 1.83	(CH) Clay, soft, grey-brown, high plasticity, wet.					
253.13 2.21	(CL) Clay, firm to very stiff, brown to grey-brown, low to medium plasticity, moist, trace coarse gravel. Laboratory observation suggests evidence of clay weathering (mottled, trace organics, friable, horizontal micro-fissures with grey coloration, blocky) decreasing with depth over the entire CL interval and into the top of the lower CH interval, approximately 5 meters thick.	SS	6	76.6	4	GS
		SS	7	65.6	10	
		SS	8	85.3	18	
		SS	9	100.0	12	
249.77 5.56	(CH) Clay, very soft to stiff, brown to light grey, high plasticity, low sensitivity, moist. Horizontal micro fissures with grey coloration.	SS	3	87.5	12	Fissures
248.24 7.10						
		SS	4	135.6	9	
		SH	5	100.0		
		VA				10.67m Tapered



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FOTH BOREHOLE RECORD MINAGO_CONSOLIDATED.GPJ FOTH.GDT 5/11/12

RECORD OF BOREHOLE No. FTWR-14

FIGURE NO. 1
SHEET 2 OF 2

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger **LOGGED BY** JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area Center **DATUM** MSL **COMPILED BY** JOE
ELEVATION 255.34m **COORD.** N: 5,996,126.98m, E: 483,408.51m **BORING DATE** 17 Jan 12 **CHECKED BY** JSL

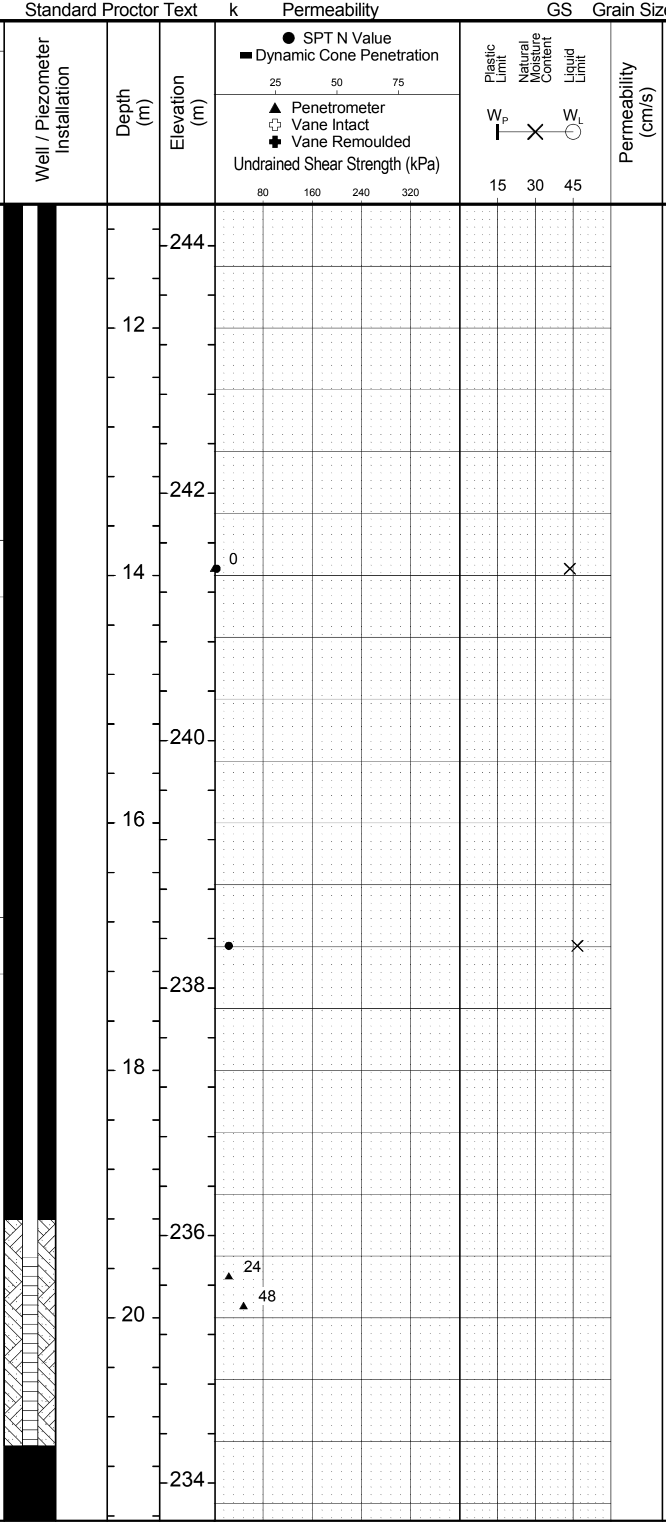
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Remarks
	(CH) Clay, very soft to stiff, brown to light grey, high plasticity, low sensitivity, moist. Horizontal micro fissures with grey coloration. *(continued)*	▨					small standard vane.
			SS	10	133.4	1	
			SS	11	133.4	6	
			SH	6	100.0		C
233.69 21.64	END OF THE HOLE						



RECORD OF BOREHOLE No. FTWR-15

FIGURE NO. 1
SHEET 1 OF 1

PROJECT	Victory Nickel - Minago Geotechnical Investigation					**ENGINEER**	
PROJECT NO.	11V777	**DRILLER**	Paddock Drilling	**BORING METHOD**	Hollow Stem Auger	**LOGGED BY**	JSL
CLIENT	Victory Nickel	**LOCATION**	Tailings and Waste Rock Area East	**DATUM**	MSL	**COMPILED BY**	JOE
ELEVATION	255.37m	**COORD.**	N: 5,995,803.15m, E: 483,916.82m	**BORING DATE**		**CHECKED BY**	JSL

SAMPLE TYPES

		RC	Rock Core
AU	Auger	SS	Split Spoon
BU	Bulk	TW(SH)	Thin-Walled Open (Shelby)
GB	Grab Sample	VA	Vane
PS	Piston Sampler	WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✚ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit / Natural Moisture Content / Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Overburden. Blind drilled to auger refusal. No recovery.								255				
								5	250				
								10	245				
								15	240				
								20	235				
230.67 24.70	END OF THE HOLE												

Foth

RECORD OF BOREHOLE No. FTWR-16

FIGURE NO. 1
SHEET 1 OF 2

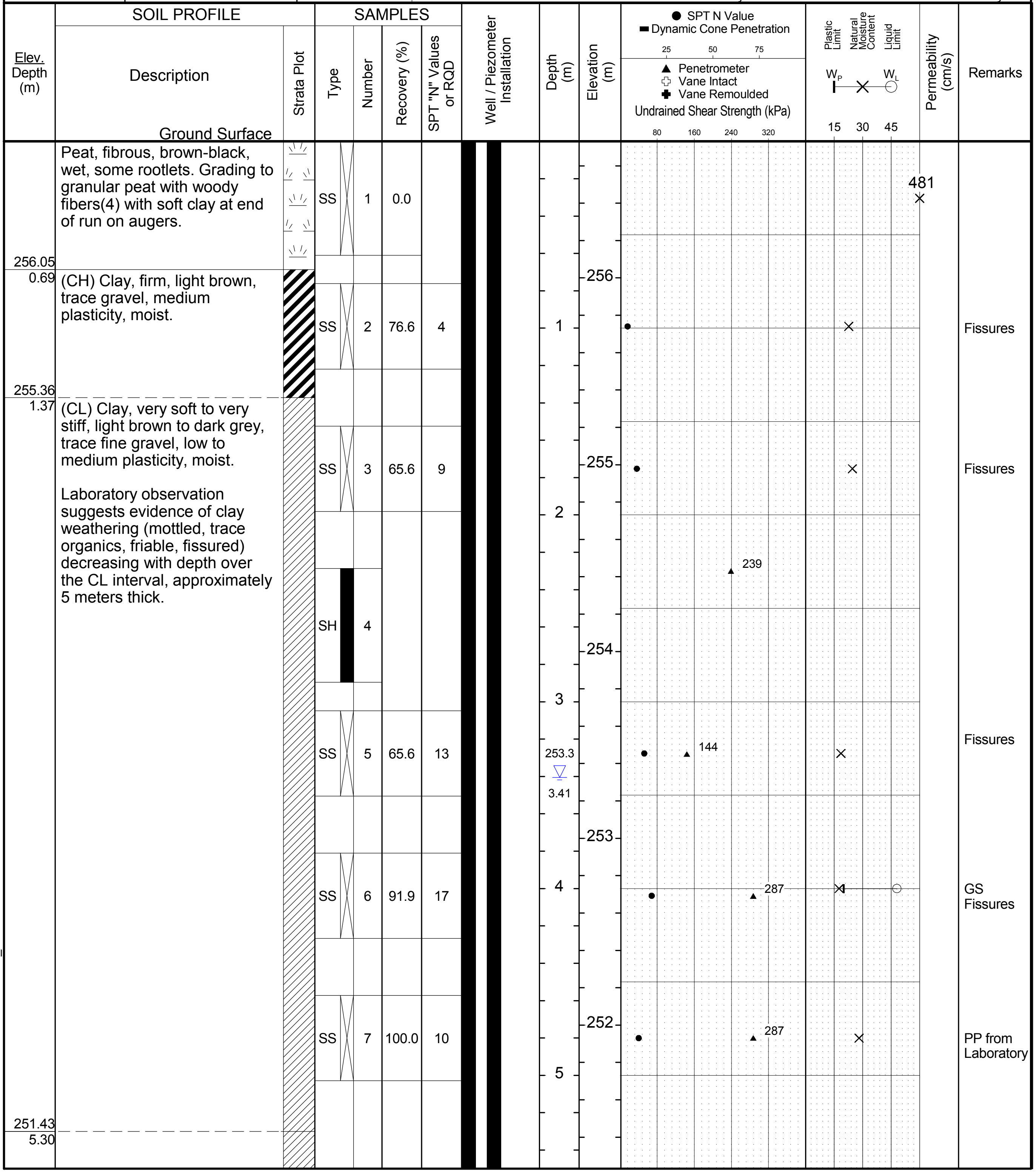
PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger **LOGGED BY** JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL **COMPILED BY** JOE
ELEVATION 256.73m **COORD.** N: 5,995,573.35m, E: 484,284.33m **BORING DATE** 10 Jan 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis



Elev. Depth (m)	Description	Type	Number	Recovery (%)	SPT "N" Values or RQD	Remarks
	Ground Surface					
	Peat, fibrous, brown-black, wet, some rootlets. Grading to granular peat with woody fibers(4) with soft clay at end of run on augers.	SS	1	0.0		
256.05 0.69	(CH) Clay, firm, light brown, trace gravel, medium plasticity, moist.	SS	2	76.6	4	Fissures
255.36 1.37	(CL) Clay, very soft to very stiff, light brown to dark grey, trace fine gravel, low to medium plasticity, moist. Laboratory observation suggests evidence of clay weathering (mottled, trace organics, friable, fissured) decreasing with depth over the CL interval, approximately 5 meters thick.	SS	3	65.6	9	Fissures
		SH	4			
		SS	5	65.6	13	Fissures
		SS	6	91.9	17	GS Fissures
		SS	7	100.0	10	PP from Laboratory
251.43 5.30						

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Foth

RECORD OF BOREHOLE No. FTWR-16

FIGURE NO. 1
SHEET 2 OF 2

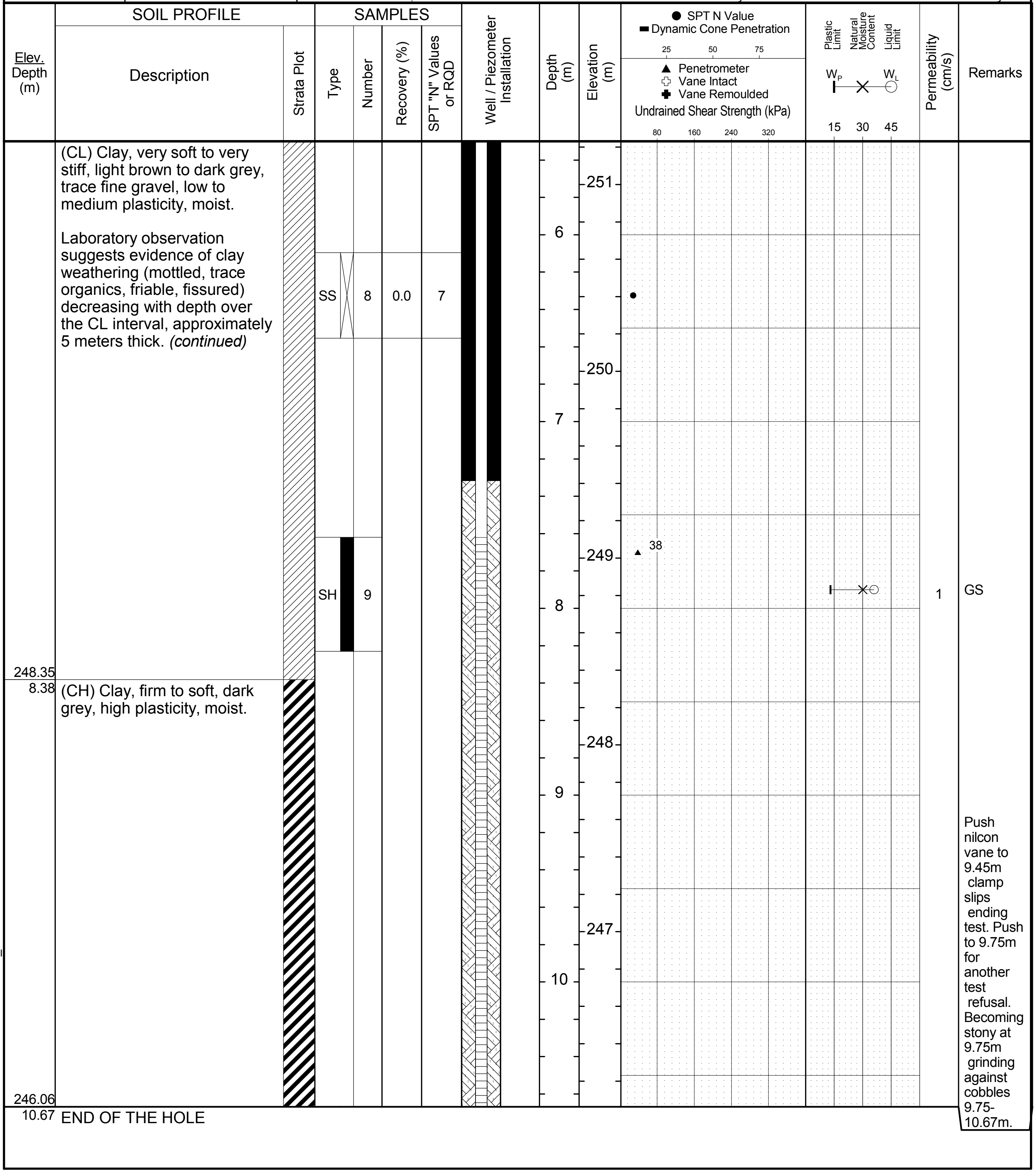
PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger
LOGGED BY JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL
COMPILED BY JOE
ELEVATION 256.73m **COORD.** N: 5,995,573.35m, E: 484,284.33m **BORING DATE** 10 Jan 12
CHECKED BY JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis



Elev. Depth (m)	Description	Type	Number	Recovery (%)	SPT "N" Values or RQD	Permeability (cm/s)	Remarks
	(CL) Clay, very soft to very stiff, light brown to dark grey, trace fine gravel, low to medium plasticity, moist. Laboratory observation suggests evidence of clay weathering (mottled, trace organics, friable, fissured) decreasing with depth over the CL interval, approximately 5 meters thick. *(continued)*	SS	8	0.0	7		
		SH	9			1	GS
248.35 8.38	(CH) Clay, firm to soft, dark grey, high plasticity, moist.						Push nilcon vane to 9.45m clamp slips ending test. Push to 9.75m for another test refusal. Becoming stony at 9.75m grinding against cobbles 9.75-10.67m.
246.06 10.67	END OF THE HOLE						

RECORD OF BOREHOLE No. FTWR-16BR

FIGURE NO. 1
SHEET 1 OF 2

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Rock Core
LOGGED BY JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL
COMPILED BY JOE
ELEVATION 257.70m **COORD.** N: 5,995,517.71m, E: 484,422.40m **BORING DATE** 26 Jan 12
CHECKED BY JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Legend: ● SPT N Value; ▬ Dynamic Cone Penetration (25, 50, 75); ▲ Penetrometer; ✣ Vane Intact; ✚ Vane Remoulded; Undrained Shear Strength (kPa) (80, 160, 240, 320); Plastic Limit, Natural Moisture Content, Liquid Limit: W_P — W_L (15, 30, 45)

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	Permeability (cm/s)	Remarks
	Ground Surface										
	Overburden. Blind drilled. No recovery.							2 4 6	256 254 252		
251.22 6.48	LIMESTONE: Light brown, very fine grained, slightly weathered, medium strong rock (R3), poor to excellent quality, one joint paralled to core axis at top of bedrock, all other joints below that are widely spaced, sub horizontal, with very rough surfaces, wavy bedding.		RC	1	49.6	35		250.5 ∇ 7.21			
			RC	2	100.0	100		8 10	250 248		

(Continued Next Page)

RECORD OF BOREHOLE No. FTWR-16BR

FIGURE NO. 1
SHEET 2 OF 2

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Rock Core **LOGGED BY** JSL

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL **COMPILED BY** JOE

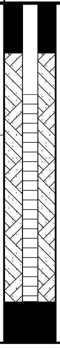
ELEVATION 257.70m **COORD.** N: 5,995,517.71m, E: 484,422.40m **BORING DATE** 26 Jan 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✚ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit, Natural Moisture Content, Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	LIMESTONE: Light brown, very fine grained, slightly weathered, medium strong rock (R3), poor to excellent quality, one joint paralled to core axis at top of bedrock, all other joints below that are widely spaced, sub horizontal, with very rough surfaces, wavy bedding. *(continued)*		RC	3	96.9	93							
			RC	4	98.7	99		12	246				
245.20 12.50	END OF THE HOLE												

RECORD OF BOREHOLE No. FTWR-16U

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger
LOGGED BY JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL
COMPILED BY JOE
ELEVATION 257.88m **COORD.** N: 5,995,520.13m, E: 484,423.87m **BORING DATE** 11 Jan 12
CHECKED BY JSL

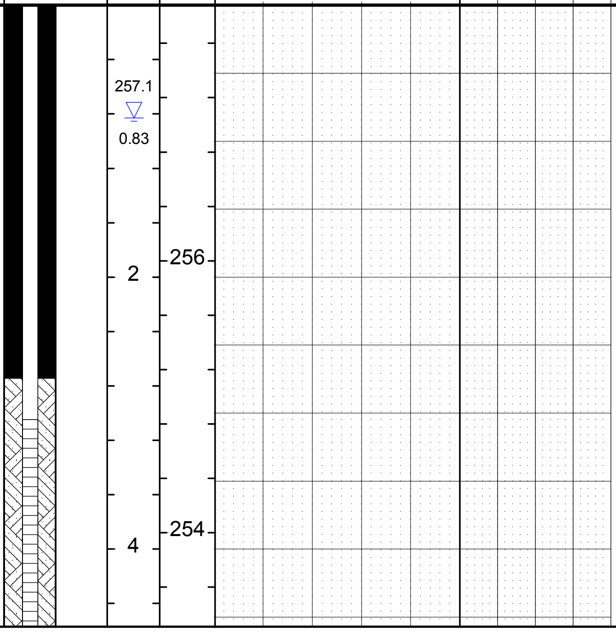
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✙ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit, Natural Moisture Content, Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Overburden. Blind drilled. No recovery.												WLI stuck/ice
253.31 4.57	END OF THE HOLE												



Foth

RECORD OF BOREHOLE No. FTWR-26

FIGURE NO. 1
SHEET 1 OF 1

PROJECT	Victory Nickel - Minago Geotechnical Investigation					**ENGINEER**	
PROJECT NO.	11V777	**DRILLER**	Paddock Drilling	**BORING METHOD**	Hollow Stem Auger	**LOGGED BY**	JSL
CLIENT	Victory Nickel	**LOCATION**	Tailings and Waste Rock Area East	**DATUM**	MSL	**COMPILED BY**	JOE
ELEVATION	257.10m	**COORD.**	N: 5,995,486.60m, E: 482,992.46m	**BORING DATE**		**CHECKED BY**	JSL

SAMPLE TYPES

		RC	Rock Core
AU	Auger	SS	Split Spoon
BU	Bulk	TW(SH)	Thin-Walled Open (Shelby)
GB	Grab Sample	VA	Vane
PS	Piston Sampler	WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✜ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit, Natural Moisture Content, Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Overburden. Blind drilled to auger refusal. No recovery.												
									255				
								5					
									250				
								10					
									245				
								15					
									240				
								20					
235.50 21.60	END OF THE HOLE												

Foth

RECORD OF BOREHOLE No. FTWR-29

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger
LOGGED BY JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area South **DATUM** MSL
COMPILED BY JOE
ELEVATION 257.66m **COORD.** N: 5,995,443.04m, E: 482,398.36m **BORING DATE**
CHECKED BY JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✣ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit, Natural Moisture Content, Liquid Limit W_P ✕ W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Overburden. Blind drilled to auger refusal. No recovery.												
									256				
								2					
									254				
								4					
									252				
								6					
									250				
								8					
									248				
								10					
									246				
								12					
									244				
								14					
241.86									242				
15.80	END OF THE HOLE												

RECORD OF BOREHOLE No. FTWR-3

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger **LOGGED BY** JSL

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area North **DATUM** MSL **COMPILED BY** JOE

ELEVATION 253.67m **COORD.** N: 5,997,119.45m, E: 483,499.42m **BORING DATE** **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Elev. Depth (m)	SOIL PROFILE: Description	Strata Plot	SAMPLES: Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75; ▲ Penetrometer ✚ Vane Intact ✚ Vane Remoulded; Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit / Natural Moisture Content / Liquid Limit; W_P W_L; 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Overburden. Blind drilled to auger refusal. No recovery.												
									250				
								5					
									245				
								10					
									240				
								15					
235.07 18.60	END OF THE HOLE												

RECORD OF BOREHOLE No. FTWR-30

FIGURE NO. 1
SHEET 1 OF 3

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger
LOGGED BY JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area South **DATUM** MSL
COMPILED BY JOE
ELEVATION 257.11m **COORD.** N: 5,995,278.49m, E: 482,820.12m **BORING DATE** 23 Jan 12
CHECKED BY JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

SOIL PROFILE

Elev. Depth (m)	Description
	Ground Surface
	Peat, soft, woody, non woody, amorphous, fibrous (14), granular (6).
256.14 0.96	(CH) Clay, soft, grey, medium plasticity, moist.
255.73 1.37	(CL) Clay, firm to stiff, grey to brown, medium plasticity, moist.
254.91 2.20	Laboratory observation suggests evidence of clay weathering (organic inclusions, blocky) decreasing with depth over the CL interval and into the top of the lower CH interval, approximately 3 meters thick.
253.98 3.12	(CH) Clay, soft to stiff, brown to grey, high plasticity, low to medium sensitivity, moist to wet, trace gravel.
251.51 5.60	

SAMPLES

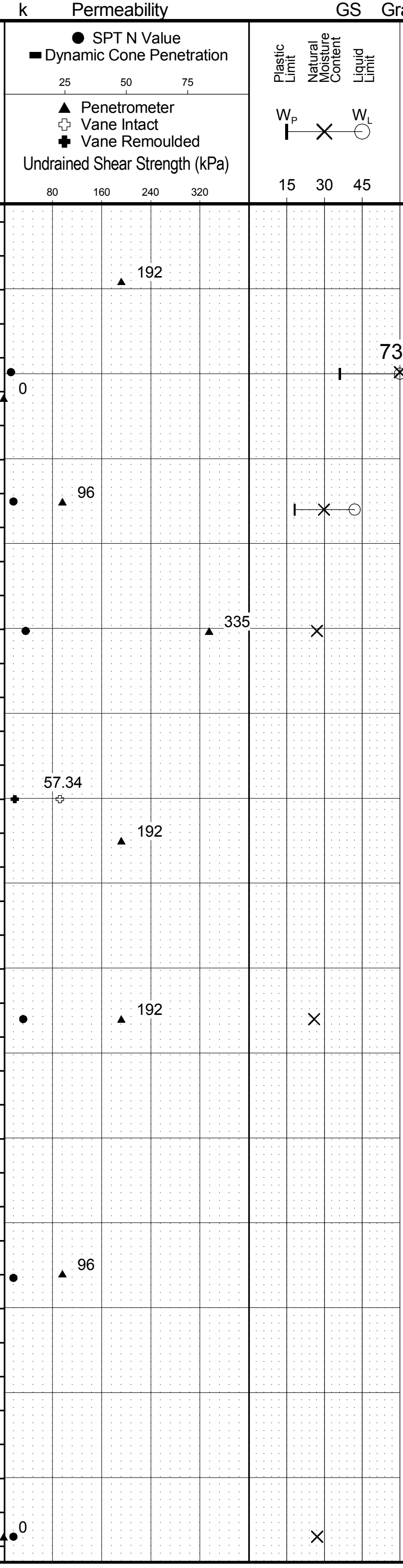
Type	Number	Recovery (%)	SPT "N" Values or RQD	Remarks
SS	1	65.6	3	
SS	2	59.1	4	GS
SS	10	48.1	9	
VA				3.51m- Standard vane. C
SH	3	82.0		
SS	4	100.0	8	
SS	5		4	
SS	6		4	

Well / Piezometer Installation

Depth (m)	Elevation (m)
	257
	256
2	255
3	254
4	253
5	252
6	251
7	250
8	

256.1
∇
1.05

11.47



Permeability (cm/s)

Remarks

(Continued Next Page)

RECORD OF BOREHOLE No. FTWR-30

FIGURE NO. 1
SHEET 2 OF 3

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger **LOGGED BY** JSL

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area South **DATUM** MSL **COMPILED BY** JOE

ELEVATION 257.11m **COORD.** N: 5,995,278.49m, E: 482,820.12m **BORING DATE** 23 Jan 12 **CHECKED BY** JSL

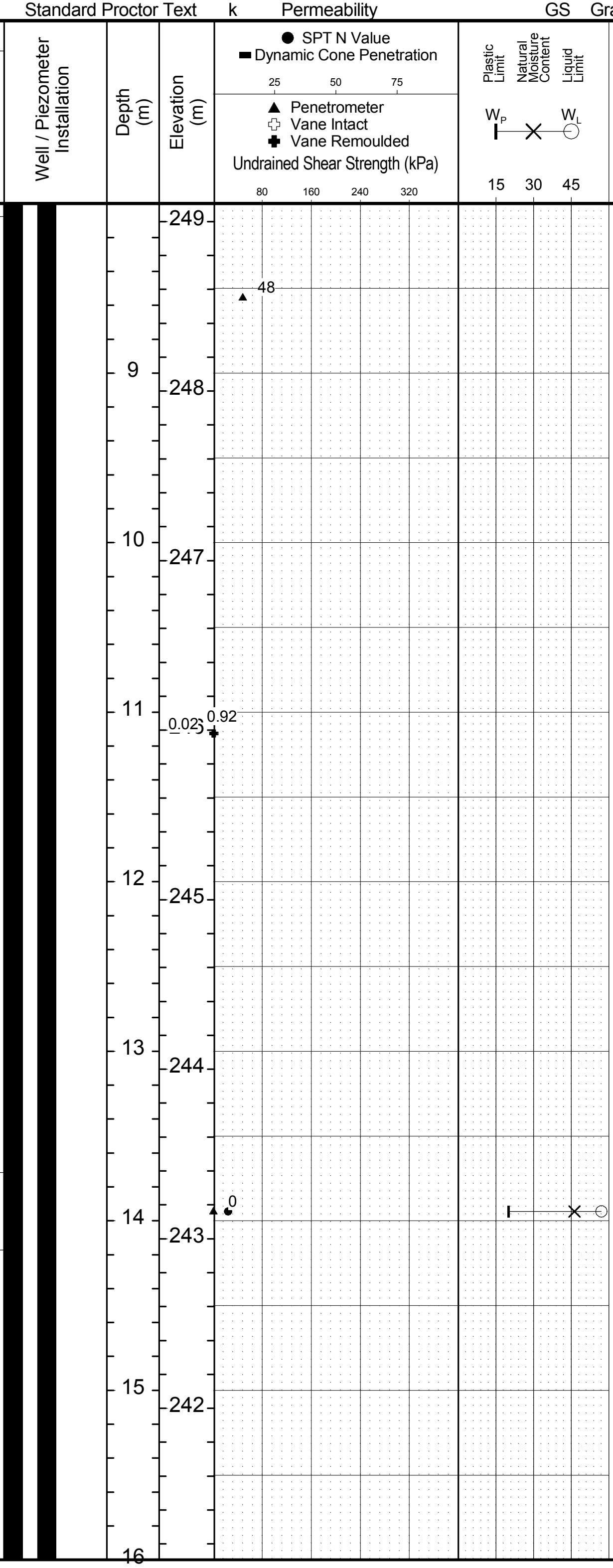
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Remarks
	(CH) Clay, soft to stiff, brown to grey, high plasticity, low to medium sensitivity, moist to wet, trace gravel. *(continued)*						
			SH	7			GS C CU
			VA				9.60m- Nilcon vane pushed from 9.14m to 9.60m: large tapered vane. 10.67m- Nilcon vane test smallest tapered vane successfully completed test.
			SS	8	135.6	6	
							hit rocks while drilling this interval.



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RECORD OF BOREHOLE No. FTWR-30

FIGURE NO. 1
SHEET 3 OF 3

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER

PROJECT NO. 11V777
DRILLER Paddock Drilling
BORING METHOD Hollow Stem Auger
LOGGED BY JSL

CLIENT Victory Nickel
LOCATION Tailings and Waste Rock Area South
DATUM MSL
COMPILED BY JOE

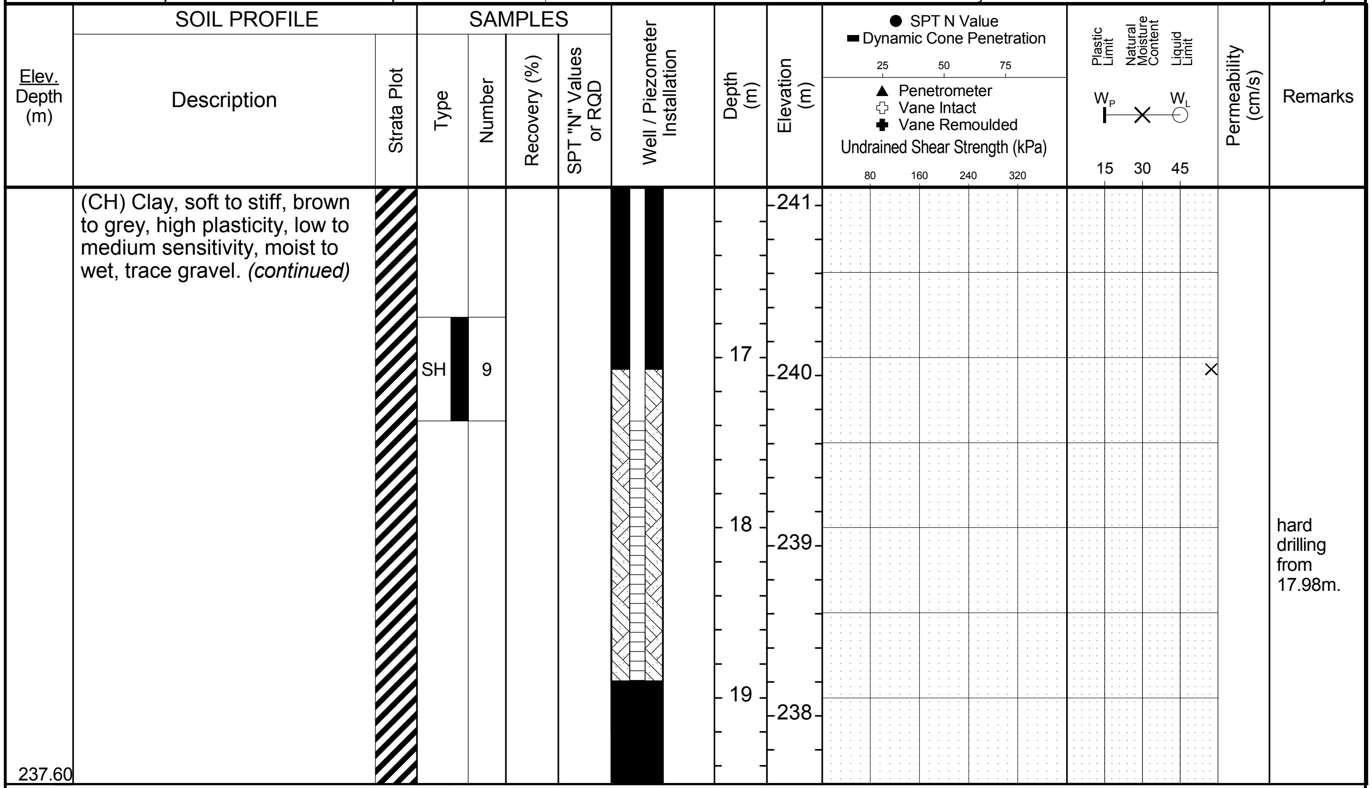
ELEVATION 257.11m
COORD. N: 5,995,278.49m, E: 482,820.12m
BORING DATE 23 Jan 12
CHECKED BY JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		



(CH) Clay, soft to stiff, brown to grey, high plasticity, low to medium sensitivity, moist to wet, trace gravel. *(continued)*

hard drilling from 17.98m.

237.60
19.51 END OF THE HOLE

Foth

RECORD OF BOREHOLE No. FTWR-31

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger
LOGGED BY JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area South **DATUM** MSL
COMPILED BY JOE
ELEVATION 257.49m **COORD.** N: 5,994,893.59m, E: 483,342.09m **BORING DATE**
CHECKED BY JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Elev. Depth (m)	SOIL PROFILE: Description	Strata Plot	SAMPLES: Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 / ▲ Penetrometer ✚ Vane Intact ✚ Vane Remoulded / Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit / Natural Moisture Content / Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Overburden. Blind drilled to auger refusal. No recovery.												
									255				
								5					
									250				
								10					
									245				
								15					
									240				
								20					
235.89 21.60	END OF THE HOLE												

Foth

RECORD OF BOREHOLE No. FTWR-5

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger
LOGGED BY JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area North **DATUM** MSL
COMPILED BY JOE
ELEVATION 253.43m **COORD.** N: 5,996,521.36m, E: 484,412.10m **BORING DATE**
CHECKED BY JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✣ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit / Natural Moisture Content / Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Overburden. Blind drilled to auger refusal. No recovery.												
									250				
								5					
									245				
								10					
									240				
								15					
									235				
233.33 20.10	END OF THE HOLE							20					

RECORD OF BOREHOLE No. FTWR-6

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger **LOGGED BY** JSL

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area Northeast **DATUM** MSL **COMPILED BY** JOE

ELEVATION 254.25m **COORD.** N: 5,996,314.25m, E: 484,736.85m **BORING DATE** 13 Jan 12 **CHECKED BY** JSL

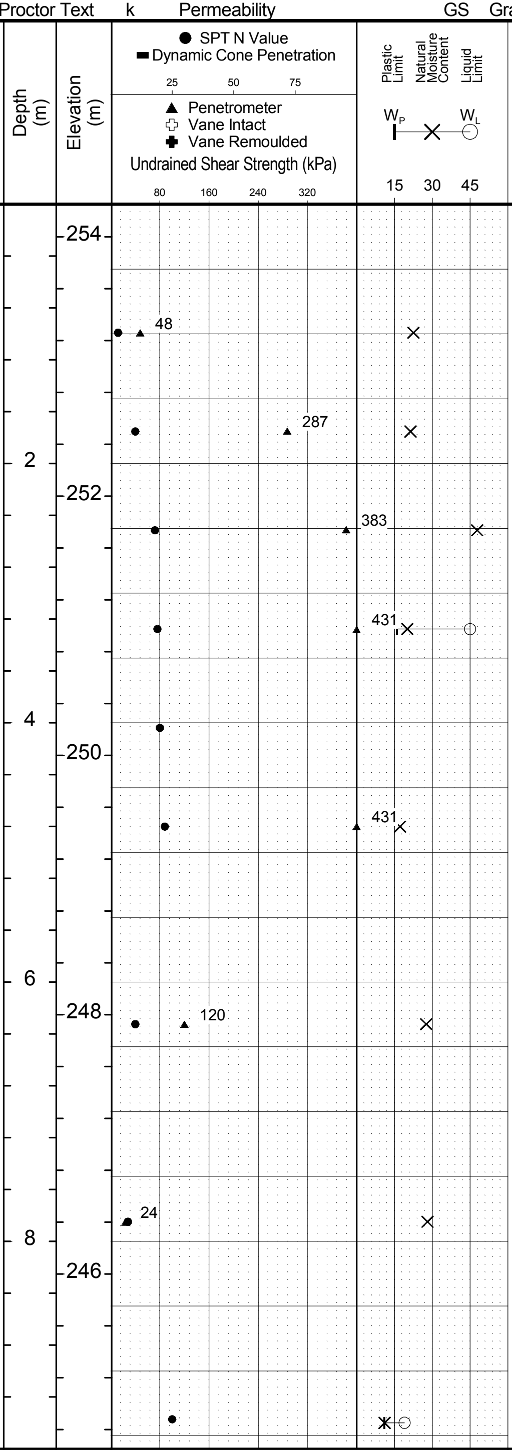
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Permeability (cm/s)	Remarks
	Ground Surface							
	Peat, fibrous, brown-black, some rootlets, wet.	SS	1	0.0				
253.64 0.61	(CH) Clay, soft, light brown, high plasticity, moist.	SS	2	54.7	3			
252.88 1.37	(CL) Clay, stiff to very stiff, light brown to dark brown, low to medium plasticity, moist. Laboratory observation suggests evidence of clay weathering (mottled, trace organics friable, micro-fissures, blocky) decreasing with depth over portions of the CL interval, approximately 2 meters thick.	SS	3	48.1	10			Fissures
		SS	4	65.6	18			
		SS	5	83.1	19			GS
250.55 3.70		SS	6	0.0	20			
249.83 4.42	(CH) Clay with fine to coarse gravel, firm to very stiff, dark brown to grey, high plasticity, moist. Rocks noted as grinding during augering to 7.62m	SS	7	87.5	22			
		SS	8	131.2	10			GS
		SS	9	131.2	7			Grinding on rock from 7.92-8.84m. Auger refusal at 8.84m.
245.64 8.61	(ML) Silt with clay and 20% coarse angular gravel (limestone clasts), light grey, very stiff, non-plastic, moist.	SS	10	65.6	25			GS
244.65 9.60	END OF THE HOLE							Hard drilling auger refusal at 9.60m



RECORD OF BOREHOLE No. FTWR-8

FIGURE NO. 1
SHEET 1 OF 2

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger **LOGGED BY** JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL **COMPILED BY** JOE
ELEVATION 255.42m **COORD.** N: 5,996,004.41m, E: 484,498.53m **BORING DATE** 12 Jan 12 **CHECKED BY** JSL

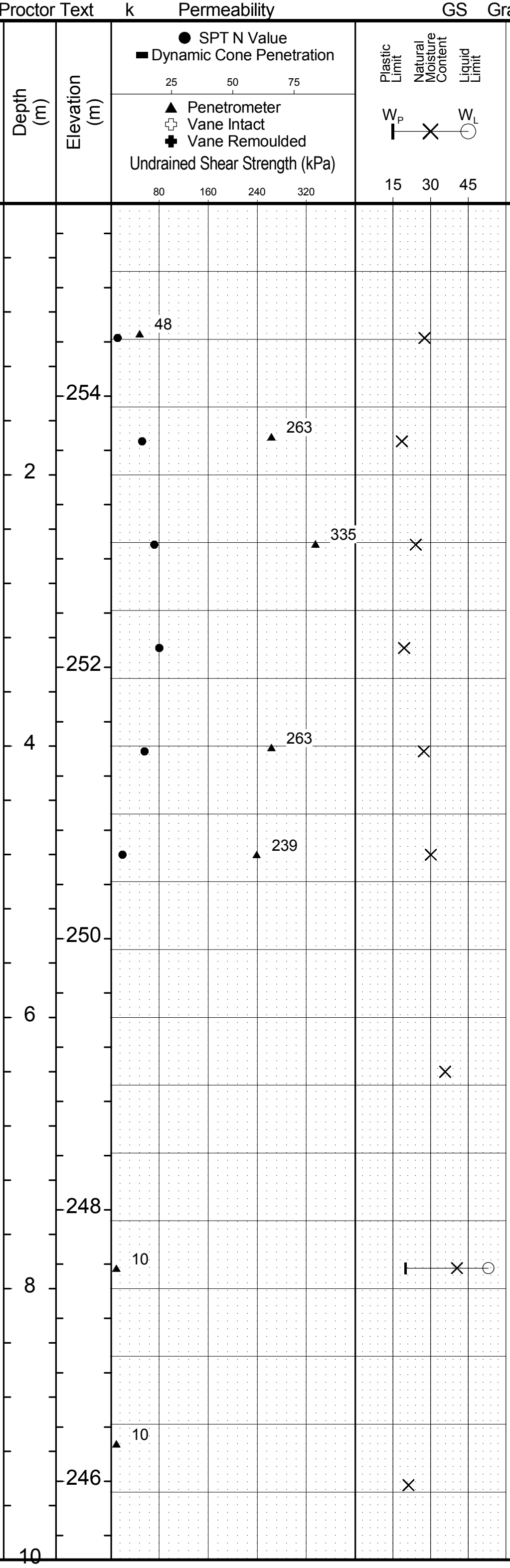
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Elev. Depth (m)	SOIL PROFILE Description (Ground Surface)	Type	Number	Recovery (%)	SPT "N" Values or RQD	Remarks
	Peat, brown to black, woody and non woody, particles held in fibrous peat, wet. Thin light brown fine grained sand and silt on bottom of auger at end of run.	SS	1	0.0		
254.81 0.61	(CL) Clay, soft to very stiff, yellow-brown to light brown, low to medium plasticity, moist.	SS	2	83.1	3	
254.02 1.40	Laboratory observation suggests evidence of clay weathering (mottled, friable, horizontal micro-fissures with grey coloration, blocky) decreasing with depth over the CL interval and into the top of the lower CH interval, approximately 4 meters thick.	SS	3	59.1	13	GS Fissures
		SS	4	26.2	18	
		SS	5	0.0	20	
		SS	6	72.2	14	
251.00 4.42	(CH) Clay with up to 15% subangular gravel, soft to firm, light brown to dark grey, high plasticity, moist to wet.	SS	7	100.0	5	PP test does not match SPT
249.92 5.50		SH	8	70.5		
		SS	9	100.0		GS
		SH	10	100.1		stony



(Continued Next Page)

FOTH BOREHOLE RECORD MINAGO_CONSOLIDATED.GPJ FOTH.GDT 5/11/12

RECORD OF BOREHOLE No. FTWR-8

FIGURE NO. 1
SHEET 2 OF 2

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger **LOGGED BY** JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL **COMPILED BY** JOE
ELEVATION 255.42m **COORD.** N: 5,996,004.41m, E: 484,498.53m **BORING DATE** 12 Jan 12 **CHECKED BY** JSL

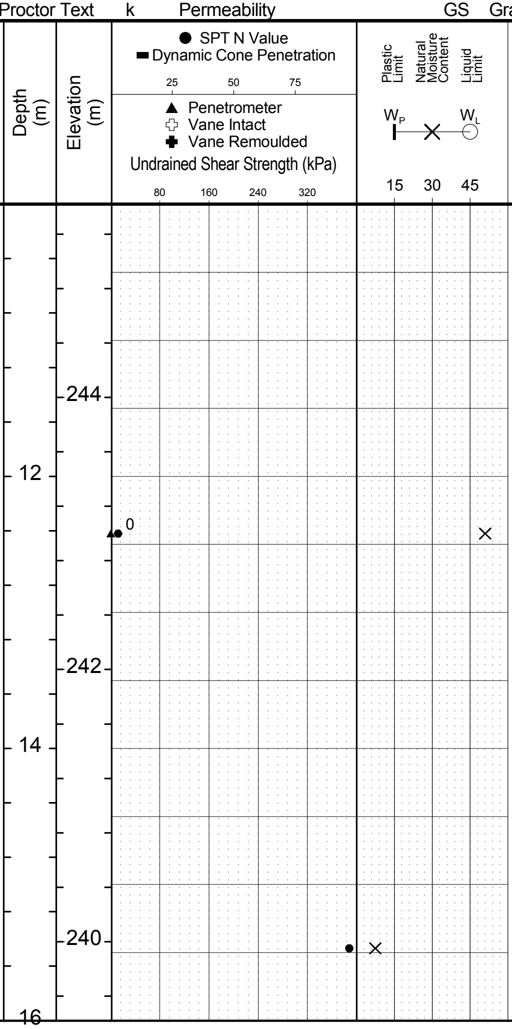
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Permeability (cm/s)	Remarks
	(CH) Clay with up to 15% subangular gravel, soft to firm, light brown to dark grey, high plasticity, moist to wet. *(continued)*								becoming very stony (grinding on auger)
			SS	11	100.0	3			
242.77 12.65	(CH) Light brown silty clay layers in very soft wet clay, becoming very wet soft clay with 15% gravel in last 0.61m								
241.48 13.94	Till, weathered limestone, tan to coarse angular gravel in sandy matrix, very dense, saturated.								
			SS	12		97			
239.42 16.00	END OF THE HOLE								



RECORD OF BOREHOLE No. FTWR-9

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** Paddock Drilling **BORING METHOD** Hollow Stem Auger
LOGGED BY JSL
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area Center **DATUM** MSL
COMPILED BY JOE
ELEVATION 254.62m **COORD.** N: 5,996,477.70m, E: 483,663.41m **BORING DATE**
CHECKED BY JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✚ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit / Natural Moisture Content / Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Overburden. Blind drilled to auger refusal. No recovery.												
								5	250				
								10	245				
								15	240				
								20	235				
233.92 20.70	END OF THE HOLE												

Appendix D

Test Pit Logs

Foth

RECORD OF BOREHOLE No. FCD 11

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH

CLIENT Victory Nickel **LOCATION** Southeast of Tailings and Waste Rock Area **DATUM** MSL **COMPILED BY** JOE

ELEVATION 258.00m **COORD.** N: 5,994,215.00m, E: 483,609.00m **BORING DATE** 22 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

		RC	Rock Core
AU	Auger	SS	Split Spoon
BU	Bulk	TW(SH)	Thin-Walled Open (Shelby)
GB	Grab Sample	VA	Vane
PS	Piston Sampler	WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description Ground Surface	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✚ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit / Natural Moisture Content / Liquid Limit W_P ⊢×⊸ W_L 15 30 45	Permeability (cm/s)	Remarks
	Muskeg.												
257.70 0.30	Peat.												
256.00 2.00	(CH) Clay, gray to brown, blocky structure, hard to very hard, high plasticity, moist, water percolating from bottom of peat, gradational contact.			FCD11 BS01-2.0m				2	256	▲ 343			
								4	254	▲ 441			
				FCD11 BS02-6.1m				6	252				
250.40 7.60	END OF THE HOLE												

Foth

RECORD OF BOREHOLE No. VNEE01 TP05

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777
DRILLER ET
BORING METHOD Track Hoe Test Pit
LOGGED BY JMH
CLIENT Victory Nickel
LOCATION Tailings and Waste Rock Area East
DATUM MSL
COMPILED BY JOE
ELEVATION 256.21m
COORD. N: 5,996,139.00m, E: 484,808.00m
BORING DATE 21 Mar 12
CHECKED BY JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE: Description	Strata Plot	SAMPLES: Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✚ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit, Natural Moisture Content, Liquid Limit W_P ✕ W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Peat, vegetation- dead leaves, pine.												
256.16 0.05	(CL) Clay, red-brown, moist, with silt, some small pebbles, trace sand, variable gradational contact, firm to soft, residuum.	▨						0.5	256.0				
255.61 0.60	END OF THE HOLE												

RECORD OF BOREHOLE No. VNEE01 TP06

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL **COMPILED BY** JOE

ELEVATION 255.68m **COORD.** N: 5,996,146.00m, E: 484,792.00m **BORING DATE** 21 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

SOIL PROFILE			SAMPLES							● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✜ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit / Natural Moisture Content / Liquid Limit W_P W_L 15 30 45		
Elev. Depth (m)	Description Ground Surface	Strata Plot	Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)			Permeability (cm/s)	Remarks
255.65 0.03	Decayed vegetation.									▲ 441.3			
	(CL) Clay, brown, dry, very hard, blocky structure, trace angular limestone cobbles and gravel, little fine sand in upper 0.3m, fining downward, gradational contact, high plasticity when moistened.	▨							255.5				
								0.5	255.0				
								1.0	254.5				
								1.5	254.0				
253.68 2.00	END OF THE HOLE							2.0					

RECORD OF BOREHOLE No. VNEE01 TP07

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit
LOGGED BY JMH
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL
COMPILED BY JOE
ELEVATION 255.00m **COORD.** N: 5,996,159.00m, E: 484,770.00m **BORING DATE** 21 Mar 12
CHECKED BY JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Elev. Depth (m)	SOIL PROFILE Description Ground Surface	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✣ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit, Natural Moisture Content, Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
254.90 0.10	Peat/Vegetation, same as TP06												
	(CL) Clay, brown, dry to moist at 4m, very hard, blocky prismatic structure, trace cobbles and small gravel, high plasticity when moistened. Mottled gray at 4.5m												
								1	254				
								2	253				
								3	252				
			VNEE01 BS01-4.0m					4	251				
250.00 5.00	END OF THE HOLE							5	250				

RECORD OF BOREHOLE No. VNEE01 TP08

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL **COMPILED BY** JOE
ELEVATION 254.86m **COORD.** N: 5,996,177.00m, E: 484,740.00m **BORING DATE** 21 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

		RC	Rock Core
AU	Auger	SS	Split Spoon
BU	Bulk	TW(SH)	Thin-Walled Open (Shelby)
GB	Grab Sample	VA	Vane
PS	Piston Sampler	WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration (25 50 75) ▲ Penetrometer ✧ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) (80 160 240 320)	Plastic Limit / Natural Moisture Content / Liquid Limit W_P W_L (15 30 45)	Permeability (cm/s)	Remarks
	Ground Surface												
254.76 0.10	Peat/Vegetation.									▲ 441			
	(CL) Clay, brown, dry, sandy at top to 0.7m, laminated bedding. Below 0.7m- moist, very hard, plastic when moistened, gradational contact, mottled gray @1.4m.	▨											
249.86 5.00	(CH) Clay, gray, blue-gray, high plasticity, trace cobbles, very hard.	▨	VNEE01 BS02-5.0m					5	250	▲ 441			
247.86 7.00	END OF THE HOLE							7	248				

RECORD OF BOREHOLE No. VNEE02 TP01

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL **COMPILED BY** JOE

ELEVATION 263.34m **COORD.** N: 5,995,840.00m, E: 484,683.00m **BORING DATE** 21 Mar 12 **CHECKED BY** JSL

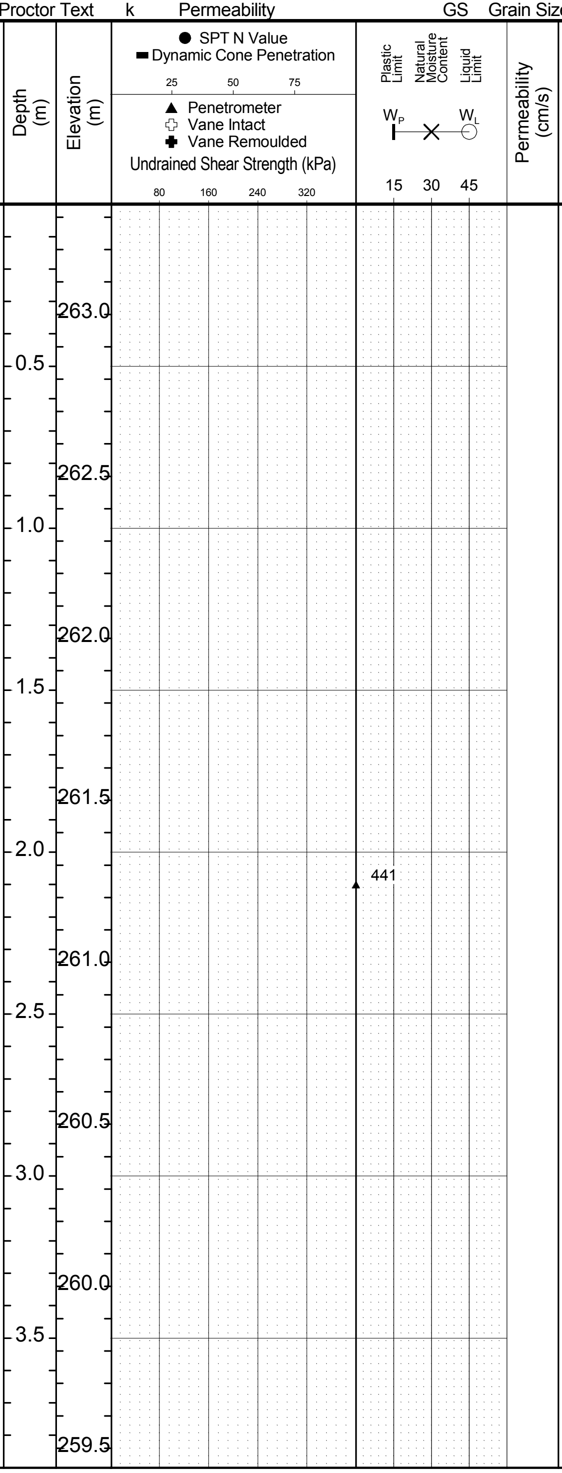
SAMPLE TYPES

		RC	Rock Core
AU	Auger	SS	Split Spoon
BU	Bulk	TW(SH)	Thin-Walled Open (Shelby)
GB	Grab Sample	VA	Vane
PS	Piston Sampler	WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Remarks
	Ground Surface							
263.29 0.05	Leaves/Pine - decayed vegetation							
	(GW) Gravel and sand, silt and clay, well graded, clast supported yellow-brown, dry, subrounded, imbricated, possible terrace deposit. Interbedded lenses of sand and cobble-based deposits. Trace boulders, dry, distinct contact.							Gravel and cobbles are mainly limestone with some granite / igneous erratics observed.
261.24 2.10	(CL) Clay, brown, some silt, some sand, dry, gradational contact, very hard.	▨						
259.44 3.90	END OF THE HOLE							



RECORD OF BOREHOLE No. VNEE02 TP03

FIGURE NO. 1
SHEET 1 OF 1

PROJECT	Victory Nickel - Minago Geotechnical Investigation			**ENGINEER**	
PROJECT NO.	11V777	**DRILLER**	ET	**BORING METHOD**	Track Hoe Test Pit
LOGGED BY	JMH				
CLIENT	Victory Nickel	**LOCATION**	Tailings and Waste Rock Area East	**DATUM**	MSL
COMPILED BY	JOE				
ELEVATION	266.44m	**COORD.**	N: 5,995,825.00m, E: 484,739.00m	**BORING DATE**	21 Mar 12
CHECKED BY	JSL				

SAMPLE TYPES

AU	Auger
BU	Bulk
GB	Grab Sample
PS	Piston Sampler
RC	Rock Core
SS	Split Spoon
TW(SH)	Thin-Walled Open (Shelby)
VA	Vane
WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer
U.W.	Wet Unit Weight
PT	Standard Proctor Text
P.L.	Point Load Strength Index (I_{50})
RQD	Rock Quality Designation
SCR	Solid Core Recovery
k	Permeability
C	Consolidation
CU	CU Triaxial
GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✣ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit / Natural Moisture Content / Liquid Limit W_P ⊢✕⊖ W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
266.39 0.05	Peat, decayed vegetation/pine.												
	Cobbles and gravel, imbricated, sand with silt, clay matrix, clast supported, subangular to subrounded, medium dense, erratics, fining upward, moist, gradational contact, subangular weathered bedrock below platy cobbles, possibly outwash.							0.5 1.0 1.5	266.0 265.5 265.0 264.5				
264.44 2.00	END OF THE HOLE							2.0					

RECORD OF BOREHOLE No. VNEE02 TP04

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL **COMPILED BY** JOE
ELEVATION 256.85m **COORD.** N: 5,995,868.00m, E: 484,576.00m **BORING DATE** 21 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger
BU	Bulk
GB	Grab Sample
PS	Piston Sampler
RC	Rock Core
SS	Split Spoon
TW(SH)	Thin-Walled Open (Shelby)
VA	Vane
WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer
U.W.	Wet Unit Weight
PT	Standard Proctor Text
P.L.	Point Load Strength Index (I_{50})
RQD	Rock Quality Designation
SCR	Solid Core Recovery
k	Permeability
C	Consolidation
CU	CU Triaxial
GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✚ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit, Natural Moisture Content, Liquid Limit W_P — ✕ — W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
256.80 0.05	Peat/decayed vegetation.									▲ 441			
	(CL) Clay, brown, dry, very hard, plastic when moistened, blocky structure, trace limestone cobbles and gravel. Trace boulders.	▨							256.5				
		▨						0.5					
		▨							256.0				
		▨						1.0					
		▨							255.5				
		▨						1.5					
255.15 1.70	END OF THE HOLE												

RECORD OF BOREHOLE No. VNEE02 TP06

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL **COMPILED BY** JOE
ELEVATION 255.59m **COORD.** N: 5,995,900.00m, E: 484,470.00m **BORING DATE** 21 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Legend: ● SPT N Value; ▬ Dynamic Cone Penetration (25, 50, 75); ▲ Penetrometer; ✣ Vane Intact; ✚ Vane Remoulded; Undrained Shear Strength (kPa) (80, 160, 240, 320); Plastic Limit, Natural Moisture Content, Liquid Limit: W_P ⊢ × ○ W_L (15, 30, 45)

Elev. Depth (m)	SOIL PROFILE: Description	Strata Plot	SAMPLES: Type	SAMPLES: Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Undrained Shear Strength (kPa)	Plastic Limit / Natural Moisture Content / Liquid Limit	Permeability (cm/s)	Remarks
	Ground Surface										
	Peat.							▲ 466			
255.29 0.30	(CL) Clay, gray, medium plasticity, very hard, blocky structure, moist.	▨		VNEE02 BS02-4m							
251.29 4.30	(CH) Clay, gray, hard, very plastic, moist, trace subangular pebbles.	▨		VNEE02 BS02-7m				▲ 392			
248.59 7.00	END OF THE HOLE										

RECORD OF BOREHOLE No. VNEE03 TP04

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL **COMPILED BY** JOE
ELEVATION 262.09m **COORD.** N: 5,995,282.00m, E: 484,433.00m **BORING DATE** 22 Mar 12 **CHECKED BY** JSL

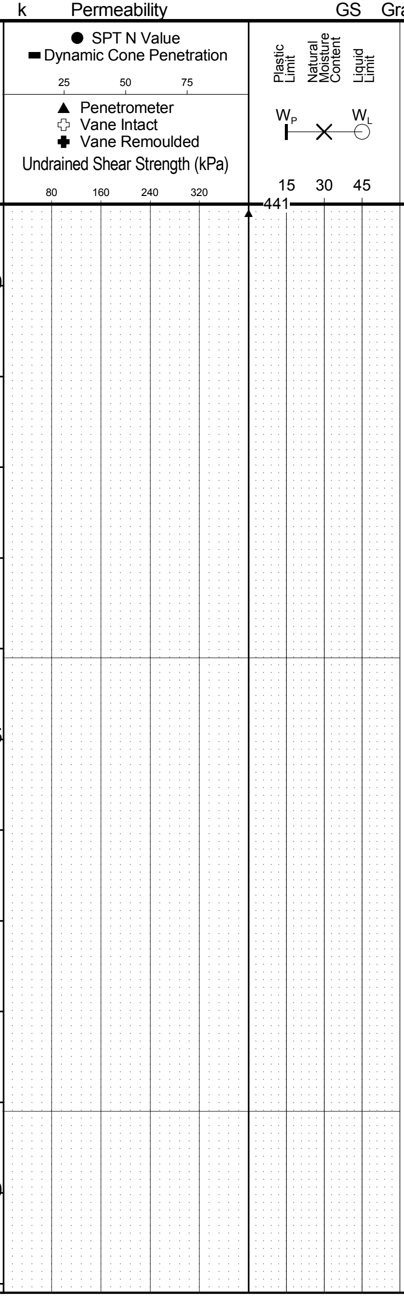
SAMPLE TYPES

		RC	Rock Core
AU	Auger	SS	Split Spoon
BU	Bulk	TW(SH)	Thin-Walled Open (Shelby)
GB	Grab Sample	VA	Vane
PS	Piston Sampler	WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	Permeability (cm/s)	Remarks
	Ground Surface										
262.08 0.01	Peat/decayed vegetation.										
	(CL-ML) Clay and silt, brown, very hard (not frozen), moist, low plasticity, prismatic structure, some rock, trace gravel, subangular, gradational contact.								262.0		
								0.5	261.5		
261.39 0.70	(CL) Clay wtih cobbles, limestone, subangular, very hard, brown, residuum, weathered limestone, plastic, moist.							1.0	261.0		
260.89 1.20	END OF THE HOLE										



RECORD OF BOREHOLE No. VNEE03 TP05

FIGURE NO. 1
SHEET 1 OF 1

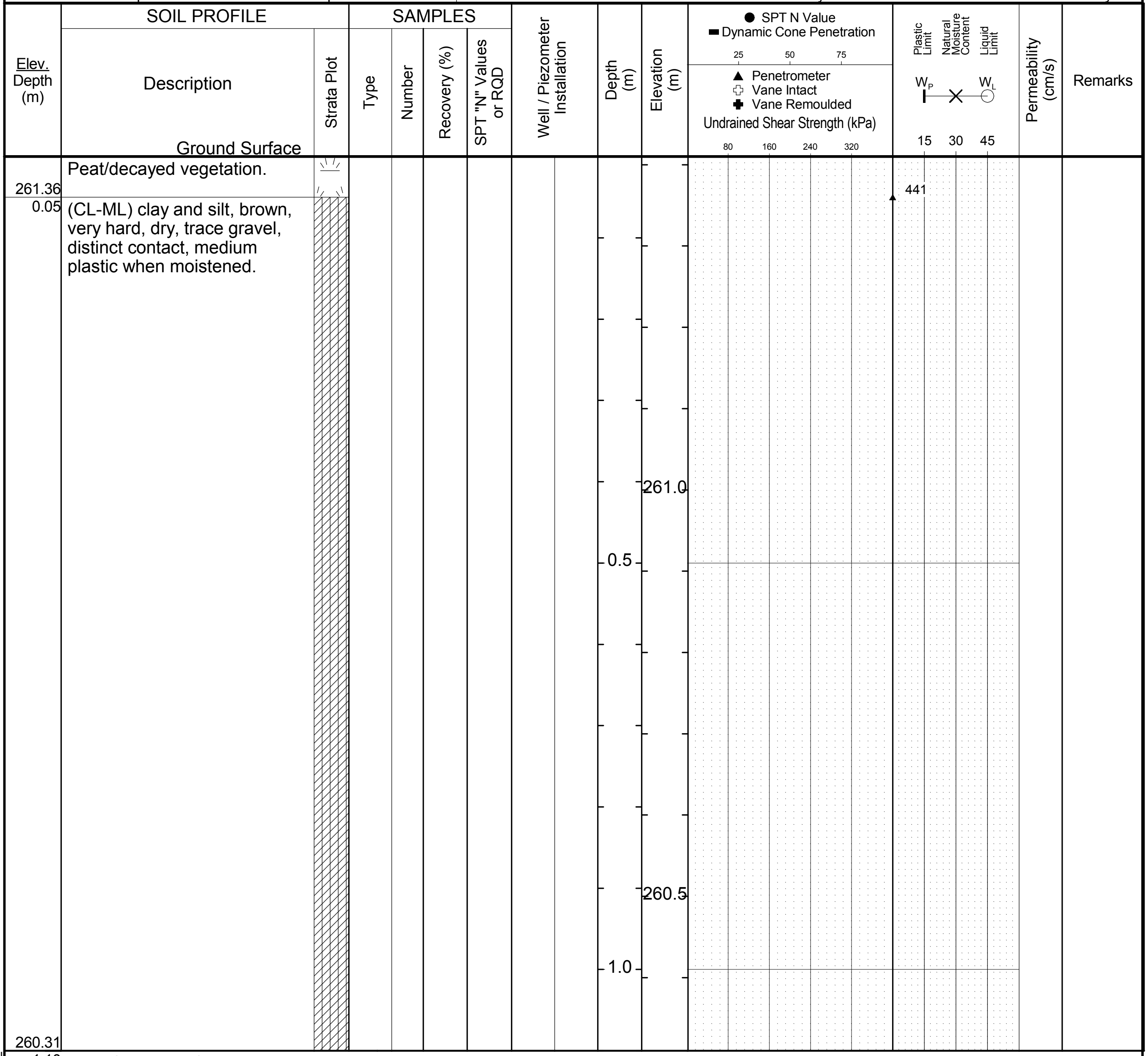
PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777
DRILLER ET
BORING METHOD Track Hoe Test Pit
LOGGED BY JMH
CLIENT Victory Nickel
LOCATION Tailings and Waste Rock Area East
DATUM MSL
COMPILED BY JOE
ELEVATION 261.41m
COORD. N: 5,995,296.00m, E: 484,404.00m
BORING DATE 22 Mar 12
CHECKED BY JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		



Elev. Depth (m)	Description
	Peat/decayed vegetation.
261.36 0.05	(CL-ML) clay and silt, brown, very hard, dry, trace gravel, distinct contact, medium plastic when moistened.
260.31 1.10	END OF THE HOLE

RECORD OF BOREHOLE No. VNEE03 TP07

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL **COMPILED BY** JOE

ELEVATION 259.68m **COORD.** N: 5,995,331.00m, E: 484,345.00m **BORING DATE** 22 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Elev. Depth (m)	SOIL PROFILE: Description (Ground Surface)	Strata Plot	SAMPLES: Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value (25 50 75) ▬ Dynamic Cone Penetration ▲ Penetrometer ✚ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) (80 160 240 320)	Plastic Limit / Natural Moisture Content / Liquid Limit (W_P — W_L) (15 30 45)	Permeability (cm/s)	Remarks
259.63 0.05	Peat.									▲ 441			
	(CL-ML) Clay and silt, some gravel and cobbles, igneous erratics, dry, very hard, medium plasticity when moist, brown, matrix supported, gradational contact.												
256.18 3.50	(ML) Silt with clay, gray-brown, moist, low plasticity, very hard, glacial erratics, gravel, matrix supported.									▲ 441			
254.88 4.80	END OF THE HOLE												

RECORD OF BOREHOLE No. VNEE03 TP08

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit
LOGGED BY JMH
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL
COMPILED BY JOE
ELEVATION 258.00m **COORD.** N: 5,995,360.00m, E: 484,300.00m **BORING DATE** 22 Mar 12
CHECKED BY JSL

SAMPLE TYPES

		RC	Rock Core
AU	Auger	SS	Split Spoon
BU	Bulk	TW(SH)	Thin-Walled Open (Shelby)
GB	Grab Sample	VA	Vane
PS	Piston Sampler	WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration (25 50 75) ▲ Penetrometer ✣ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) (80 160 240 320)	Plastic Limit / Natural Moisture Content / Liquid Limit W_P W_L (15 30 45)	Permeability (cm/s)	Remarks
	Ground Surface												
257.95 0.05	Peat.									▲ 441			
	(CL-ML) Silt with clay, trace subrounded cobbles, boulders, gravel, limestone, igneous, hard, dry, medium plasticity when moistened, brown, gradational contact, till.												
								1	257				
								2	256				
255.00 3.00	(CH) Clay, trace silt, moist, high plasticity, brown, hard, trace erratic cobbles.							3	255	▲ 245			
								4	254				
			VNEE03 BS01-4.5m										
253.20 4.80	END OF THE HOLE												

RECORD OF BOREHOLE No. VNEE04 TP01

FIGURE NO. 1
SHEET 1 OF 1

PROJECT	Victory Nickel - Minago Geotechnical Investigation					**ENGINEER**	
PROJECT NO.	11V777	**DRILLER**	ET	**BORING METHOD**	Track Hoe Test Pit	**LOGGED BY**	JMH
CLIENT	Victory Nickel	**LOCATION**	Tailings and Waste Rock Area East	**DATUM**	MSL	**COMPILED BY**	JOE
ELEVATION	264.89m	**COORD.**	N: 5,994,452.00m, E: 484,391.00m	**BORING DATE**	22 Mar 12	**CHECKED BY**	JSL

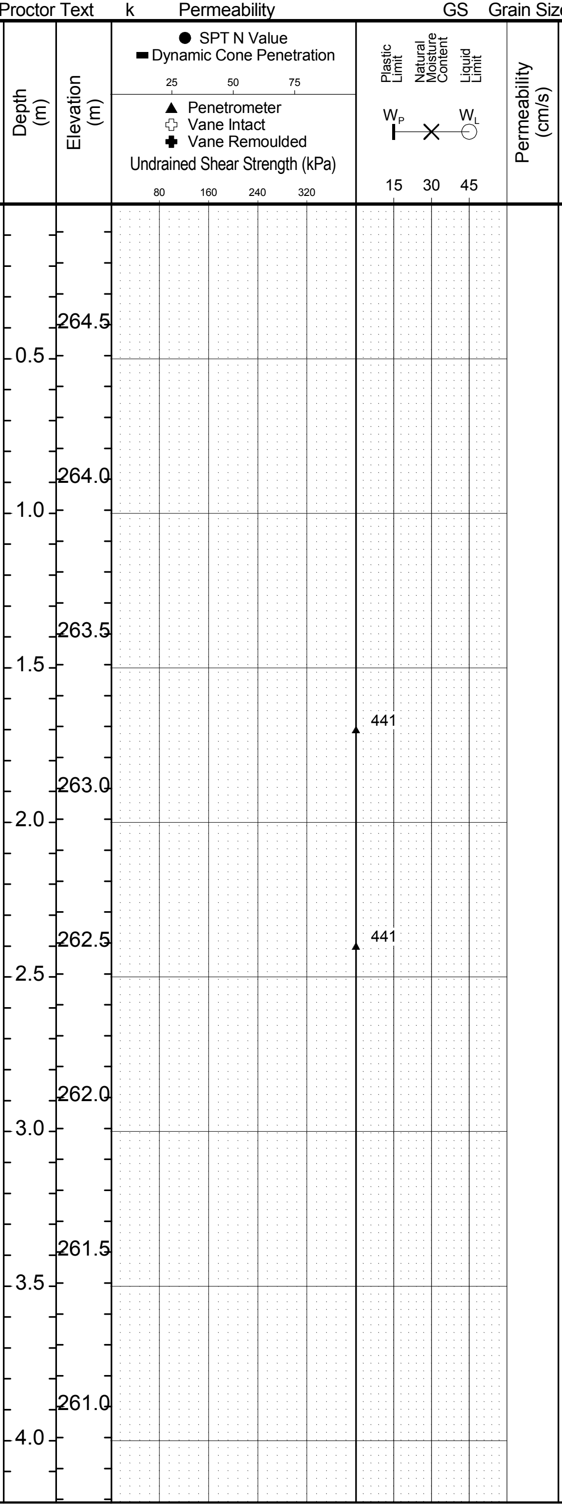
SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Remarks
	Ground Surface							
264.79 0.10	Peat/decayed vegetation							
263.19 1.70	(GW) Cobbles/gravel, subrounded to rounded, thinly bedded channel deposits, sand, clay in matrix, clast supported, fining upward, repeating alluvial deposits (4 beds), gradational contact, brown, dry, variable composition.							
262.49 2.40	(ML) Silt, some clay, brown, very hard, dry, low plasticity, gradational contact.							
260.69 4.20	(CH) Clay, dry, brown gray, very hard, high plasticity when moist, trace cobbles and boulders, variable composition.							
	END OF THE HOLE							



Foth

RECORD OF BOREHOLE No. VNEE04 TP02

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL **COMPILED BY** JOE

ELEVATION 260.00m **COORD.** N: 5,994,420.00m, E: 484,308.00m **BORING DATE** 22 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Legend: ● SPT N Value; ▬ Dynamic Cone Penetration (25, 50, 75); ▲ Penetrometer; ✚ Vane Intact; ✚ Vane Remoulded; Undrained Shear Strength (kPa) (80, 160, 240, 320); Plastic Limit, Natural Moisture Content, Liquid Limit: W_P ⊢ × ○ W_L (15, 30, 45)

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	Undrained Shear Strength (kPa)	Wp / W / WL	Permeability (cm/s)	Remarks
	Ground Surface												
259.90	Peat/decayed vegetation.									▲ 196			
0.10	(CL) Clay and silt, brown, some gravel and cobbles, moist, some fine sand, low plasticity. Matrix supported, firm, distinct contact, cross-cutting into deposit below.							0.5	259.5				
259.30 0.70	(SP) Sand, fine grained, dense, yellow-gray, trace angular pebbles, some silt, trace cobbles, moist.							1.0	259.0				
								1.5	258.5				
								2.0	258.0				
								2.5	257.5				
								3.0	257.0				
								3.5	256.5				
								4.0	256.0				
255.60 4.40	END OF THE HOLE												

RECORD OF BOREHOLE No. VNEE04 TP03

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area East **DATUM** MSL **COMPILED BY** JOE

ELEVATION 260.00m **COORD.** N: 5,994,410.00m, E: 484,256.00m **BORING DATE** 22 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

SOIL PROFILE — SAMPLES

● SPT N Value
▬ Dynamic Cone Penetration
25 50 75
▲ Penetrometer
✣ Vane Intact
✚ Vane Remoulded
Undrained Shear Strength (kPa)
80 160 240 320

Plastic Limit, Natural Moisture Content, Liquid Limit
W_P W_L
15 30 45

Elev. Depth (m)	Description	Strata Plot	Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	Undrained Shear Strength (kPa)	Plastic Limit / Natural Moisture Content / Liquid Limit	Permeability (cm/s)	Remarks
	Ground Surface												
259.95 0.05	Peat.									▲ 441			
	(CH) Clay, very hard, brown, dry, trace cobbles, matrix supported, high plasticity when moist.							0.5	259.5				
								1.0	259.0				
								1.5	258.5				
								2.0	258.0				
257.40 2.60	END OF THE HOLE							2.5	257.5				

RECORD OF BOREHOLE No. VNWE01 TP05

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL **COMPILED BY** JOE

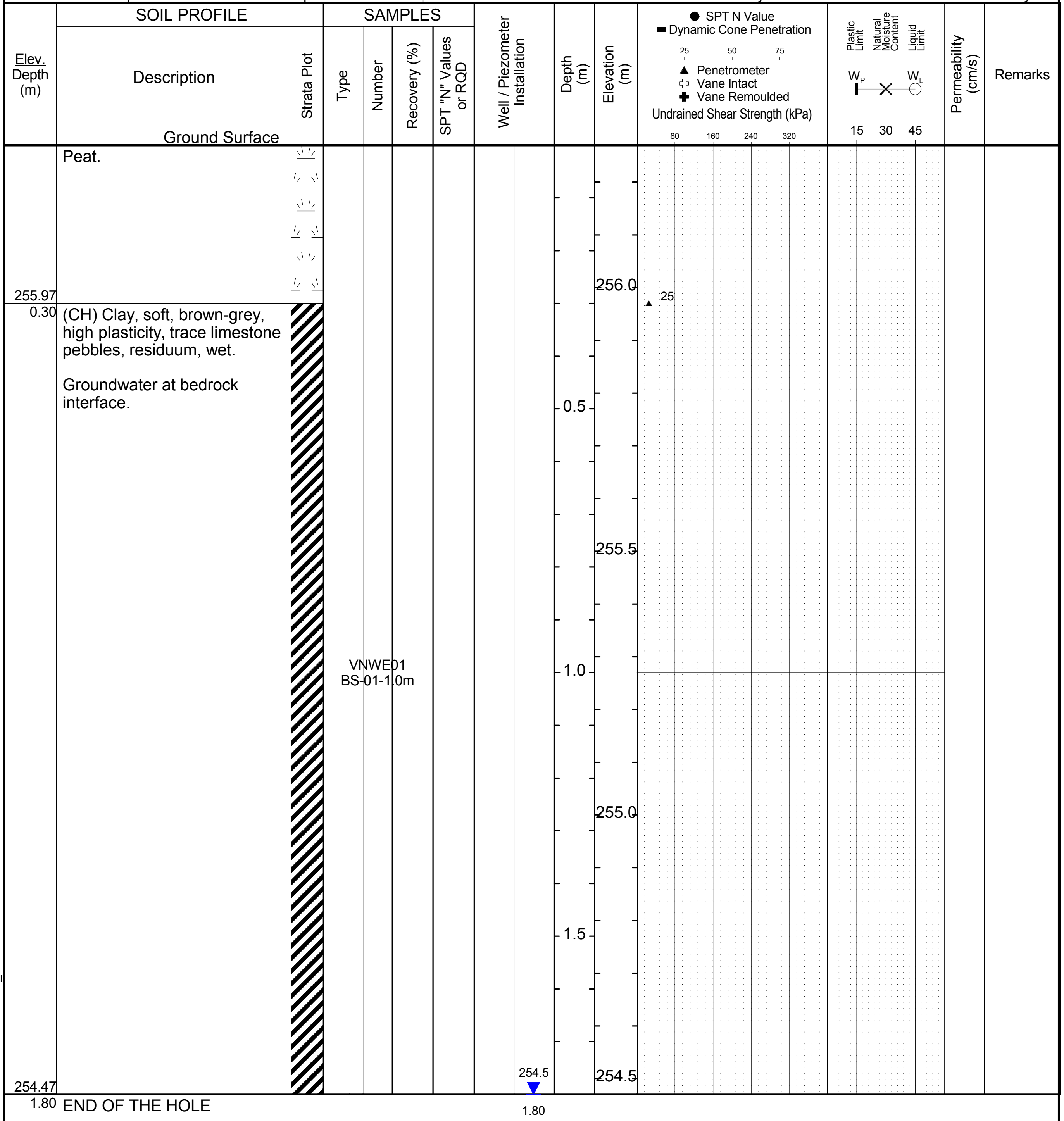
ELEVATION 256.27m **COORD.** N: 5,997,369.00m, E: 482,525.00m **BORING DATE** 20 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		



Elev. Depth (m)	Description	Sample
	Peat.	
255.97 0.30	(CH) Clay, soft, brown-grey, high plasticity, trace limestone pebbles, residuum, wet. Groundwater at bedrock interface.	VNWE01 BS-01-1.0m
254.47 1.80	END OF THE HOLE	

RECORD OF BOREHOLE No. VNWE01 TP06

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER

PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL **COMPILED BY** JOE

ELEVATION 256.00m **COORD.** N: 5,997,366.00m, E: 482,534.00m **BORING DATE** 20 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✜ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit, Natural Moisture Content, Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Peat.												
255.60 0.40	(CH) Clay, same as TP05, soft, brown-gray, high plasticity, trace limestone pebbles, residuum, wet.							0.5 1.0 1.5	255.5 255.0 254.5				
254.30 1.70	END OF THE HOLE						254.3 ▼ 1.70						

Foth

RECORD OF BOREHOLE No. VNWE01 TP07

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL **COMPILED BY** JOE
ELEVATION 256.00m **COORD.** N: 5,997,362.00m, E: 482,542.00m **BORING DATE** 20 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Legend: ● SPT N Value; ▬ Dynamic Cone Penetration (25, 50, 75); ▲ Penetrometer; ✚ Vane Intact; ✚ Vane Remoulded; Undrained Shear Strength (kPa) (80, 160, 240, 320); Plastic Limit, Natural Moisture Content, Liquid Limit: W_P ⊢ × ⊖ W_L (15, 30, 45)

Elev. Depth (m)	SOIL PROFILE: Description	Strata Plot	SAMPLES: Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	Undrained Shear Strength (kPa)	Plastic Limit / Natural Moisture Content / Liquid Limit	Permeability (cm/s)	Remarks
	Ground Surface												
	Peat.							0.5	255.5				
255.10 0.90	(CH) Clay, brown to gray, soft to hard, high plasticity, trace limestone, residuum, moist to wet. Groundwater percolating at 2.0m.									▲ 221			
								1.0	255.0				
								1.5	254.5				
								2.0	254.0				
								2.5	253.5				
								3.0	253.0				
								3.5	252.5				
			VNWE01-BS02-3.7m										
252.10 3.90	END OF THE HOLE												

Foth

RECORD OF BOREHOLE No. VNWE02 TP02

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL **COMPILED BY** JOE
ELEVATION 262.30m **COORD.** N: 5,996,853.00m, E: 482,262.00m **BORING DATE** 20 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	SPT N Value / Dynamic Cone Penetration / Undrained Shear Strength (kPa)	Plastic Limit / Natural Moisture Content / Liquid Limit	Permeability (cm/s)	Remarks
	Ground Surface											
	(GW) Peat, decayed vegetation with subrounded gravel and cobbles, imbricated, dry, fine sand and silt matrix, medium dense, dark brown.							262.0				
261.90 0.40	(GW) Gravel, subrounded cobbles, fining downward, gradational contact, silt to fine sand matrix, clast supported, outwash or terrace deposit, imbricated, well graded.						0.5					
261.60 0.70	(SW) Sand, coarse, well graded with subrounded to rounded limestone and igneous gravel, medium dense, fining upward, gradational contact.						1.0	261.5				
261.20 1.10	(GW) Cobbles, platy, fining upward, meduim sand matrix, fining upward, gradational contact.						1.5	261.0				
260.60 1.70	(GP) Weathered limestone, platy, dense, cobble to gravel, brown, dry. Weathered intact limestone, light gray, dry, groundwater percolating from bottom of trench, wet.					259.9 ▼ 2.40	2.0	260.5 260.0				
259.90 2.40	END OF THE HOLE											

Legend: ● SPT N Value; ▬ Dynamic Cone Penetration (25, 50, 75); ▲ Penetrometer; ✣ Vane Intact; ✚ Vane Remoulded; Undrained Shear Strength (kPa) (80, 160, 240, 320); W_P ⊢—✕—○ W_L (15, 30, 45)

RECORD OF BOREHOLE No. VNWE02 TP03 EAST

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL **COMPILED BY** JOE

ELEVATION 258.87m **COORD.** N: 5,996,836.00m, E: 482,290.00m **BORING DATE** 20 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Legend: ● SPT N Value; ▬ Dynamic Cone Penetration (25, 50, 75); ▲ Penetrometer; ✚ Vane Intact; ✚ Vane Remoulded; Undrained Shear Strength (kPa) (80, 160, 240, 320); Plastic Limit, Natural Moisture Content, Liquid Limit (W_P — × — W_L; 15, 30, 45); Permeability (cm/s); Remarks

Elev. Depth (m)	SOIL PROFILE Description	Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Remarks
	Ground Surface						
	Peat with organic matter.						
258.37 0.50	(GW) Cobbles and sand, subrounded, clay matrix, well graded.						
257.67 1.20	Weathered bedrock to 3.1m, highly fractured with solution cavities, light yellow-gray, heavy groundwater flow at bedrock/soil interface, filling pit.						
255.77 3.10	END OF THE HOLE						

Depth (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0
Elevation (m): 258.5, 258.0, 257.5, 257.0, 256.5, 256.0

FOTH BOREHOLE RECORD MINAGO_CONSOLIDATED.GPJ FOTH.GDT 5/11/12

RECORD OF BOREHOLE No. VNWE02 TP03 WEST

Foth

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit
LOGGED BY JMH
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL
COMPILED BY JOE
ELEVATION 260.90m **COORD.** N: 5,996,844.00m, E: 482,274.00m **BORING DATE** 20 Mar 12
CHECKED BY JSL

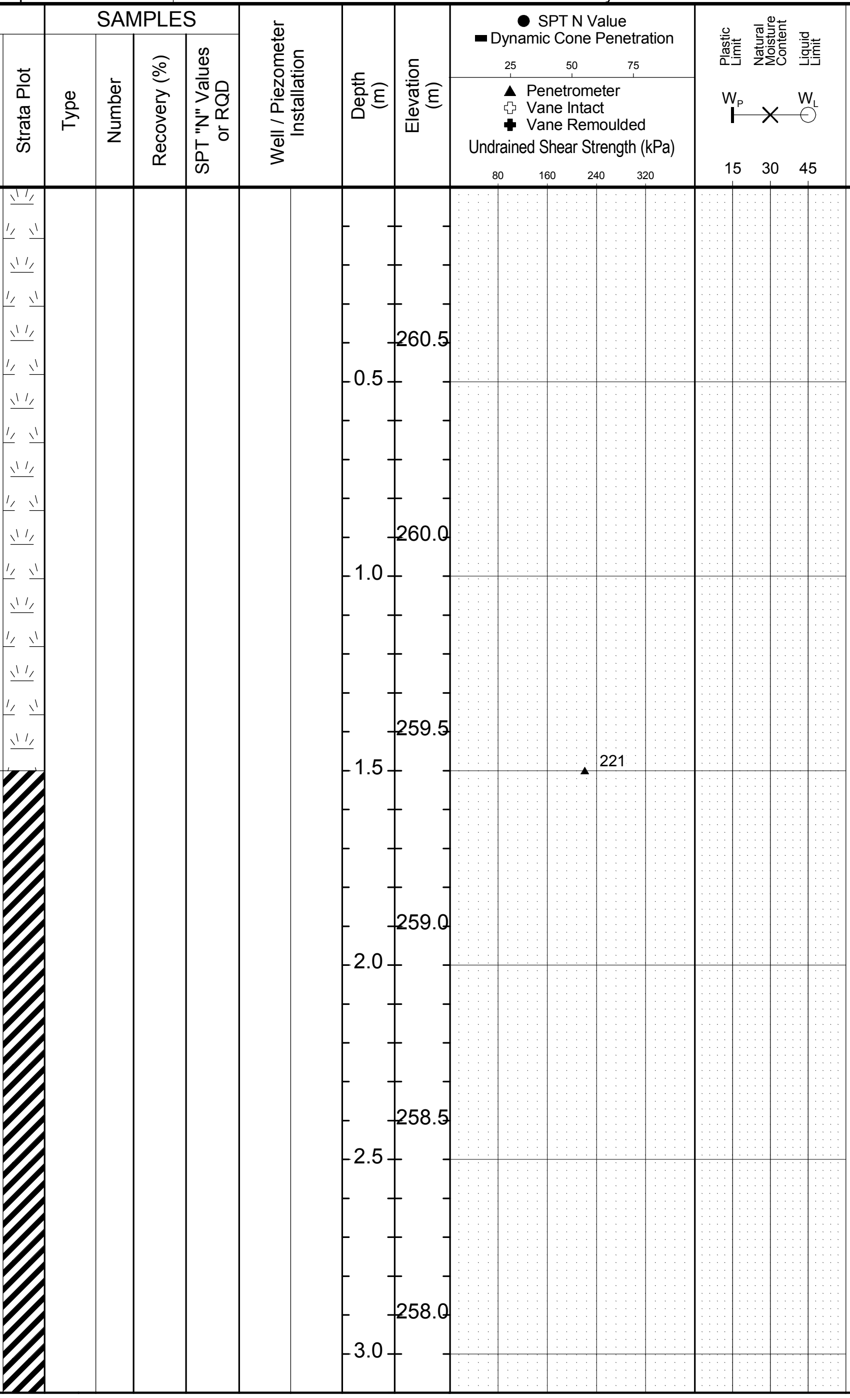
SAMPLE TYPES

		RC	Rock Core
AU	Auger	SS	Split Spoon
BU	Bulk	TW(SH)	Thin-Walled Open (Shelby)
GB	Grab Sample	VA	Vane
PS	Piston Sampler	WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Remarks
	Ground Surface						
	Peat.						
259.40 1.50	(CH) Silty clay with pebbles, matrix supported, gradational lateral contact, stiff, high plasticity. This trench marks the transition between weathered bedrock and alluvial deposits and basin/peat and clay wetland deposits.						
257.80 3.10	END OF THE HOLE						



RECORD OF BOREHOLE No. VNWE02 TP04

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Test Pit **LOGGED BY** JMH
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL **COMPILED BY** JOE
ELEVATION 258.54m **COORD.** N: 5,996,826.00m, E: 482,303.00m **BORING DATE** 20 Mar 12 **CHECKED BY** JSL

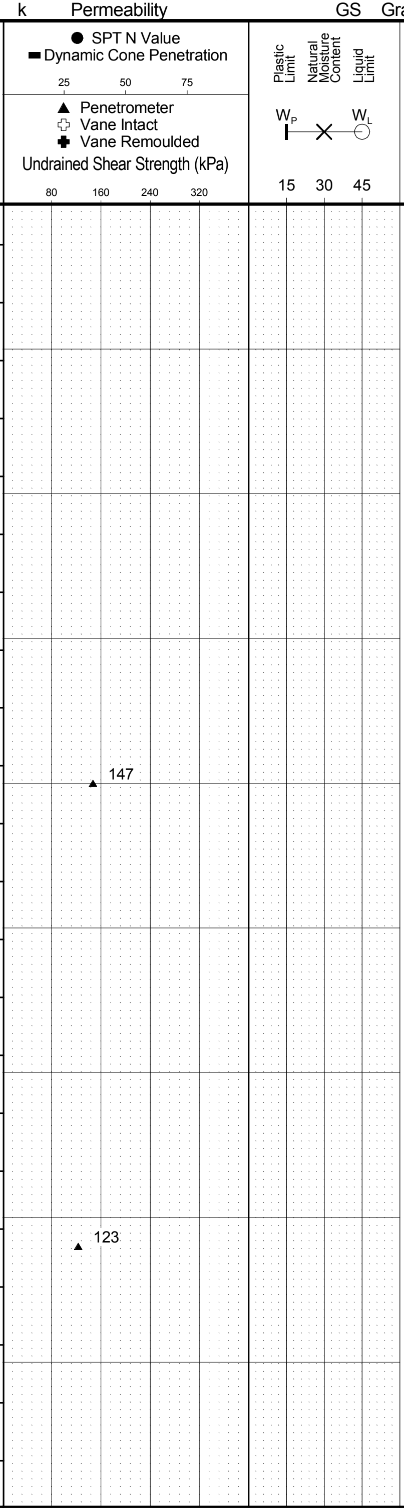
SAMPLE TYPES

		RC	Rock Core
AU	Auger	SS	Split Spoon
BU	Bulk	TW(SH)	Thin-Walled Open (Shelby)
GB	Grab Sample	VA	Vane
PS	Piston Sampler	WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	Undrained Shear Strength (kPa)	Plastic Limit / Natural Moisture Content / Liquid Limit	Permeability (cm/s)	Remarks
	Ground Surface												
	Peat.												
256.54 2.00	(CH) Clay, yellow-brown-gray, blue mottling, moist, with fine sand, trace angular limestone pebbles (0.6mm - 25mm), high plasticity, mottled gray peat flecks, medium stiff to stiff, distinct contact.			VNWE02 BS-01				2		147			
				VNWE02 BS-02						123			
254.04 4.50	END OF THE HOLE												



RECORD OF BOREHOLE No. VNWE03 log 1

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation **ENGINEER**

PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Trenching **LOGGED BY** JMH

CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL **COMPILED BY** JOE

ELEVATION 263.22m **COORD.** N: 5,996,489.00m, E: 482,101.00m **BORING DATE** 19 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Legend: ● SPT N Value; ▬ Dynamic Cone Penetration (25, 50, 75); ▲ Penetrometer; ✚ Vane Intact; ✚ Vane Remoulded; Undrained Shear Strength (kPa) (80, 160, 240, 320); Plastic Limit, Natural Moisture Content, Liquid Limit: W_P ⊢—×—○ W_L (15, 30, 45)

Elev. Depth (m)	SOIL PROFILE Description	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	Undrained Shear Strength (kPa)	Water Content	Permeability (cm/s)	Remarks
	Ground Surface												
	Peat, granular, basal fine sand, dark brown												
263.02 0.20	(SW) Sand with rounded gravel, well graded, loose, some clay lenses, brown, outwash or alluvial.								263.0				
								0.5					
									262.5				
								1.0					
262.02 1.20	END OF THE HOLE												

FOTH BOREHOLE RECORD MINAGO_CONSOLIDATED.GPJ FOTH.GDT 5/11/12

RECORD OF BOREHOLE No. VNWE03 log 2

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Trenching **LOGGED BY** JMH
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL **COMPILED BY** JOE
ELEVATION 261.00m **COORD.** N: 5,996,489.00m, E: 482,159.00m **BORING DATE** 19 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE: Description	Strata Plot	SAMPLES: Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✣ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit, Natural Moisture Content, Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	Ground Surface												
	Peat, granular, basal fine sand, dark brown, frozen.												
260.70 0.30	(GW) Cobbles and gravel with sand, some clay lenses, subrounded, brown, well graded, clast supported, loose to medium dense, dry, imbricated, till or outwash, small esker forms longitudinal ridge subparallel to outcrop trend (NNW).							0.5 1.0 1.5 2.0	260.5 260.0 259.5 259.0				
258.60 2.40	(CH) Clay, hard, brown to grey, high plasticity, moist, grading to gray, some angular cobbles.	▨						2.5 3.0 3.5 4.0	258.5 258.0 257.5 257.0				
256.70 4.30	END OF THE HOLE												

RECORD OF BOREHOLE No. VNWE03 log 3

FIGURE NO. 1
SHEET 1 OF 1

PROJECT	Victory Nickel - Minago Geotechnical Investigation					**ENGINEER**	
PROJECT NO.	11V777	**DRILLER**	ET	**BORING METHOD**	Track Hoe Trenching	**LOGGED BY**	JMH
CLIENT	Victory Nickel	**LOCATION**	Tailings and Waste Rock Area West	**DATUM**	MSL	**COMPILED BY**	JOE
ELEVATION	259.14m	**COORD.**	N: 5,996,489.00m, E: 482,201.00m	**BORING DATE**	19 Mar 12	**CHECKED BY**	JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

P.P.	Pocket Penetrometer	P.L.	Point Load Strength Index (I_{50})	C	Consolidation
U.W.	Wet Unit Weight	RQD	Rock Quality Designation	CU	CU Triaxial
PT	Standard Proctor Text	SCR	Solid Core Recovery	GS	Grain Size Analysis
		k	Permeability		

Elev. Depth (m)	SOIL PROFILE Description (Ground Surface)	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	Permeability (cm/s)	Remarks
	Peat, granular, basal fine sand, dark brown, frozen.								259.0		
258.64 0.50	(GW) Sand, well graded with round gravel, loose, some clay lenses, till or outwash.							0.5 1.0	258.5		
257.94 1.20	(SC) Sandy clay, brown, moist, medium stiff, high plasticity, trace local limestone pebble lenses, gradational contact.							1.5 2.0 2.5 3.0	258.0 257.5 257.0 256.5 256.0		
255.94 3.20	(CH) Clay, hard, high plasticity, moist, some angular cobbles, brown, grading to gray/blue-gray. Groundwater located at bedrock interface.						255.1 ▼ 4.00	3.5 4.0	255.5 255.0		
254.94 4.20	END OF THE HOLE										

● SPT N Value
▬ Dynamic Cone Penetration
25 50 75
▲ Penetrometer
✧ Vane Intact
✚ Vane Remoulded
Undrained Shear Strength (kPa)
80 160 240 320

Plastic Limit / Natural Moisture Content / Liquid Limit
W_P — × — W_L
15 30 45

FOTH BOREHOLE RECORD MINAGO_CONSOLIDATED.GPJ FOTH.GDT 5/11/12

RECORD OF BOREHOLE No. VNWE04 log 1

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Trenching **LOGGED BY** JMH
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL **COMPILED BY** JOE
ELEVATION 257.35m **COORD.** N: 5,996,044.00m, E: 481,720.00m **BORING DATE** 19 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

AU	Auger	RC	Rock Core
BU	Bulk	SS	Split Spoon
GB	Grab Sample	TW(SH)	Thin-Walled Open (Shelby)
PS	Piston Sampler	VA	Vane
		WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE: Description (Ground Surface)	Strata Plot	SAMPLES: Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	Depth (m)	Elevation (m)	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✣ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit, Natural Moisture Content, Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	(GW) Limestone gravel with silt, fine sand, wet, decayed vegetation								257.0				
256.95 0.40	(SW) Sand, brown, fien to medium grained, well graded, poorly sorted, moist, loose, limestone gravel, silt.							0.5 1.0	256.5				
256.15 1.20	END OF THE HOLE												

RECORD OF BOREHOLE No. VNWE04 log 2

FIGURE NO. 1
SHEET 1 OF 1

PROJECT Victory Nickel - Minago Geotechnical Investigation
ENGINEER
PROJECT NO. 11V777 **DRILLER** ET **BORING METHOD** Track Hoe Trenching **LOGGED BY** JMH
CLIENT Victory Nickel **LOCATION** Tailings and Waste Rock Area West **DATUM** MSL **COMPILED BY** JOE
ELEVATION 257.00m **COORD.** N: 5,996,014.00m, E: 481,756.00m **BORING DATE** 19 Mar 12 **CHECKED BY** JSL

SAMPLE TYPES

		RC	Rock Core
AU	Auger	SS	Split Spoon
BU	Bulk	TW(SH)	Thin-Walled Open (Shelby)
GB	Grab Sample	VA	Vane
PS	Piston Sampler	WS	Wash Sample

ABBREVIATIONS

		P.L.	Point Load Strength Index (I_{50})		
P.P.	Pocket Penetrometer	RQD	Rock Quality Designation	C	Consolidation
U.W.	Wet Unit Weight	SCR	Solid Core Recovery	CU	CU Triaxial
PT	Standard Proctor Text	k	Permeability	GS	Grain Size Analysis

Elev. Depth (m)	SOIL PROFILE Description Ground Surface	Strata Plot	SAMPLES Type	Number	Recovery (%)	SPT "N" Values or RQD	Well / Piezometer Installation	● SPT N Value ▬ Dynamic Cone Penetration 25 50 75 ▲ Penetrometer ✣ Vane Intact ✚ Vane Remoulded Undrained Shear Strength (kPa) 80 160 240 320	Plastic Limit / Natural Moisture Content / Liquid Limit W_P W_L 15 30 45	Permeability (cm/s)	Remarks
	Peat, decayed vegetation, frozen.										
256.60 0.40	(GW) Gravel with fine sand, loose, moist.										
256.20 0.80	(CH) Clay, gray, firm to very hard, with fine gravel, well graded, matrix supported, angular, yellow-brown, moist, till, medium to high plasticity, occasional limestone boulders.	▨									
253.50 3.50	END OF THE HOLE										

Depth (m)	Elevation (m)
0.5	256.5
1.0	256.0
1.5	255.5
2.0	255.0
2.5	254.5
3.0	254.0
3.5	253.5

Appendix E

Project Geotechnical Investigation Photo Logs

Photographic Log

Client's Name:	**Site Location:**	**Project No.**
Victory Nickel-Minago Investigation	Manitoba, Canada	11V777

Photo No. 1.

Date: 3/22/12

Test Pit ID:

FCD 11

Photo Taken By:

Jeremy Haynes

Description:

Very dark brown peat overlying grey-brown fat clay.

Photo No. 2.

Date: 3/22/12

Test Pit ID:

FCD 11

Photo Taken By:

Jeremy Haynes

Description:

Very dark brown peat overlying grey-brown fat clay.

Photographic Log

Client's Name:	**Site Location:**	**Project No.**
Victory Nickel-Minago Investigation	Manitoba, Canada	11V777

Photo No. **1.**	**Date:** 3/21/12
Test Pit ID: VNEE01 TP05	
Photo Taken By: Jeremy Haynes	
Description: Peat above thin layer of red-brown clay with silt overlying limestone bedrock. Refusal at 0.6m on competent bedrock.	

Photo No. **2.**	**Date:** 3/21/12
Test Pit ID: VNEE01 TP06	
Photo Taken By: Jeremy Haynes	
Description: Peat above clast-supported, bedded, cobble and gravel deposit with sand and clay matrix. This is underlain by silt and fat clay units. Refusal at 4.2m on limestone bedrock.	

Photo No. **3.**	**Date:** 3/21/12
Test Pit ID: VNEE01 TP07	
Photo Taken By: Jeremy Haynes	
Description: Thin layer of peat overlying brown fat clay.	

Photo No. **4.**	**Date:** 3/21/12
Test Pit ID: VNEE01 TP08	
Photo Taken By: Jeremy Haynes	
Description: Peat above brown lean clay, sandy at top, overlying 2m of gray fat clay. Refusal at 7m.	

Photographic Log

Client's Name:	**Site Location:**	**Project No.**
Victory Nickel-Minago Investigation	Manitoba, Canada	11V777

Photo No. 1.	**Date:** 3/21/12
Test Pit ID: VNEE02 TP01	
Photo Taken By: Jeremy Haynes	
Description: Well graded clast-supported gravel and sand with silt and clay above interbedded lenses of sand and cobbles. This is underlain by 1.8m of brown lean clay with some silt and sand. Refusal at 3.9m on bedrock.	

Photo No. 2.	**Date:** 3/21/12
Test Pit ID: VNEE02 TP04	
Photo Taken By: Jeremy Haynes	
Description: Brown peat overlying very hard brown lean clay. Refusal at 1.7m on bedrock.	

Client's Name: Victory Nickel-Minago Investigation	**Site Location:** Manitoba, Canada	**Project No.** 11V777

Photo No. **3.**	**Date:** 3/21/12
Test Pit ID: VNEE02 TP06	
Photo Taken By: Jeremy Haynes	
Description: Peat above very hard lean clay overlying 2.7m of fat clay. Refusal at 7m on bedrock.	

Photographic Log

Client's Name:	Site Location:	Project No.
Victory Nickel-Minago Investigation	Manitoba, Canada	11V777

Photo No. 1.

Date: 3/22/12

Test Pit ID:

VNEE03 TP05

Photo Taken By:

Jeremy Haynes

Description:

Thin layer of peat overlying very hard brown clay and silt. Refusal at 1.1m on bedrock.

Photo No. 2.

Date: 3/22/12

Test Pit ID:

VNEE03 TP08

Photo Taken By:

Jeremy Haynes

Description:

Thin layer of peat above brown silt with clay and trace cobbles and gravel. Underlain by hard brown fat clay with trace silt.

Client's Name: Victory Nickel-Minago Investigation	**Site Location:** Manitoba, Canada	**Project No.** 11V777

Photo No. **1.**	**Date:** 3/22/12
Test Pit ID: VNEE04 TP01	
Photo Taken By: Jeremy Haynes	
Description: Dark brown peat overlying thinly bedded repeating fining upward sequences of cobbles and gravel. This is underlain by 0.7m of very hard silt and 1.8m of brown-gray fat clay. Refusal at 4.2m on bedrock.	

Photo No. **2.**	**Date:** 3/22/12
Test Pit ID: VNEE04 TP03	
Photo Taken By: Jeremy Haynes	
Description: Thin layer of peat overlying very hard brown fat clay with trace cobbles. End Test Pit at 2.6m in clay.	

Photographic Log

Client's Name: Victory Nickel-Minago Investigation	**Site Location:** Manitoba, Canada	**Project No.** 11V777

Photo No. **1.**	**Date:** 3/20/12
Test Pit ID: VNWE01 TP05	
Photo Taken By: Jeremy Haynes	
Description: Peat overlying soft brown-gray fat clay. Refusal at 1.8m on limestone bedrock.	

Photographic Log

Client's Name:	Site Location:	Project No.
Victory Nickel-Minago Investigation	Manitoba, Canada	11V777

Photo No. 2.

Date: 3/20/12

Test Pit ID:

VNWE01 TP06

Photo Taken By:

Jeremy Haynes

Description:

Peat overlying soft brown-gray fat clay. Refusal at 1.7m on competent bedrock.

Client's Name: Victory Nickel-Minago Investigation	**Site Location:** Manitoba, Canada	**Project No.** 11V777

Photo No. 1.

Date: 3/20/12

Test Pit ID:

VNWE02 TP03

Photo Taken By:

Jeremy Haynes

Description:

Peat overlying well graded cobbles and sand in clay matrix. Around 1m of weathered and highly fractured bedrock. Refusal at 3.1m on competent limestone bedrock.

Photo No. 2.

Date: 3/20/12

Test Pit ID:

VNWE02 TP04

Photo Taken By:

Jeremy Haynes

Description:

Very dark brown peat overlying yellow-brown and gray fat clay. Refusal at 4.5m on bedrock.

Client's Name: Victory Nickel-Minago Investigation	**Site Location:** Manitoba, Canada	**Project No.** 11V777

Photo No. 3.

Date: 3/20/12

Test Pit ID:

VNWE02 TP02

Photo Taken By:

Jeremy Haynes

Description:

Dark brown peat overlying fining upward sequence of cobble, gravel, and sand units above weathered platy limestone. Refusal at 2.4m on weathered intact limestone bedrock.

Photographic Log

Client's Name: Victory Nickel-Minago Investigation	**Site Location:** Manitoba, Canada	**Project No.** 11V777

Photo No. 1.

Date: 3/19/12

Test Pit ID:

VNWE03 Log 1

Photo Taken By:

Jeremy Haynes

Description:

Brown peat overlying well graded sand with gravel. Refusal at 1.2m on limestone bedrock.

Photo No. 2.

Date: 3/19/12

Test Pit ID:

VNWE03 Log 2

Photo Taken By:

Jeremy Haynes

Description:

Dark brown peat above clast-supported well graded gravel and cobbles overlying gray fat clay. Refusal at 4.3m on limestone bedrock.

Photographic Log

Client's Name:	**Site Location:**	**Project No.**
Victory Nickel-Minago Investigation	Manitoba, Canada	11V777

Photo No. 1.

Date: 3/19/12

Trench ID:

VNWE04 Log 1

Photo Taken By:

Jeremy Haynes

Description:

Limestone gravel with silt and fine sand overlying fine to medium poorly graded sand. Refusal at 1.2m on limestone bedrock.

Photo No. 2.

Date: 3/19/12

Test Pit ID:

VNWE04 Log 2

Photo Taken By:

Jeremy Haynes

Description:

Frozen peat above gravel with fine sand overlying gray fat clay. Refusal at 3.5m on limestone bedrock.

Appendix F

Core Photo Logs

Photo No.	**Date:**
1.	1/25/12

Borehole ID:
FTWR-16BR

Photo Taken By:
Jeff Lynott

Description:
Diamond drilling for core samples and packer testing.

Photo No.	**Date:**
2.	1/26/12

Borehole ID:
FTWR-16BR

Photo Taken By:
Jeff Lynott

Description:
The bedrock surface is in the upper left corner. Fine grained limestone with fossil fragments is weathered and fractured at the surface and both decrease rapidly with depth.

Photographic Log

Client's Name:	**Site Location:**	**Project No.**
Victory Nickel-Minago Investigation	Manitoba, Canada	11V777

Photo No. 3

Date: 1/26/12

Borehole ID:
FTWR-11BR

Photo Taken By:
Jeff Lynott

Description:
Packer testing following diamond drilling for core samples.

Photo No. 4

Date: 1/26/12

Borehole ID:
FTWR-11BR

Photo Taken By:
Jeff Lynott

Description:
The bedrock surface is in the upper left corner. Fine grained limestone with fossil fragments is weathered and fractured at the surface and both decrease less rapidly with depth than FTWR-16BR. Bedrock at this location shows an increased frequency of subhorizontal open joints.
.

Photographic Log

Client's Name:	**Site Location:**	**Project No.**
Victory Nickel-Minago Investigation	Manitoba, Canada	11V777

Photo No.	**Date:**
5	1/26/12

Borehole ID:
FTWR-16BR

Photo Taken By:
Jeff Lynott

Description:
Detailed view of limestone

Photo No.	**Date:**
6	1/26/12

Borehole ID:
FTWR-16BR

Photo Taken By:
Jeff Lynott

Description:
Detailed view of limestone.

Photographic Log

Client's Name:	**Site Location:**	**Project No.**
Victory Nickel-Minago Investigation	Manitoba, Canada	11V777

Photo No. 7	**Date:** 1/26/12
Borehole ID: FTWR-11BR	
Photo Taken By: Jeff Lynott	
Description: Detailed view of dolomite. Sedimentary structures appear to be less distinct than bedrock in FTWR-16BR.	

Photo No. 8	**Date:** 1/26/12
Borehole ID: FTWR-11BR	
Photo Taken By: Jeff Lynott	
Description: Detailed view of dolomite. Closely spaced subhorizontal partings with clay gradually decrease with depth.	

Appendix G

Packer Test Analyses

FTWR-11BR Test CH-01

Interval Information

Boring Radius [R] (m)	Top (m)	Bottom (m)	Length [L] (m)
0.048	8.53	12.50	3.97

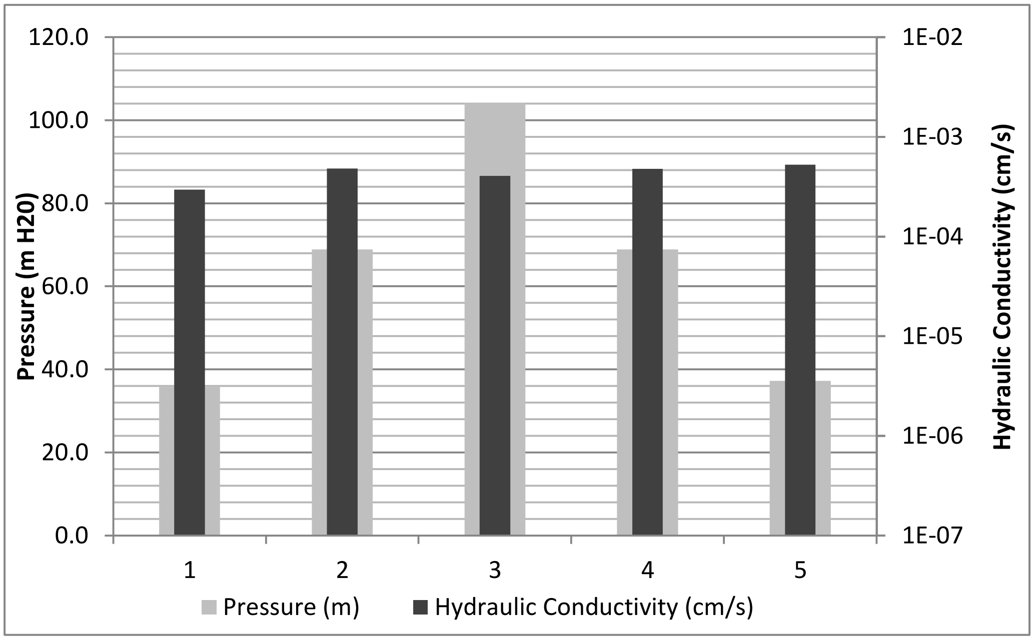
Test Information

Step	Data		
1	Flow Rate [Q] =	6.0E-04	m^3/s
	Pressure [P] =	35.8	mH_20
2	Flow Rate [Q] =	1.9E-03	m^3/s
	Pressure [P] =	68.9	mH_20
3	Flow Rate [Q] =	2.4E-03	m^3/s
	Pressure [P] =	104.1	mH_20
4	Flow Rate [Q] =	1.9E-03	m^3/s
	Pressure [P] =	68.9	mH_20
5	Flow Rate [Q] =	1.1E-03	m^3/s
	Pressure [P] =	37.2	mH_20

Steady State Equation

$$K = \frac{Q \ln\frac{L}{R}}{2\pi L P} \quad \text{(Thiem, 1906)}$$

Step	Hydraulic Conductivity [K] (cm/s)
1	3E-04
2	5E-04
3	4E-04
4	5E-04
5	5E-04



Foth Canada Corporation

Constant Head Test
Minago Project
Victory Nickel Inc.

FTWR-11BR Test CH-01

Project No: 11v777
Date: May 2013
Prepared by: MJV2
Checked by: BMS2

FTWR-16BR Test CH-01

Interval Information

Boring Radius [R] (m)	Top (m)	Bottom (m)	Length [L] (m)
0.048	8.53	12.50	3.97

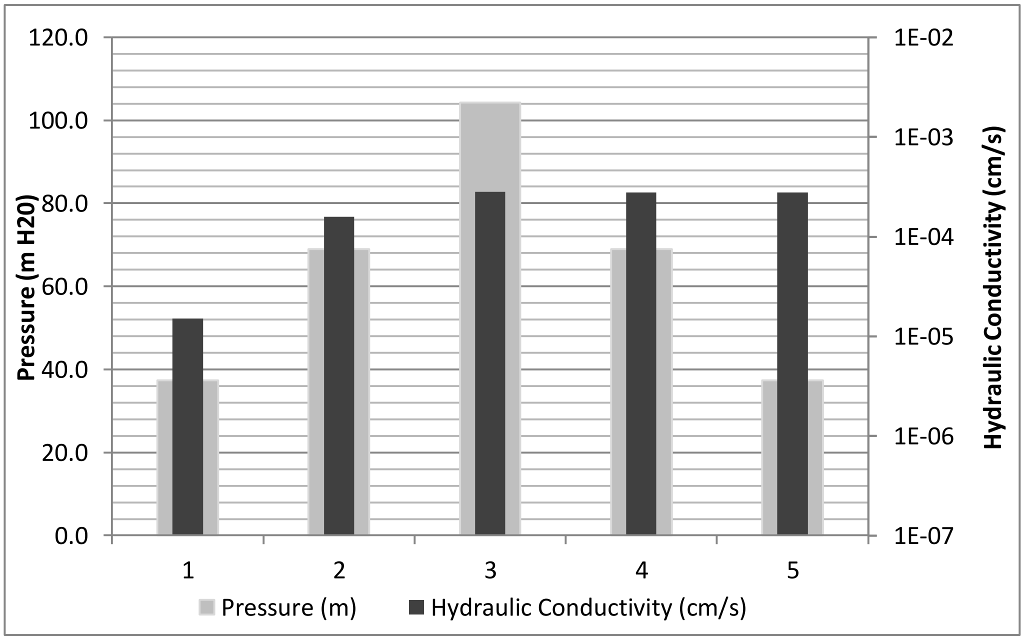
Test Information

Step	Data		
1	Flow Rate [Q] =	3.2E-05	m^3/s
	Pressure [P] =	37.4	mH_20
2	Flow Rate [Q] =	6.2E-04	m^3/s
	Pressure [P] =	69.0	mH_20
3	Flow Rate [Q] =	1.7E-03	m^3/s
	Pressure [P] =	104.2	mH_20
4	Flow Rate [Q] =	1.1E-03	m^3/s
	Pressure [P] =	69.0	mH_20
5	Flow Rate [Q] =	5.9E-04	m^3/s
	Pressure [P] =	37.4	mH_20

Steady State Equation

$$K = \frac{Q \ln\frac{L}{R}}{2\pi LP} \quad \text{(Thiem, 1906)}$$

Step	Hydraulic Conductivity [K] (cm/s)
1	2E-05
2	2E-04
3	3E-04
4	3E-04
5	3E-04



Foth
Foth Canada Corporation

Constant Head Test
Minago Project
Victory Nickel Inc.

FTWR-16BR Test CH-01

Project No: 11v777
Date: May 2013
Prepared by: MJV2
Checked by: BMS2

Appendix H

Geotechnical Laboratory Results

H-1

Geotechnical Laboratory Results – Part 1

Golder Associates

April 12, 2012 Project No. 12-1183-0015

Aleksandar Zivkovic

Foth Canada Corporation
401 Bay Street, Suite 1600
Toronto, Ontario, M5H 2Y4

RE: GEOTECHNICAL LABORATORY TESTING

Dear Sir

This letter reports the results of laboratory testing carried out on the samples received at our office in Mississauga. The results of the tests are summarized in the attached tables and figures.

The testing services reported herein have been performed in accordance with the indicated recognized standard, unless noted otherwise. This report is for the sole use of the designated client. This report constitutes a testing service only and does not represent any results interpretation or opinion regarding specification compliance or material suitability.

We trust that the results are sufficient for your current requirements. If you have any questions, please do not hesitate to call us.

Yours truly

GOLDER ASSOCIATES LTD.

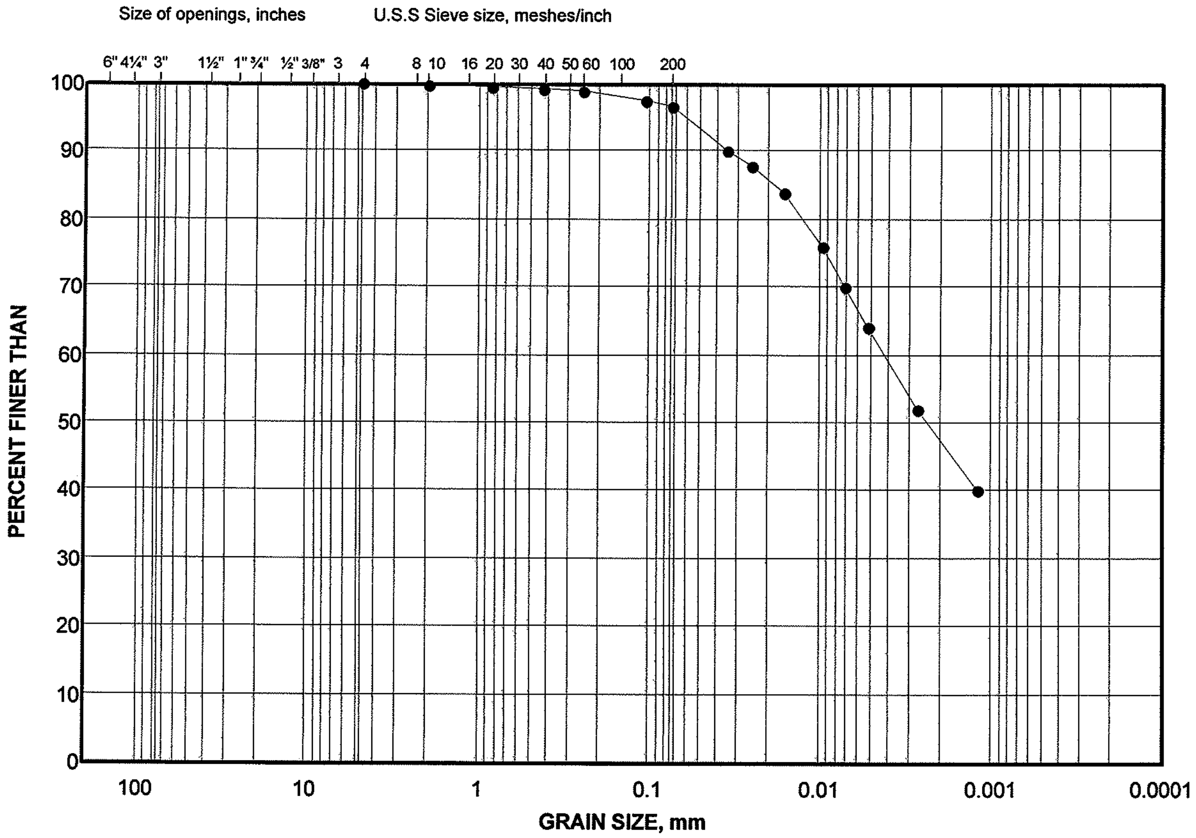
Marijana Manojlovic

Marijana Manojlovic
Laboratory Manager

MM/lg

Golder Associates Ltd.
2390 Argentia Road, Mississauga, Ontario, Canada L5N 5Z7
Tel: +1 (905) 567 4444 Fax: +1 (905) 567 6561 www.golder.com
Golder Associates: Operations in Africa, Asia, Australasia, Europe, North America and South America

GRAIN SIZE DISTRIBUTION	FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FPP4	SH1	6.10 - 6.70

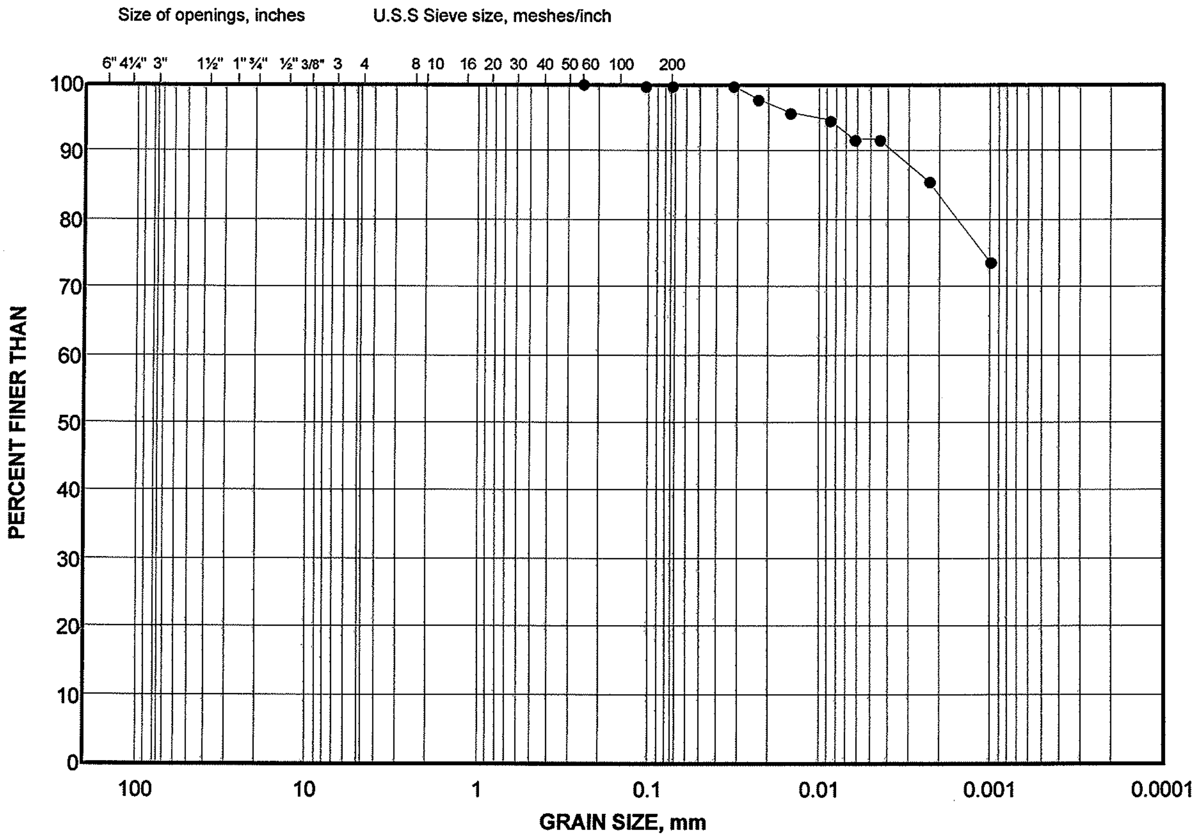
Project Number: 12-1183-0015

Checked By: ______________

Golder Associates

Date: 19-Mar-12

GRAIN SIZE DISTRIBUTION	FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FPP4	SH2	12.20 - 12.80

Project Number: 12-1183-0015

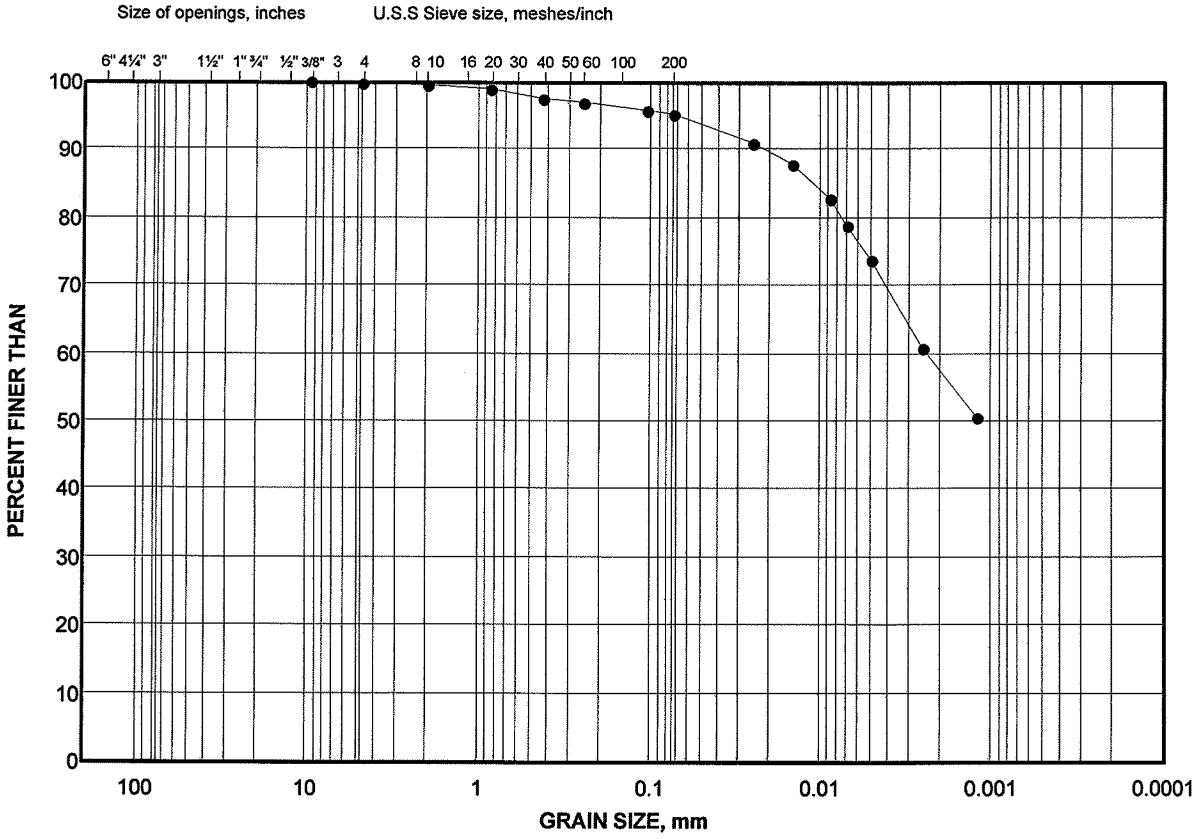
Checked By: ______________

Golder Associates

Date: 19-Mar-12

GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FPP12	SS5	3.80 - 4.30

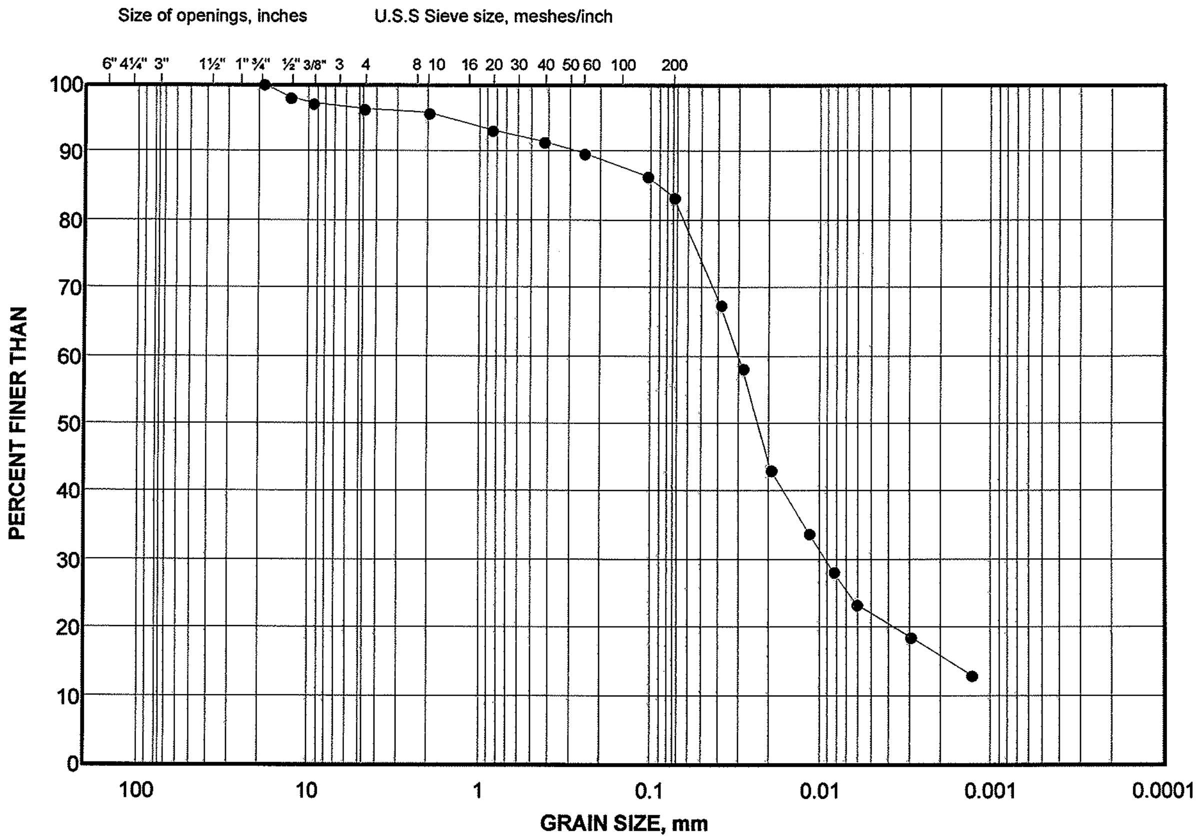
Project Number: 12-1183-0015

Checked By: ____________

Golder Associates

Date: 12-Mar-12

# GRAIN SIZE DISTRIBUTION	FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FPP12	SS12	15.20 - 15.70

Project Number: 12-1183-0015

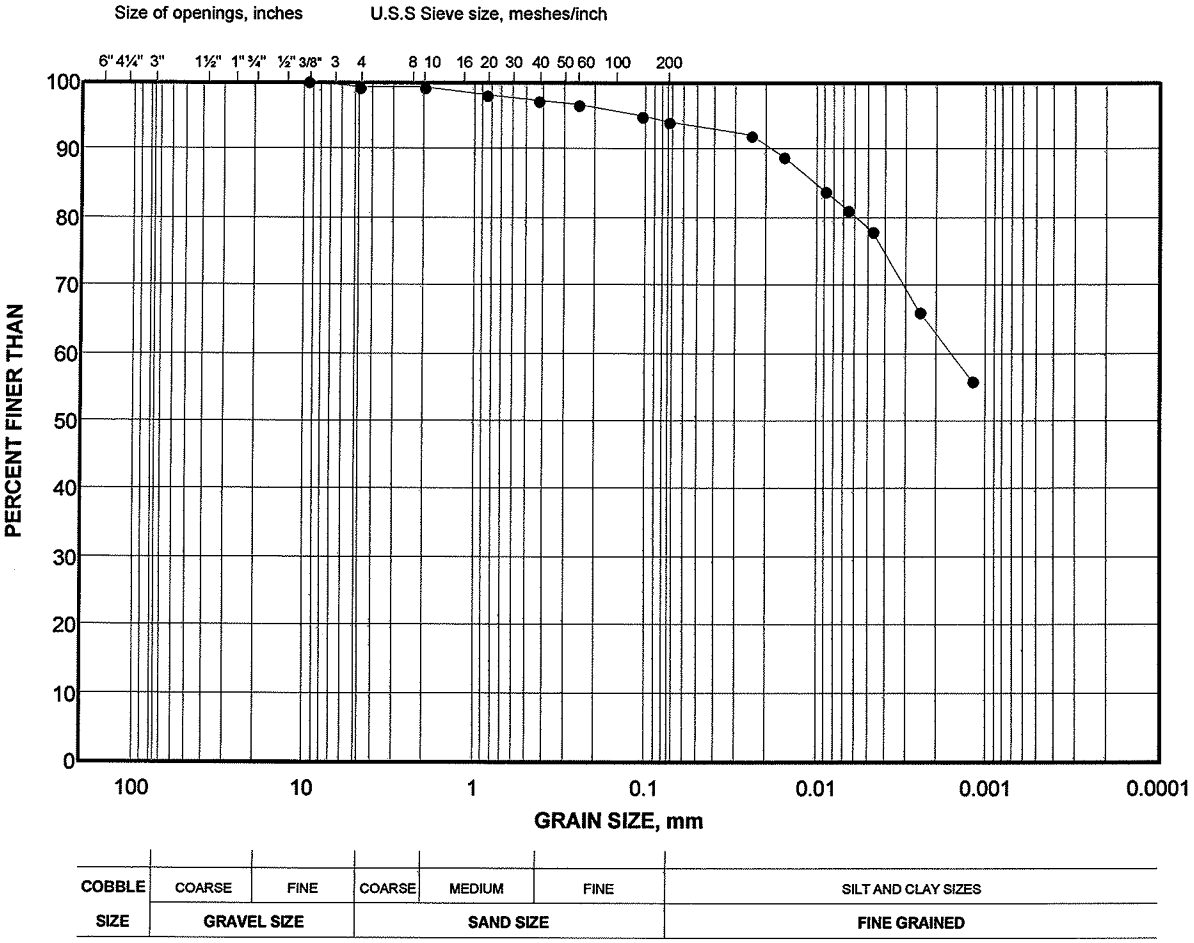
Checked By: ______________

Golder Associates

Date: 19-Mar-12

GRAIN SIZE DISTRIBUTION

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FPP14	SH10	10.70 - 11.30

Project Number: 12-1183-0015

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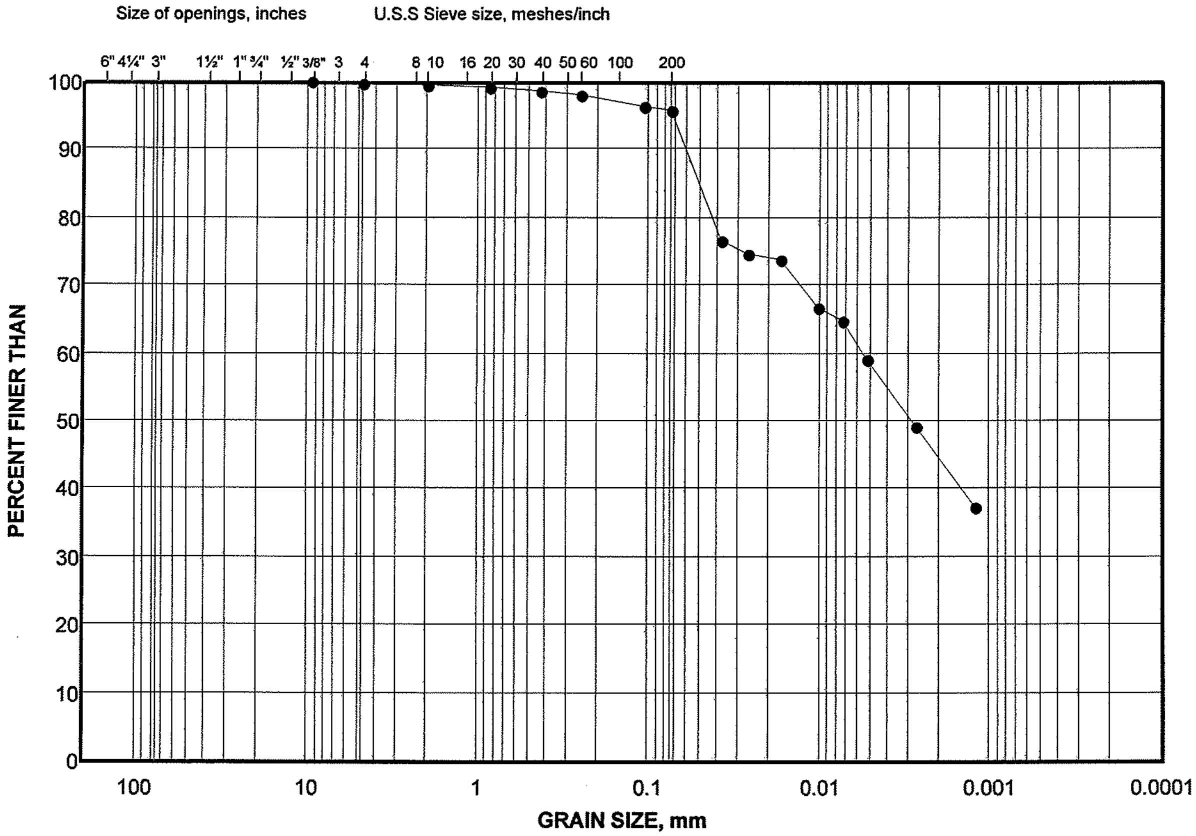
Date: 21-Mar-12

GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FPP14	SS7	4.60 - 5.00

Project Number: 12-1183-0015

Checked By: ______________

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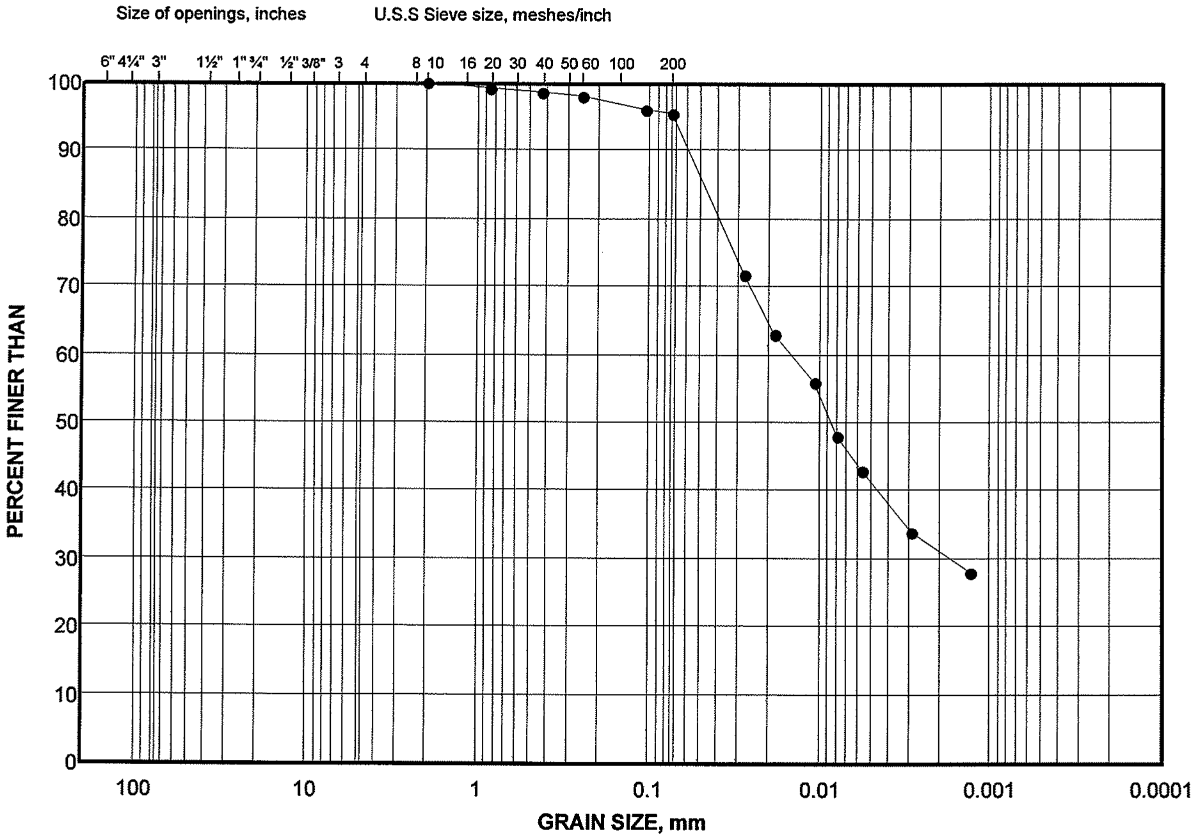
Date: 19-Mar-12

GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR6	SS5	3.00 - 3.50

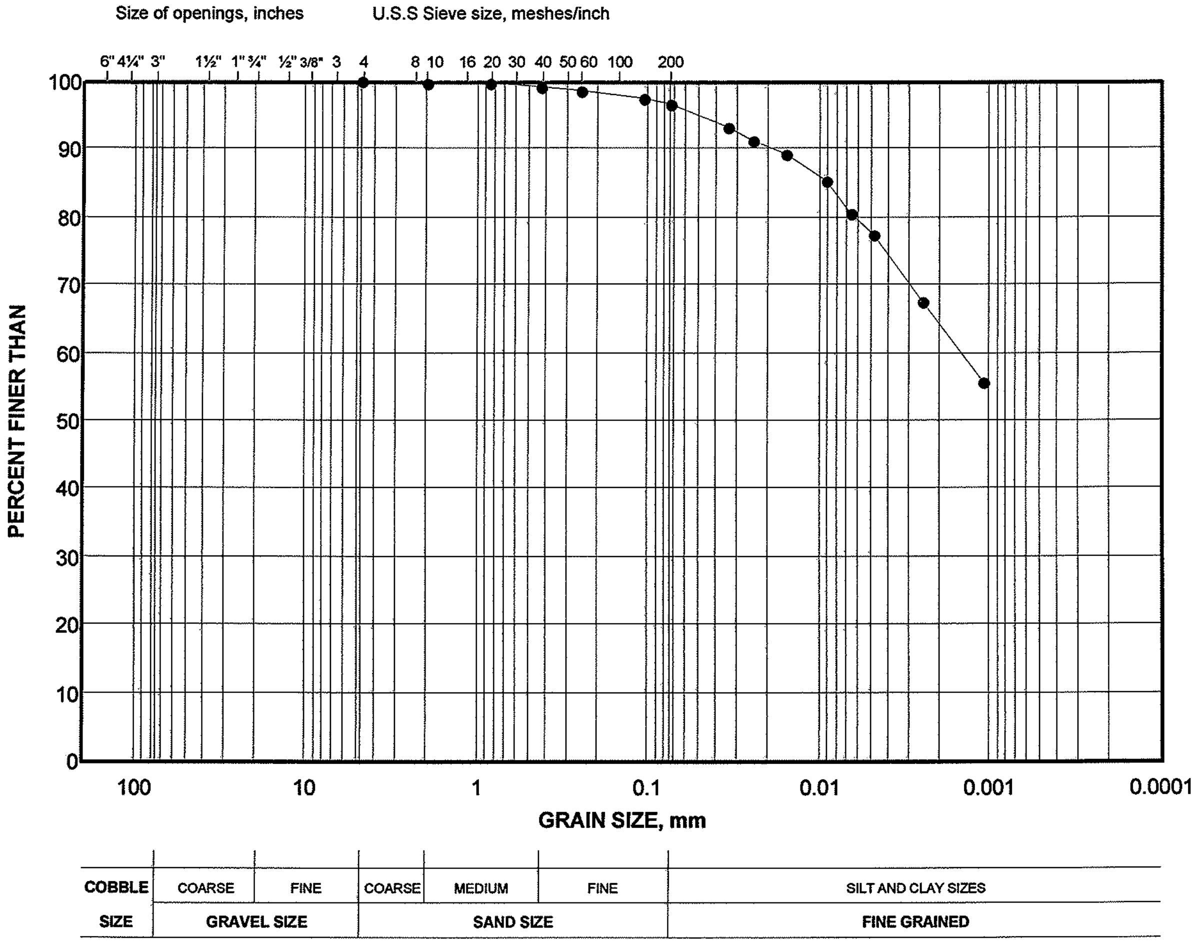
Project Number: 12-1183-0015

Checked By: ______________

Golder Associates

Date: 12-Mar-12

# GRAIN SIZE DISTRIBUTION	FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR6	SS8	6.10 - 6.60

Project Number: 12-1183-0015

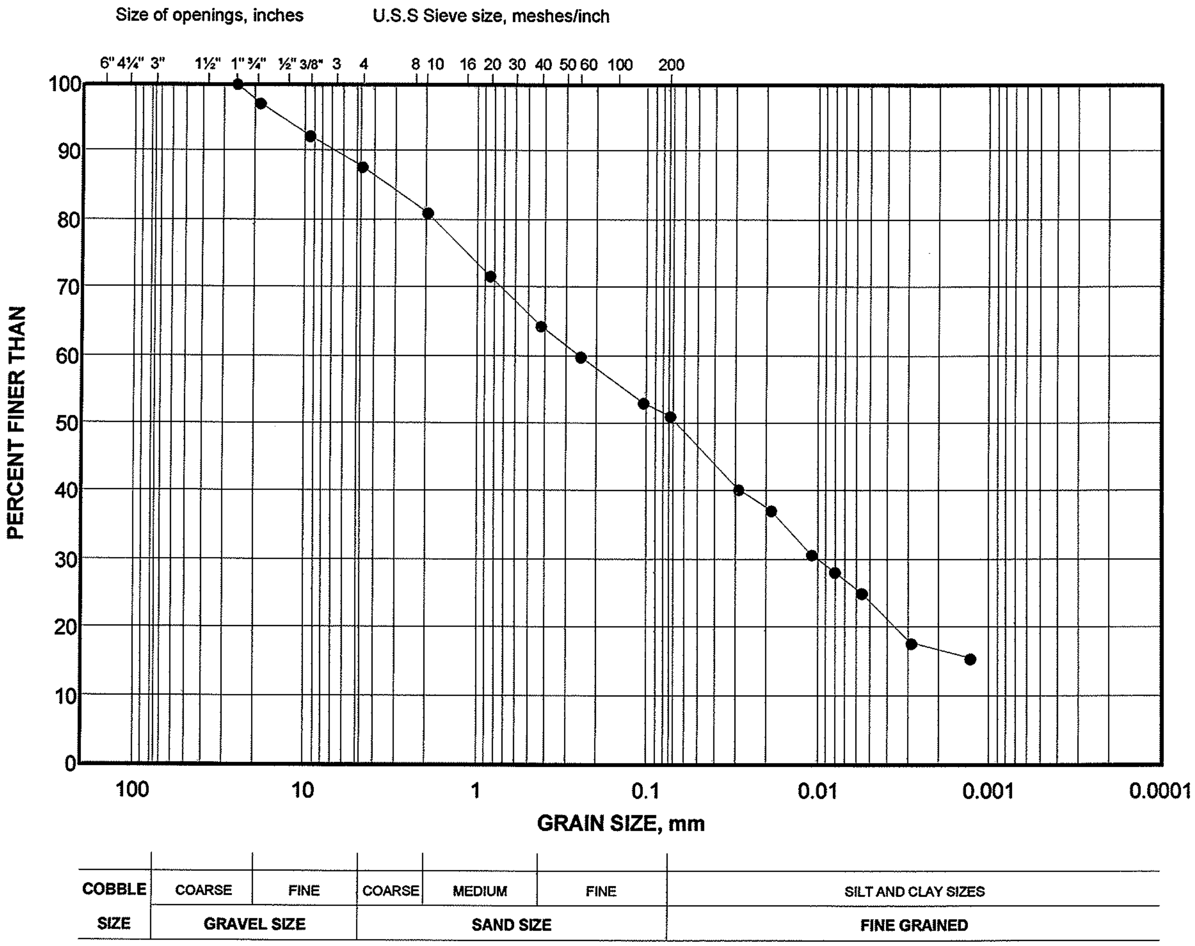
Checked By:

Golder Associates

Date: 19-Mar-12

GRAIN SIZE DISTRIBUTION

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR6	SS10	9.10 - 9.60

Project Number: 12-1183-0015

Checked By: ______________

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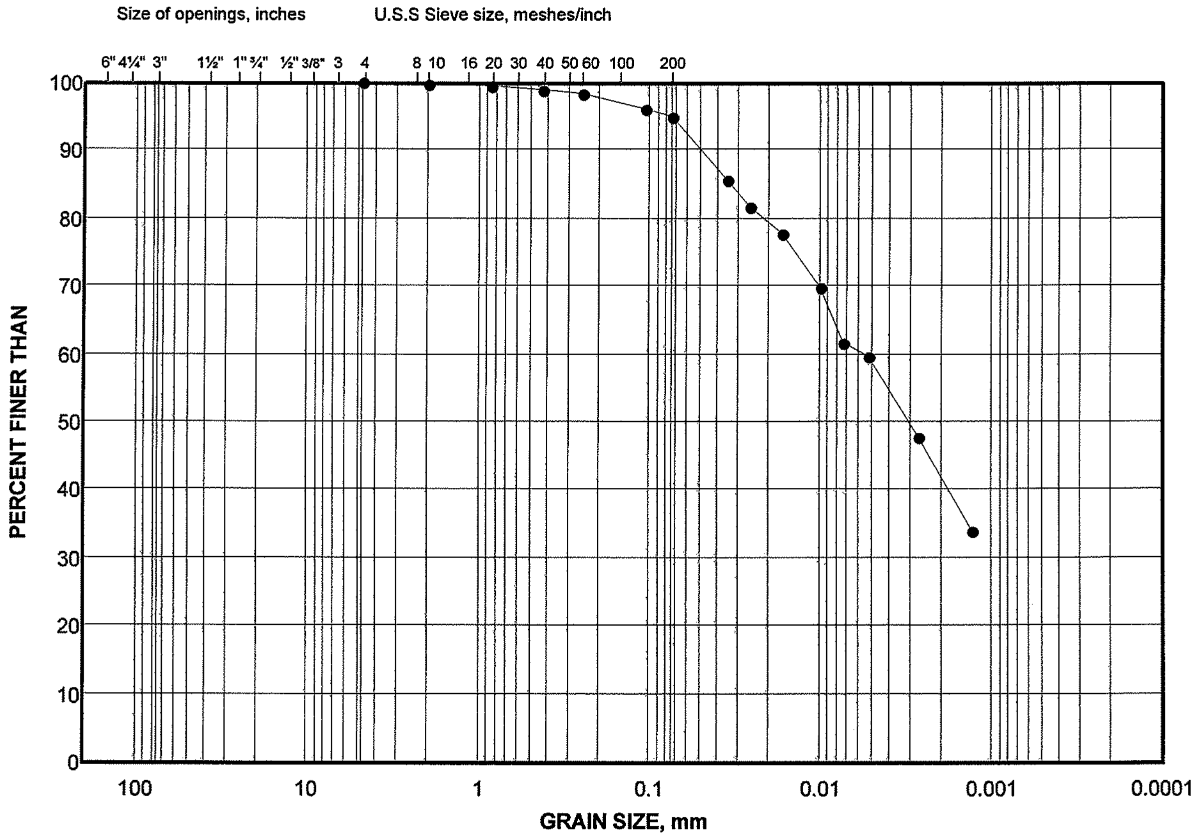
Date: 12-Mar-12

GRAIN SIZE DISTRIBUTION	FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR8	SS3	1.50 - 2.00

Project Number: 12-1183-0015

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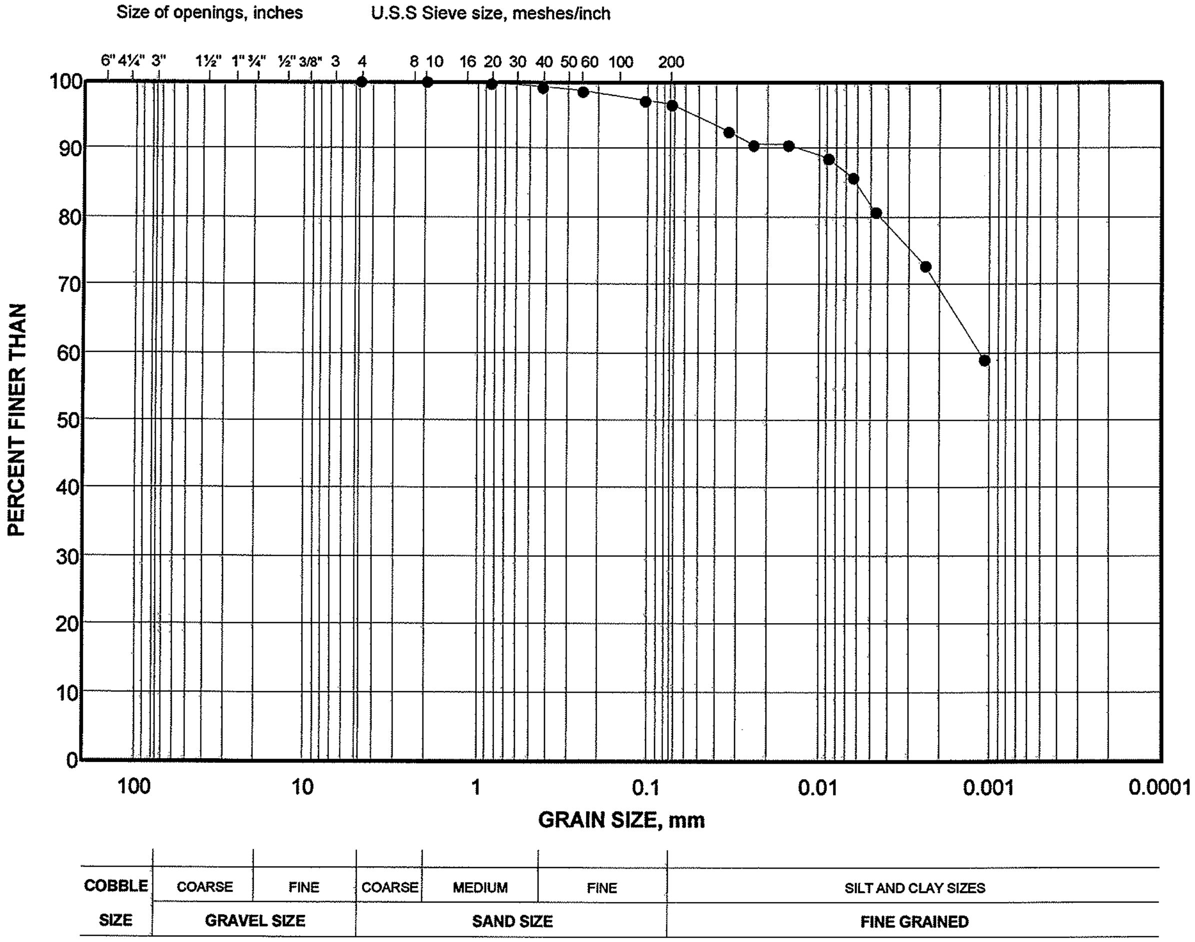
Date: 19-Mar-12

GRAIN SIZE DISTRIBUTION

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR8	SS9	7.60 - 8.10

Project Number: 12-1183-0015

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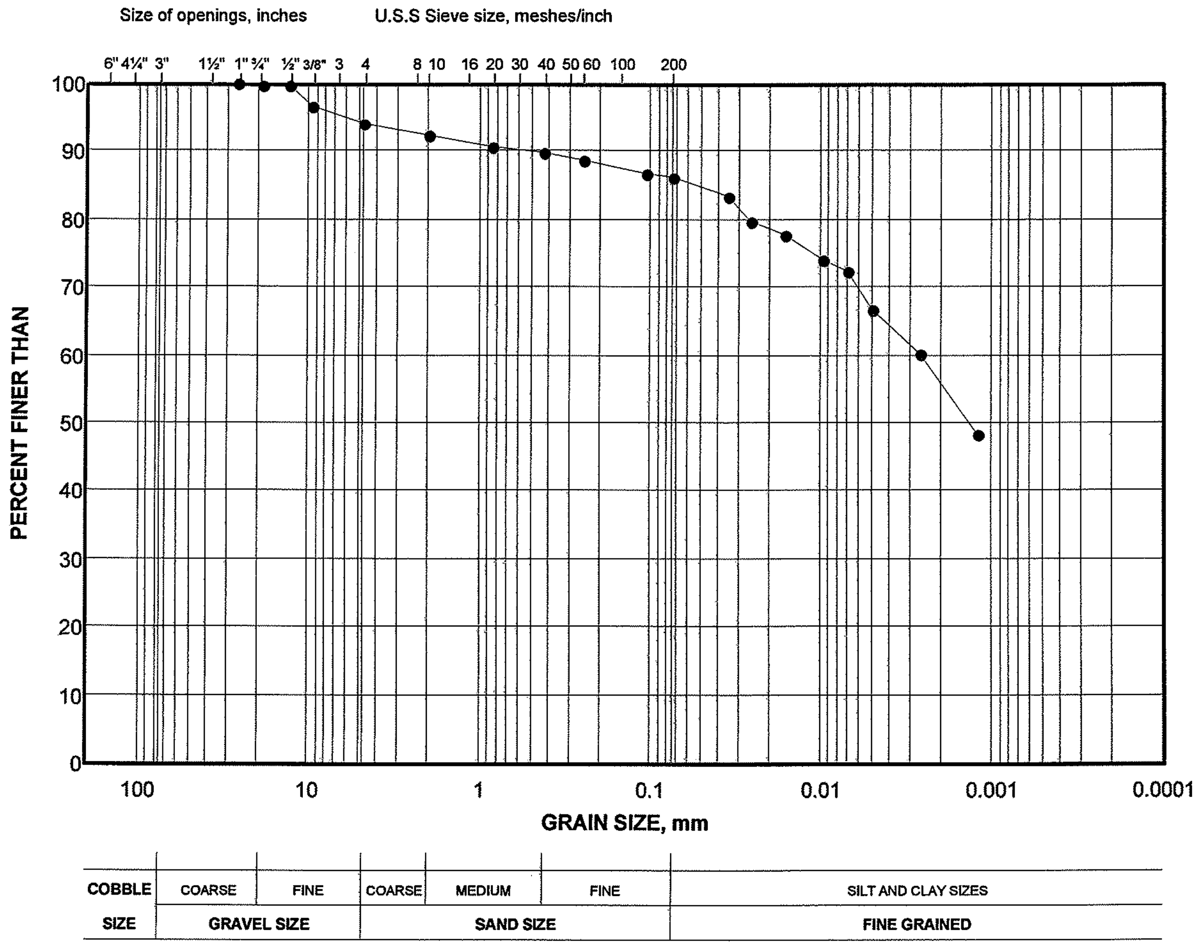
Date: 19-Mar-12

GRAIN SIZE DISTRIBUTION

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR11	SH4	3.00 - 3.70

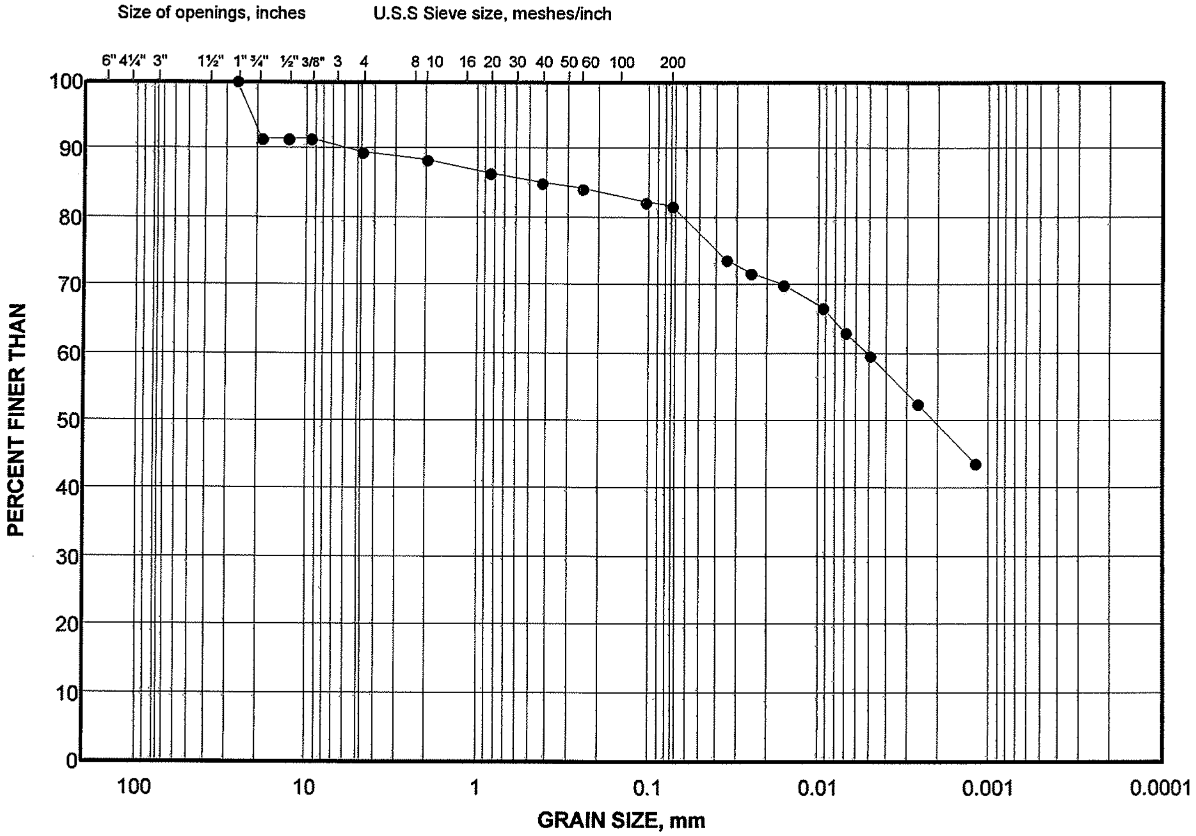
Project Number: 12-1183-0015

Checked By: ___

Golder Associates

Date: 19-Mar-12

GRAIN SIZE DISTRIBUTION	FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR11	SS5	4.60 - 5.00

Project Number: 12-1183-0015

Checked By: ______________

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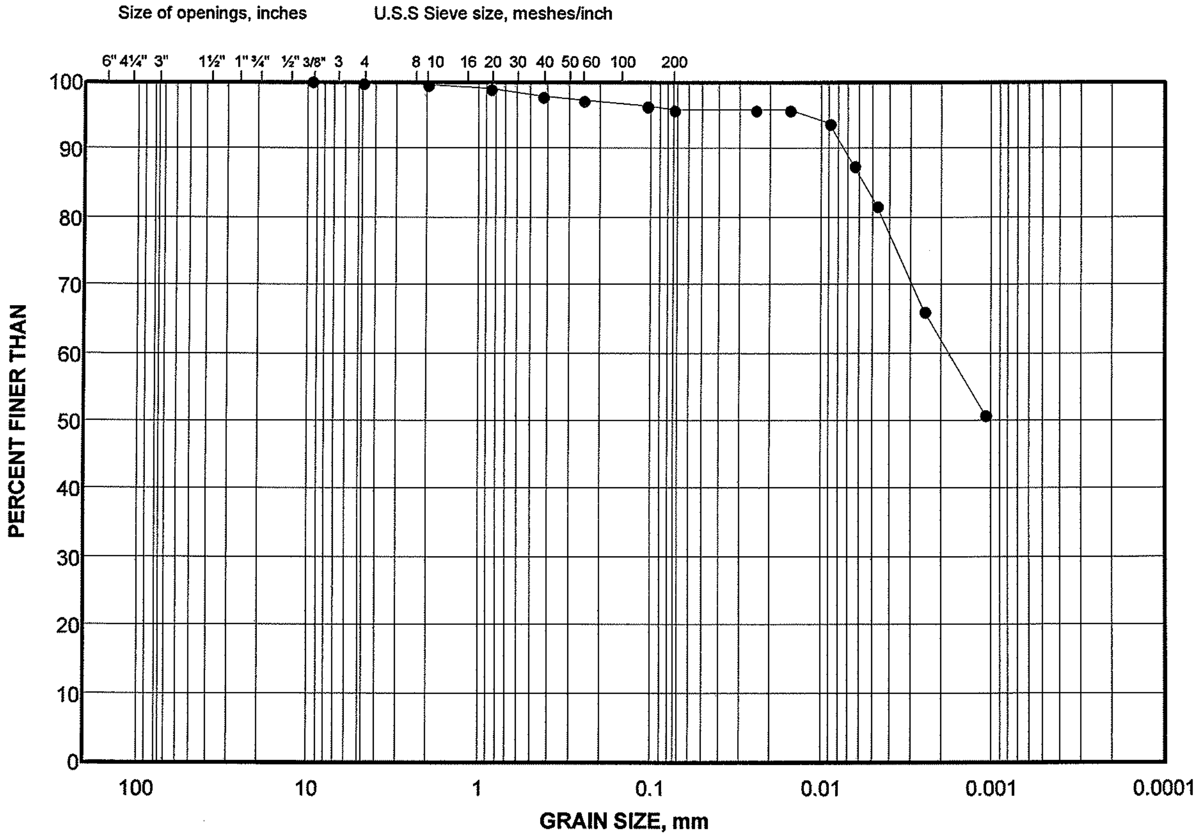
Date: 19-Mar-12

GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	**GRAVEL SIZE**		**SAND SIZE**			**FINE GRAINED**

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR12	SS4	3.00 - 3.50

Project Number: 12-1183-0015

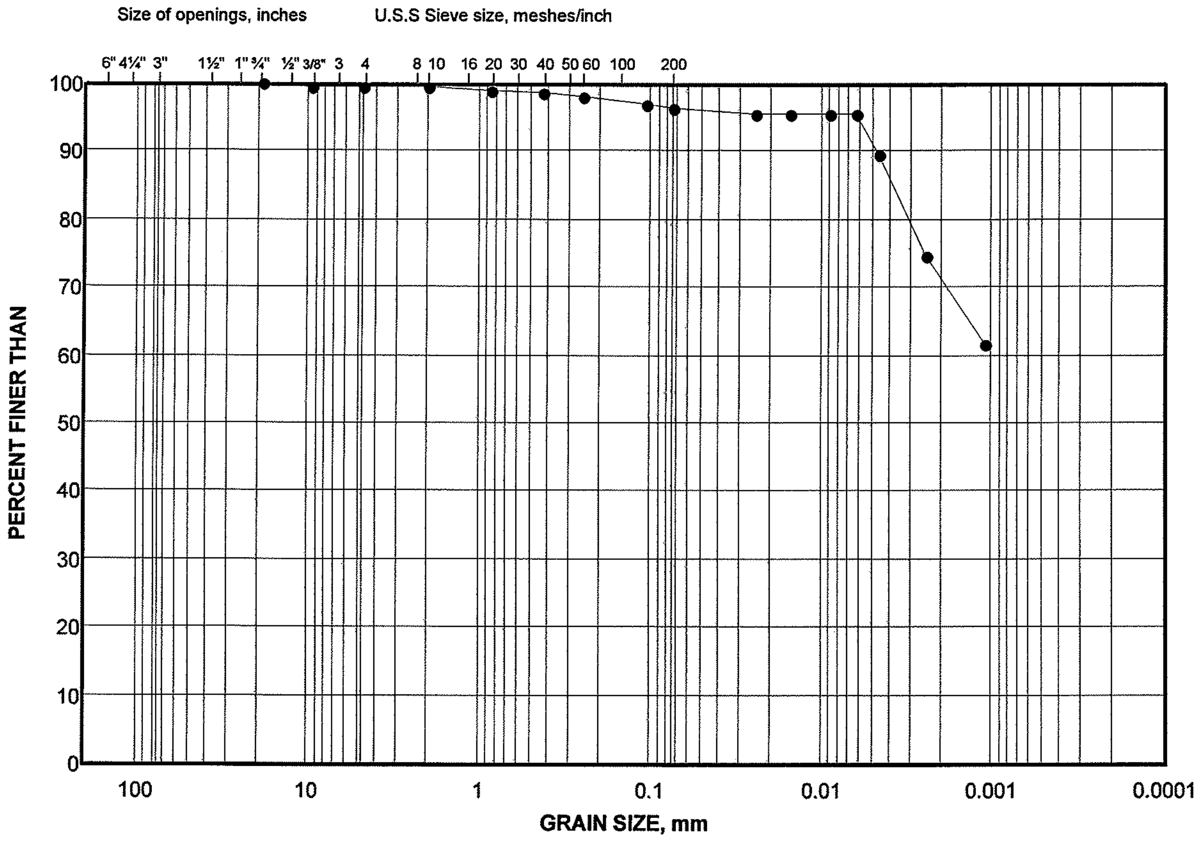
Checked By: ______________________

Golder Associates

Date: 12-Mar-12

GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR12	SS6	4.60 - 5.00

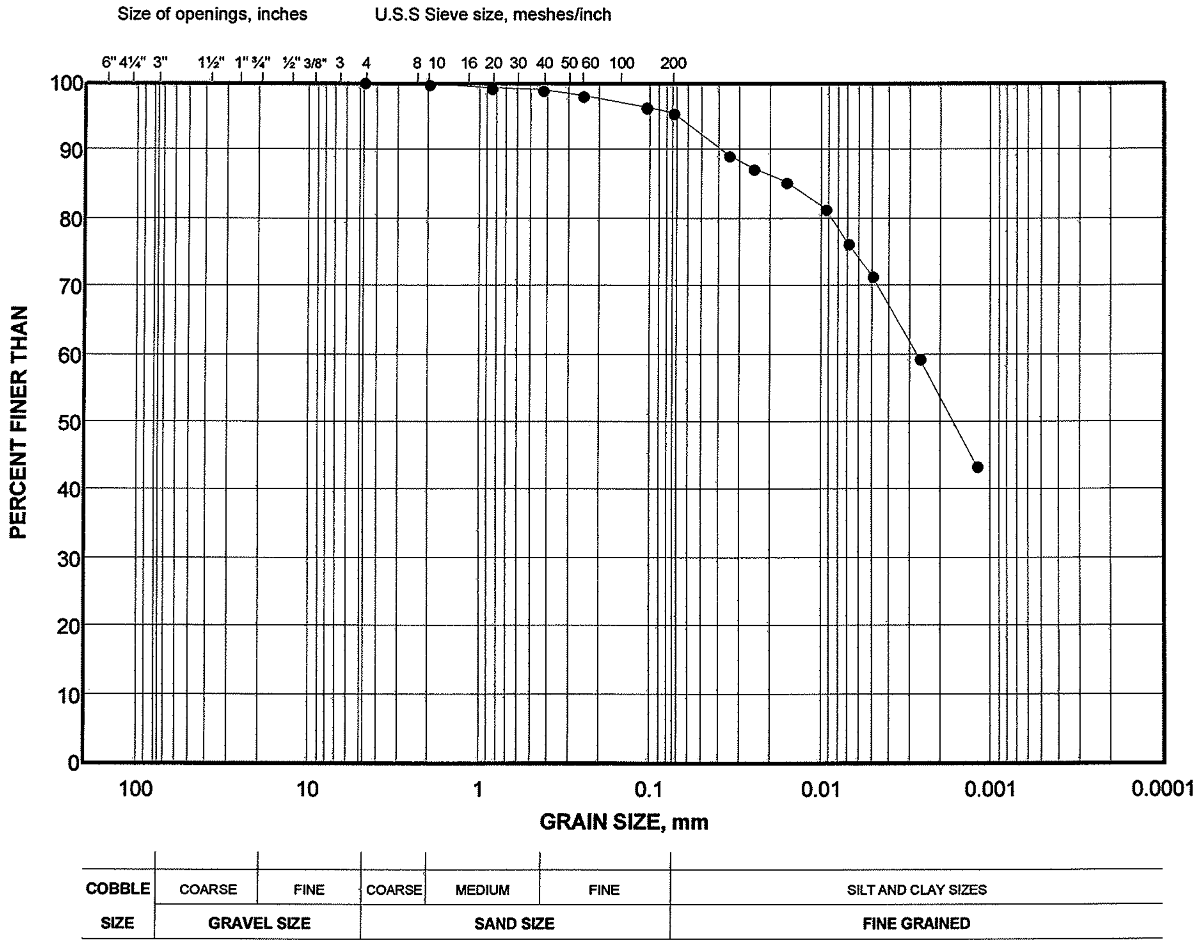
Project Number: 12-1183-0015

Checked By: ____________

Golder Associates

Date: 12-Mar-12

GRAIN SIZE DISTRIBUTION	FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR14	SS6	2.30 - 2.70

Project Number: 12-1183-0015

Checked By: ____________

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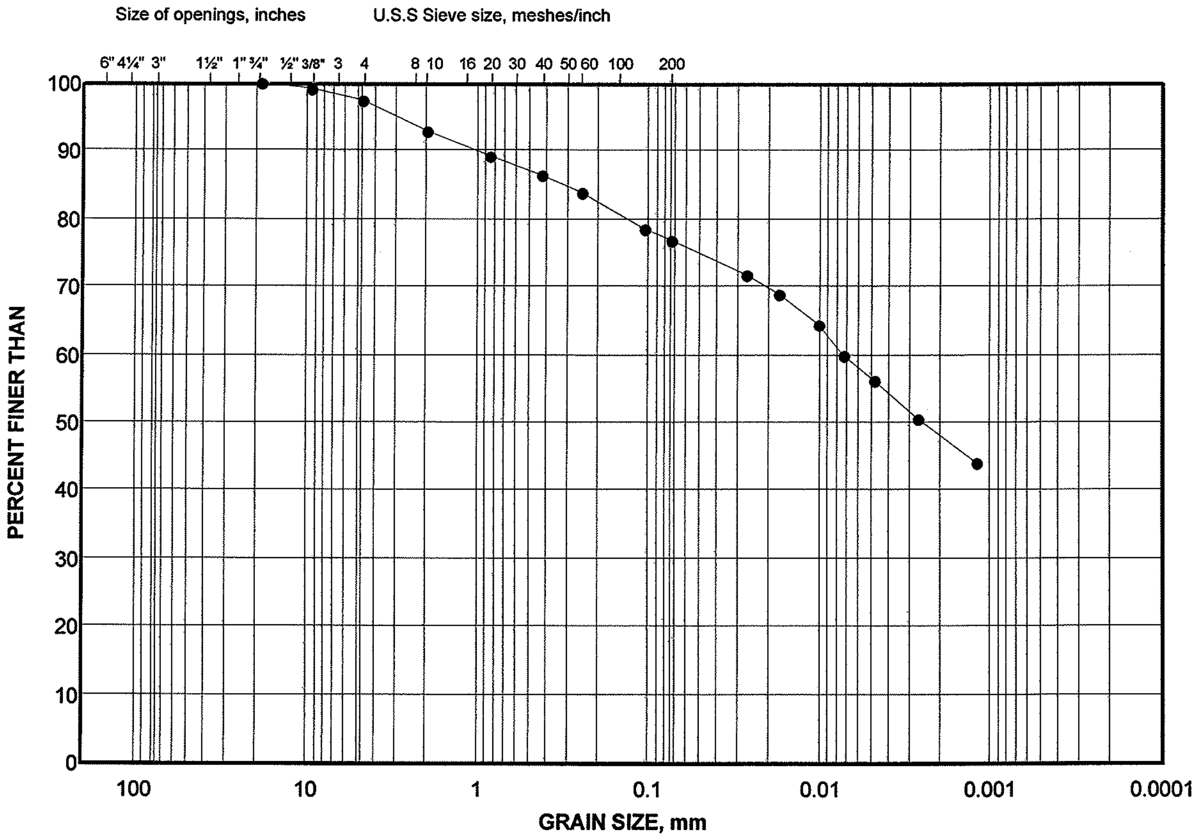
Date: 19-Mar-12

GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR16	SH9	7.60 - 8.20

Project Number: 12-1183-0015

Checked By: ____________

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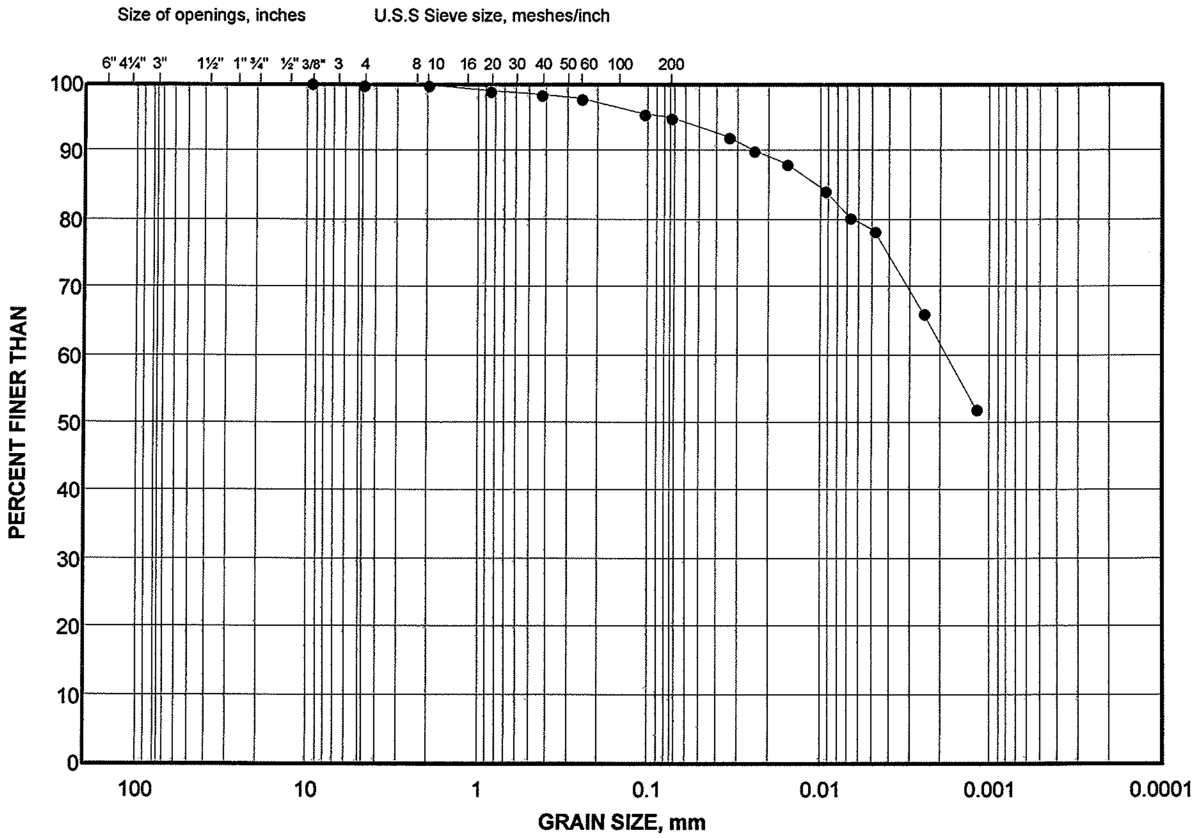
Date: 12-Mar-12

GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR16	SS6	3.80 - 4.30

Project Number: 12-1183-0015

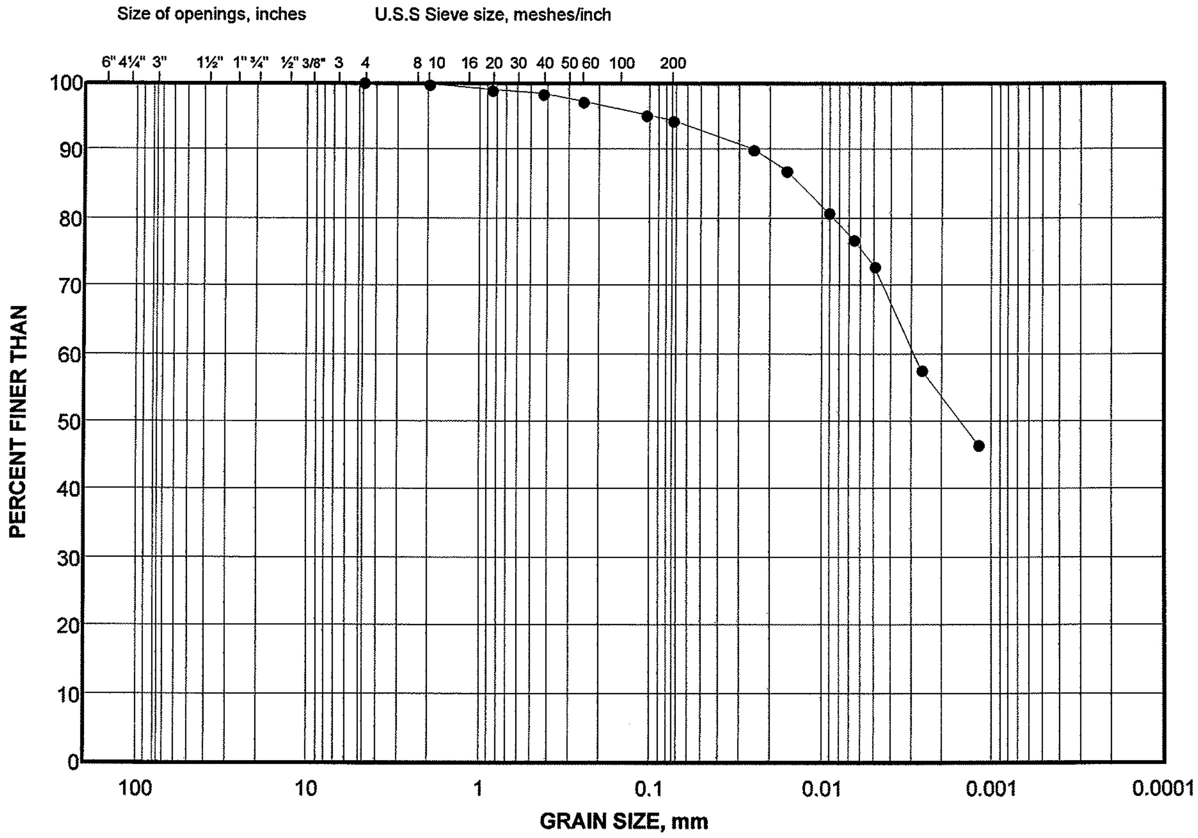
Checked By: ________________

Golder Associates

Date: 19-Mar-12

GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR30	SS2	1.50 - 2.00

Project Number: 12-1183-0015

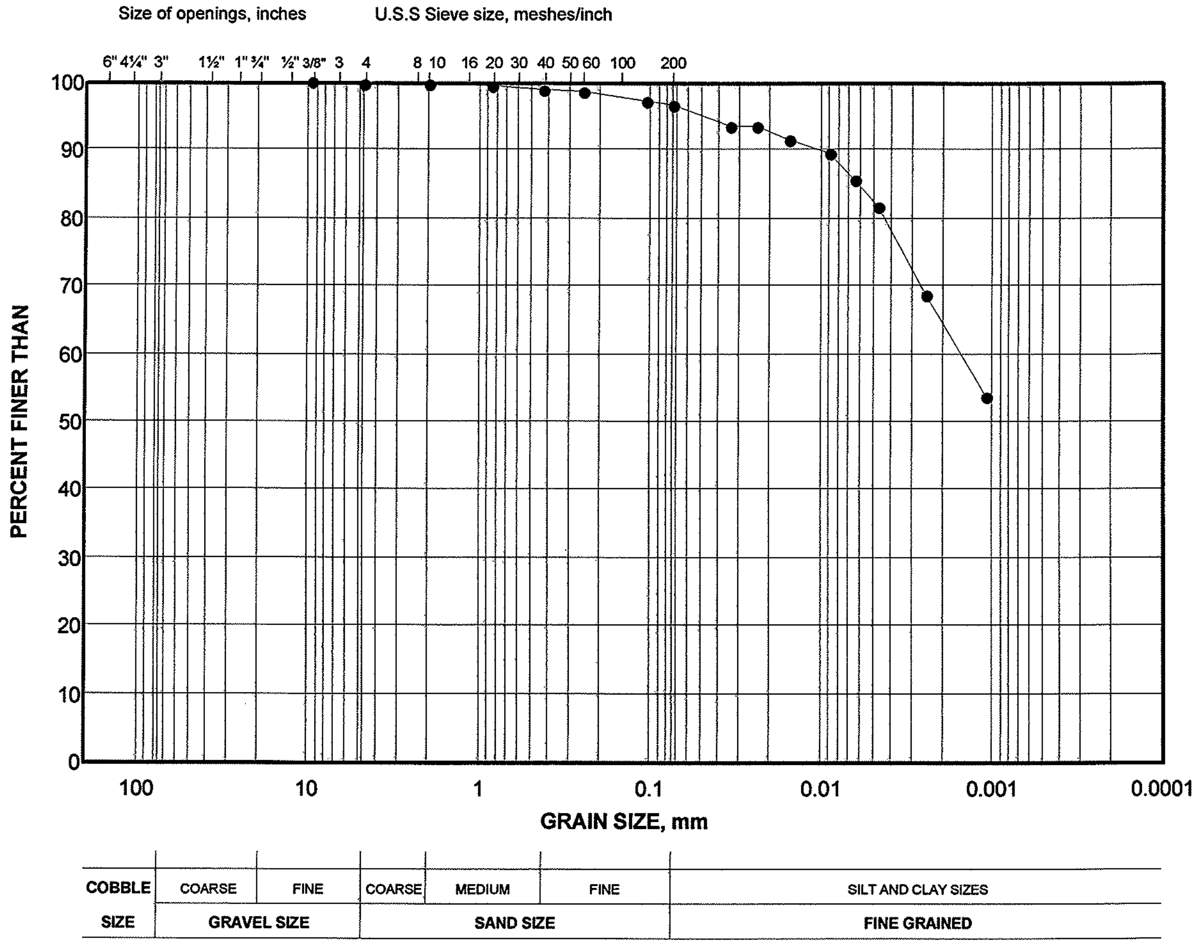
Checked By:

Golder Associates

Date: 12-Mar-12

GRAIN SIZE DISTRIBUTION

FIGURE



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	FTWR30	SH7	8.50 - 9.10

Project Number: 12-1183-0015

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Golder Associates

Date: 19-Mar-12

DENSITY AND POROSITY DETERMINATIONS OF IRREGULAR SHAPE SAMPLES

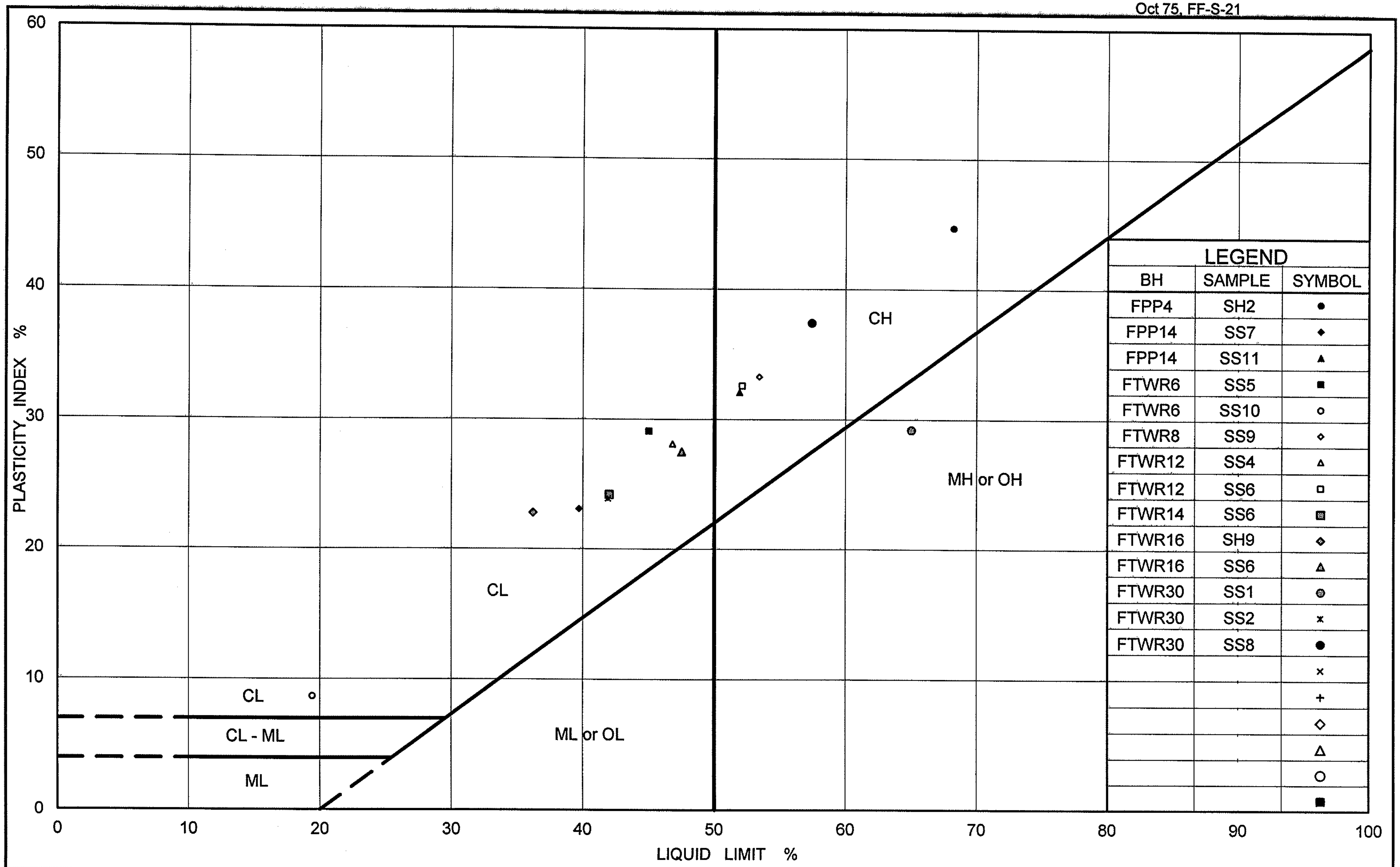
ASTM D 7263 Method A

Borehole Number	FPP14	FTWR6	FTWR6	FTWR12	FTWR12	FTWR14
Sample Number	SS7	SS8	SS10	SS4	SS6	SS4
Depth, m	4.57-5.03	6.10-6.55	9.14-9.60	3.05-3.51	4.57-5.03	7.62-8.08
Wet Mass of Soil in Air, g	54.13	88.52	110.46	79.52	107.04	87.92
Wet Mass of Soil + Wax in Air, g	62.87	94.88	120.40	85.14	110.36	92.11
Wet Mass of Soil + Wax in Water, g	27.87	42.44	62.87	39.28	51.35	44.57
Weight of Wax, g	8.74	6.36	9.94	5.62	3.32	4.19
Displaced Volume, cm^3	35.00	52.44	57.53	45.86	59.01	47.54
Displaced Wax, cm^3	9.63	7.00	10.95	6.19	3.66	4.61
Volume of Soil, cm^3	25.37	45.44	46.58	39.67	55.35	42.93
Specific Gravity, assumed	2.70	2.70	2.70	2.70	2.70	2.70
Volume of Solids, cm^3	16.96	25.24	37.53	23.66	30.33	26.20
Volume of Voids, cm^3	8.41	20.20	9.05	16.01	25.02	16.73
Porosity	0.33	0.44	0.19	0.40	0.45	0.39
Water Content, %	18.20	29.90	9.00	24.50	30.70	24.30
Unit Weight, kN/m^3	20.92	19.11	23.25	19.66	18.96	20.09
Dry Unit Weight, kN/m^3	17.70	14.71	21.33	15.79	14.51	16.16

Borehole Number	FTWR16	FTWR16	FTWR16	FTWR30	FTWR30
Sample Number	SH9 (A)	SH9 (B)	SS6	SS2	SS8
Depth, m	7.62-8.23	7.62-8.23	3.81-4.27	1.52-1.98	13.72-14.17
Wet Mass of Soil in Air, g	274.92	280.00	65.39	80.65	98.90
Wet Mass of Soil + Wax in Air, g	285.08	291.68	71.17	83.06	103.67
Wet Mass of Soil + Wax in Water, g	134.78	136.25	32.56	40.22	43.72
Weight of Wax, g	10.16	11.68	5.78	2.41	4.77
Displaced Volume, cm^3	150.30	155.43	38.61	42.84	59.95
Displaced Wax, cm^3	11.19	12.86	6.37	2.65	5.25
Volume of Soil, cm^3	139.11	142.57	32.24	40.19	54.70
Specific Gravity, assumed	2.70	2.70	2.70	2.70	2.70
Volume of Solids, cm^3	78.26	79.71	19.52	23.56	25.62
Volume of Voids, cm^3	60.85	62.86	12.73	16.63	29.08
Porosity	0.44	0.44	0.39	0.41	0.53
Water Content, %	30.10	30.10	24.10	26.80	43.00
Unit Weight, kN/m^3	19.38	19.26	19.89	19.68	17.73
Dry Unit Weight, kN/m^3	14.90	14.80	16.03	15.52	12.40

Project Number	12-1183-0015	Tested By	Shahab / RDA
Date	March, 2012	Checked By	

Oct 75, FF-S-21



LEGEND		
BH	SAMPLE	SYMBOL
FPP4	SH2	•
FPP14	SS7	◆
FPP14	SS11	▲
FTWR6	SS5	■
FTWR6	SS10	○
FTWR8	SS9	◇
FTWR12	SS4	△
FTWR12	SS6	□
FTWR14	SS6	▨
FTWR16	SH9	◈
FTWR16	SS6	△
FTWR30	SS1	◉
FTWR30	SS2	×
FTWR30	SS8	●
		×
		+
		◇
		△
		○
		■

Golder Associates

PLASTICITY CHART

Figure No.

Project No. 12-1183-0015

Checked By:

SPECIFIC GRAVITY TEST RESULTS

ASTM D 854-98 TEST METHOD A

PROJECT NUMBER	12-1183-0015
PROJECT NAME	Foth / Testing / Victory Nickel
DATE TESTED	March, 2012

Borehole No.	Sample No.	Measured Specific Gravity
FTWR12	SH1	1.65

Note: Test carried out on soil particles <4.75mm using kerosene.

Checked By:

Golder Associates

SPECIFIC GRAVITY TEST RESULTS

ASTM D 854-06 TEST METHOD A

PROJECT NUMBER	12-1183-0015
PROJECT NAME	Foth / Testing / Victory Nickel
DATE TESTED	March, 2012

Borehole No.	Sample No.	Specific Gravity
FPP4	SH1	2.65
FTWR11	SH4	2.67
FTWR14	SH6	2.67
FTWR30	SH3	2.68
FTWR30	SH7	2.67

Note: Test carried out on soil particles <2.00mm using distilled water.

Checked By:

Golder Associates

SUMMARY OF WATER CONTENT DETERMINATIONS

ASTM D 2216-05

PROJECT NUMBER	12-1183-0015
PROJECT NAME	Foth / Testing / Victory Nickel
DATE TESTED	March, 2012

Borehole No.	Sample No.	Depth (ft)	Depth (m)	Water Content (%)	Atterberg Limits LL, PL, PI
FPP4	SH2	40.0-42.0	12.19-12.80		LL=68.2, PL=23.5, PI=44.7
FPP4	SS3	10.0-11.5	3.05-3.51	23.7%	
FPP4	SS4	15.0-16.5	4.57-5.03	19.5%	
FPP4	SS5	30.0-31.5	9.14-9.60	43.8%	
FPP12	SS2	5.0-6.5	1.52-1.98	614.4%	
FPP12	SS3	7.5-9.0	2.29-2.74	42.6%	
FPP12	SS4	10.0-11.5	3.05-3.51	25.9%	
FPP12	SS5	12.5-14.0	3.81-4.27	21.2%	
FPP12	SS6	15.0-16.5	4.57-5.03	24.3%	
FPP12	SS7	20.0-21.5	6.10-6.55	24.2%	
FPP12	SS8	25.0-26.5	7.62-8.08	40.0%	
FPP12	SS11	45.0-46.5	13.72-14.17	54.4%	
FPP12	SS12	50.0-51.5	15.24-15.70	13.3%	
FPP12	SS13	55.0-56.5	16.76-17.22	11.3%	
FPP14	SH1	0.0-2.5	0.00-0.76	1184.4%	
FPP14	SS3	5.0-6.5	1.52-1.98	461.7%	LL=305.3, PL=269.3, PI=36.0
FPP14	SS4	7.5-9.5	2.29-2.90	26.7%	
FPP14	SS5	10.0-11.5	3.05-3.51	18.6%	
FPP14	SS6	12.5-14.0	3.81-4.27	20.4%	
FPP14	SS7	15.0-16.5	4.57-5.03	19.5%	LL=39.7, PL=16.6, PI=23.1
FPP14	SS8	20.0-21.5	6.10-6.55	25.0%	
FPP14	SS11	40.0-41.5	12.19-12.65	38.9%	LL=51.9, PL=19.8, PI=32.1
FPP14	SS13	50.0-51.5	15.24-15.70	43.6%	
FPP14	SS14	55.0-56.5	16.76-17.22	60.5%	
FTWR6	SS2	2.5-4.0	0.76-1.22	22.5%	
FTWR6	SS3	5.0-6.5	1.52-1.98	21.4%	
FTWR6	SS4	7.5-9.0	2.29-2.74	47.8%	
FTWR6	SS5	10.0-11.5	3.05-3.51	20.1%	LL=45.0, PL=15.9, PI=29.1
FTWR6	SS7	15.0-16.5	4.57-5.03	17.2%	
FTWR6	SS8	20.0-21.5	6.10-6.55	27.6%	
FTWR6	SS9	25.0-26.5	7.62-8.08	28.1%	
FTWR6	SS10	30.0-31.5	9.14-9.60	11.1%	LL=19.4, PL=10.7, PI=8.7
FTWR8	SH8	20.0-22.0	6.10-6.71	35.8%	

Checked By: JMJ

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SUMMARY OF WATER CONTENT DETERMINATIONS

ASTM D 2216-05

PROJECT NUMBER	12-1183-0015
PROJECT NAME	Foth / Testing / Victory Nickel
DATE TESTED	March, 2012

Borehole No.	Sample No.	Depth (ft)	Depth (m)	Water Content (%)	Atterberg Limits LL, PL, PI
FTWR8	SH10	30.0-32.0	9.14-9.75	21.2%	
FTWR8	SS2	2.5-4.0	0.76-1.22	27.6%	
FTWR8	SS3	5.0-6.5	1.52-1.98	18.6%	
FTWR8	SS4	7.5-9.0	2.29-2.74	24.1%	
FTWR8	SS5	10.0-11.5	3.05-3.51	19.5%	
FTWR8	SS6	12.5-14.0	3.81-4.27	27.3%	
FTWR8	SS7	15.0-16.5	4.57-5.03	30.1%	
FTWR8	SS9	25.0-26.5	7.62-8.08	40.5%	LL=53.4, PL=20.1, PI=33.3
FTWR8	SS11	40.0-41.5	12.19-12.65	51.0%	
FTWR8	SS12	50.0-51.5	15.24-15.70	7.4%	
FTWR11	SS1	2.5-4.0	0.76-1.22	626.3%	
FTWR11	SS2	5.0-6.5	1.52-1.98	442.3%	
FTWR11	SS3	7.5-9.0	2.29-2.74	30.2%	
FTWR11	SS5	15.0-16.5	4.57-5.03	25.3%	
FTWR11	SS6	20.0-21.5	6.10-6.55	35.8%	
FTWR12	SS2	5.0-6.5	1.52-1.98	38.3%	
FTWR12	SS3	7.5-9.0	2.29-2.74	25.1%	
FTWR12	SS4	10.0-11.5	3.05-3.51	24.3%	LL=46.8, PL=18.7, PI=28.1
FTWR12	SS5	12.5-14.0	3.81-4.27	21.1%	
FTWR12	SS6	15.0-16.5	4.57-5.03	26.4%	LL=52.1, PL=19.5, PI=32.6
FTWR12	SS7	20.0-21.5	6.10-6.55	39.5%	
FTWR12	SS8	25.0-26.5	7.62-8.08	47.3%	
FTWR12	SS9	30.0-31.5	9.14-9.60	46.6%	
FTWR12	SS10	35.0-36.5	10.67-11.13	10.6%	
FTWR14	SH2	5.0-7.0	1.52-2.13	27.9%	
FTWR14	SH5	30.0-32.0	9.14-9.75	35.9%	
FTWR14	SS1	2.5-4.0	0.76-1.22	493.1%	
FTWR14	SS3	20.0-21.5	6.10-6.55	21.9%	
FTWR14	SS4	25.0-26.5	7.62-8.08	23.9%	
FTWR14	SS6	7.5-9.0	2.29-2.74	26.0%	LL=42.0, PL=17.8, PI=24.2
FTWR14	SS7	10.0-11.5	3.05-3.51	25.5%	
FTWR14	SS8	12.4-14.0	3.78-4.27	21.4%	
FTWR14	SS9	15.0-16.5	4.57-5.03	24.5%	
FTWR14	SS10	45.0-46.5	13.72-14.17	43.7%	

Checked By:

SUMMARY OF WATER CONTENT DETERMINATIONS

ASTM D 2216-05

PROJECT NUMBER 12-1183-0015
PROJECT NAME Foth / Testing / Victory Nickel
DATE TESTED March, 2012

Borehole No.	Sample No.	Depth (ft)	Depth (m)	Water Content (%)	Atterberg Limits LL, PL, PI
FTWR14	SS11	55.0-56.5	16.76-17.22	46.7%	
FTWR16	SH9	25.0-27.0	7.62-8.23	30.1%	LL=36.2, PL=13.4, PI=22.8
FTWR16	SS1	0.0-2.0	0.00-0.61	481.0%	
FTWR16	SS2	2.5-4.0	0.76-1.22	22.7%	
FTWR16	SS3	5.0-6.5	1.52-1.98	24.6%	
FTWR16	SS5	10.1-11.5	3.08-3.51	18.6%	
FTWR16	SS6	12.5-14.0	3.81-4.27	17.6%	LL=47.5, PL=20.0, PI=27.5
FTWR16	SS7	15.0-16.5	4.57-5.03	28.1%	
FTWR30	SH9	55.0-57.0	16.76-17.37	57.3%	
FTWR30	SS1	2.5-4.0	0.76-1.22	73.9%	LL=65.0, PL=35.8, PI=29.2
FTWR30	SS2	5.0-6.5	1.52-1.98	29.8%	LL=41.9, PL=18.0, PI=23.9
FTWR30	SS4	15.0-16.5	4.57-5.03	25.9%	
FTWR30	SS6	25.0-26.5	7.62-8.08	27.1%	
FTWR30	SS8	45.0-46.5	13.72-14.17	46.3%	LL=57.4, PL=20.0, PI=37.4
FTWR30	SS10	7.5-9.0	2.29-2.74	27.0%	

Checked By:

HYDRAULIC CONDUCTIVITY TEST

ASTM D 5084 (CONSTANT HEAD)

SAMPLE IDENTIFICATION

PROJECT NUMBER	12-1183-0015	SAMPLE	SH4
PROJECT TITLE	Foth / Testing / Victory Nickel	SAMPLE DEPTH, m	3.05-3.66
BOREHOLE NUMBER	FTWR11	DATE	03/02/2012

SPECIMEN PROPERTIES AND DIMENSIONS (INITIAL)

SAMPLE HEIGHT, cm	6.58	UNIT WEIGHT, kN/m^3	20.32
SAMPLE DIAMETER, cm	5.02	DRY UNIT WEIGHT, kN/m^3	16.63
SAMPLE AREA, cm^2	19.79	SPECIFIC GRAVITY, measured	2.67
SAMPLE VOLUME, cm^3	130.23	VOLUME OF SOLIDS, cm^3	82.73
TOTAL MASS, g	269.90	VOLUME OF VOIDS, cm^3	47.50
DRY MASS, g	220.89	VOID RATIO	0.57
WATER CONTENT, %	22.19		

SATURATION STAGE

CELL PRESSURE, kPa	210	EFFECTIVE CONFINING STRESS, kPa	5
HEAD PRESSURE, kPa	205	DURATION, min	2,040
BACK PRESSURE, kPa	205	B COEFFICIENT	0.97

CONSOLIDATION STAGE

CELL PRESSURE, kPa	255	EFFECTIVE CONFINING STRESS, kPa	50
HEAD PRESSURE, kPa	205	DURATION, min	720
BACK PRESSURE, kPa	205	VOLUME CHANGE, cm^3	1.1
		DRAINAGE	Top and Bottom

HYDRAULIC CONDUCTIVITY TEST

CELL PRESSURE, kPa	268	EFFECTIVE CONFINING STRESS, kPa	50
HEAD PRESSURE, kPa	218	DURATION, min	11086
BACK PRESSURE, kPa	205	HYDRAULIC GRADIENT, i	20

SPECIMEN PROPERTIES AND DIMENSIONS (FINAL)

SAMPLE HEIGHT, cm	6.56	UNIT WEIGHT, kN/m^3	20.73
SAMPLE DIAMETER, cm	5.01	DRY UNIT WEIGHT, kN/m^3	16.77
SAMPLE AREA, cm^2	19.68	SPECIFIC GRAVITY, measured	2.67
SAMPLE VOLUME, cm^3	129.14	VOLUME OF SOLIDS, cm^3	82.73
TOTAL MASS, g	273.04	VOLUME OF VOIDS, cm^3	46.41
DRY MASS, g	220.89	VOID RATIO	0.56
WATER CONTENT, %	23.61		

TEST RESULTS

ELAPSED TIME TO STEADY STATE FLOW (min)	00
DURATION OF STEADY STATE FLOW (min)	11086
INFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	1.7
OUTFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	1.0
HYDRAULIC CONDUCTIVITY (INFLOW) (cm/s)	6.43E-09
HYDRAULIC CONDUCTIVITY (OUTFLOW) (cm/s)	3.78E-09
HYDRAULIC CONDUCTIVITY, K, cm/s	**5.10E-09**

NOTES:

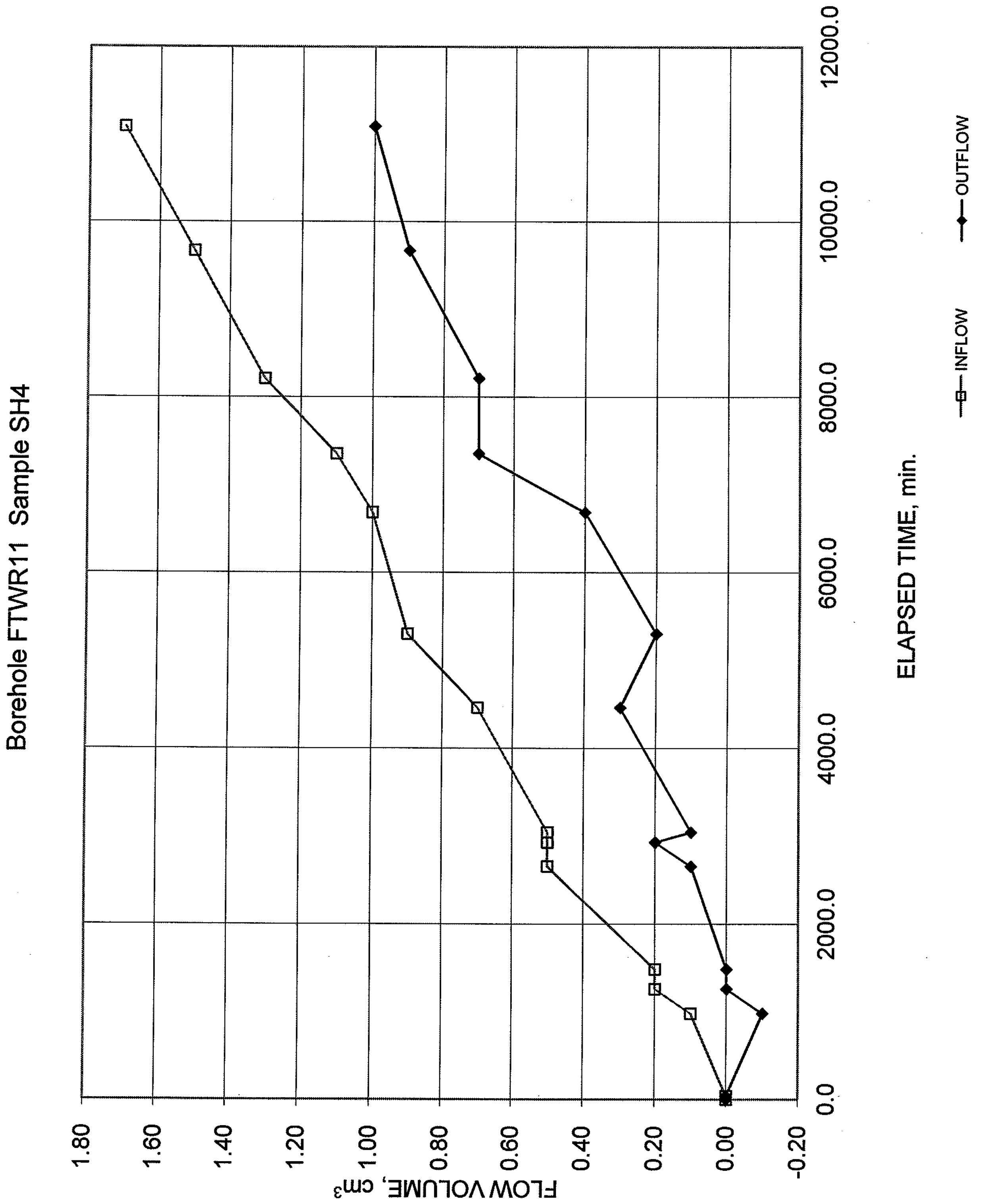
MIXING FLUID	
PERMEANT FLUID	Deaired tap water

Prepared By: MM

Golder Associates

Checked By:

HYDRAULIC CONDUCTIVITY TEST



Project No. 12-1183-0015
Prepared By: MM

Golder Associates

Checked By:

HYDRAULIC CONDUCTIVITY TEST

ASTM D 5084 (CONSTANT HEAD)

SAMPLE IDENTIFICATION

PROJECT NUMBER	12-1183-0015	SAMPLE	SH1
PROJECT TITLE	Foth / Testing / Victory Nickel	SAMPLE DEPTH, m	0.76-1.37
BOREHOLE NUMBER	FTWR12	DATE	03/09/2012

SPECIMEN PROPERTIES AND DIMENSIONS (INITIAL)

SAMPLE HEIGHT, cm	8.14	UNIT WEIGHT, kN/m^3	8.11
SAMPLE DIAMETER, cm	7.26	DRY UNIT WEIGHT, kN/m^3	1.26
SAMPLE AREA, cm^2	41.40	SPECIFIC GRAVITY, measured	1.65
SAMPLE VOLUME, cm^3	336.97	VOLUME OF SOLIDS, cm^3	26.24
TOTAL MASS, g	278.55	VOLUME OF VOIDS, cm^3	310.72
DRY MASS, g	43.30	VOID RATIO	11.84
WATER CONTENT, %	543.30		

SATURATION STAGE

CELL PRESSURE, kPa	100	EFFECTIVE CONFINING STRESS, kPa	2
HEAD PRESSURE, kPa	98	DURATION, min	7,200
BACK PRESSURE, kPa	98	B COEFFICIENT	0.89

CONSOLIDATION STAGE

CELL PRESSURE, kPa	118	EFFECTIVE CONFINING STRESS, kPa	20
HEAD PRESSURE, kPa	98	DURATION, min	480
BACK PRESSURE, kPa	98	VOLUME CHANGE, cm^3	46.0
		DRAINAGE	Top and Bottom

HYDRAULIC CONDUCTIVITY TEST

CELL PRESSURE, kPa	122	EFFECTIVE CONFINING STRESS, kPa	20
HEAD PRESSURE, kPa	102	DURATION, min	260
BACK PRESSURE, kPa	98	HYDRAULIC GRADIENT, i	5

SPECIMEN PROPERTIES AND DIMENSIONS (FINAL)

SAMPLE HEIGHT, cm	7.77	UNIT WEIGHT, kN/m^3	8.26
SAMPLE DIAMETER, cm	6.92	DRY UNIT WEIGHT, kN/m^3	1.45
SAMPLE AREA, cm^2	37.63	SPECIFIC GRAVITY, measured	1.65
SAMPLE VOLUME, cm^3	292.36	VOLUME OF SOLIDS, cm^3	26.24
TOTAL MASS, g	246.26	VOLUME OF VOIDS, cm^3	266.12
DRY MASS, g	43.30	VOID RATIO	10.14
WATER CONTENT, %	468.73		

TEST RESULTS

ELAPSED TIME TO STEADY STATE FLOW (min)	00
DURATION OF STEADY STATE FLOW (min)	260
INFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	107.7
OUTFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	93.2
HYDRAULIC CONDUCTIVITY (INFLOW) (cm/s)	3.49E-05
HYDRAULIC CONDUCTIVITY (OUTFLOW) (cm/s)	3.02E-05
HYDRAULIC CONDUCTIVITY, K, cm/s	**3.26E-05**

NOTES:

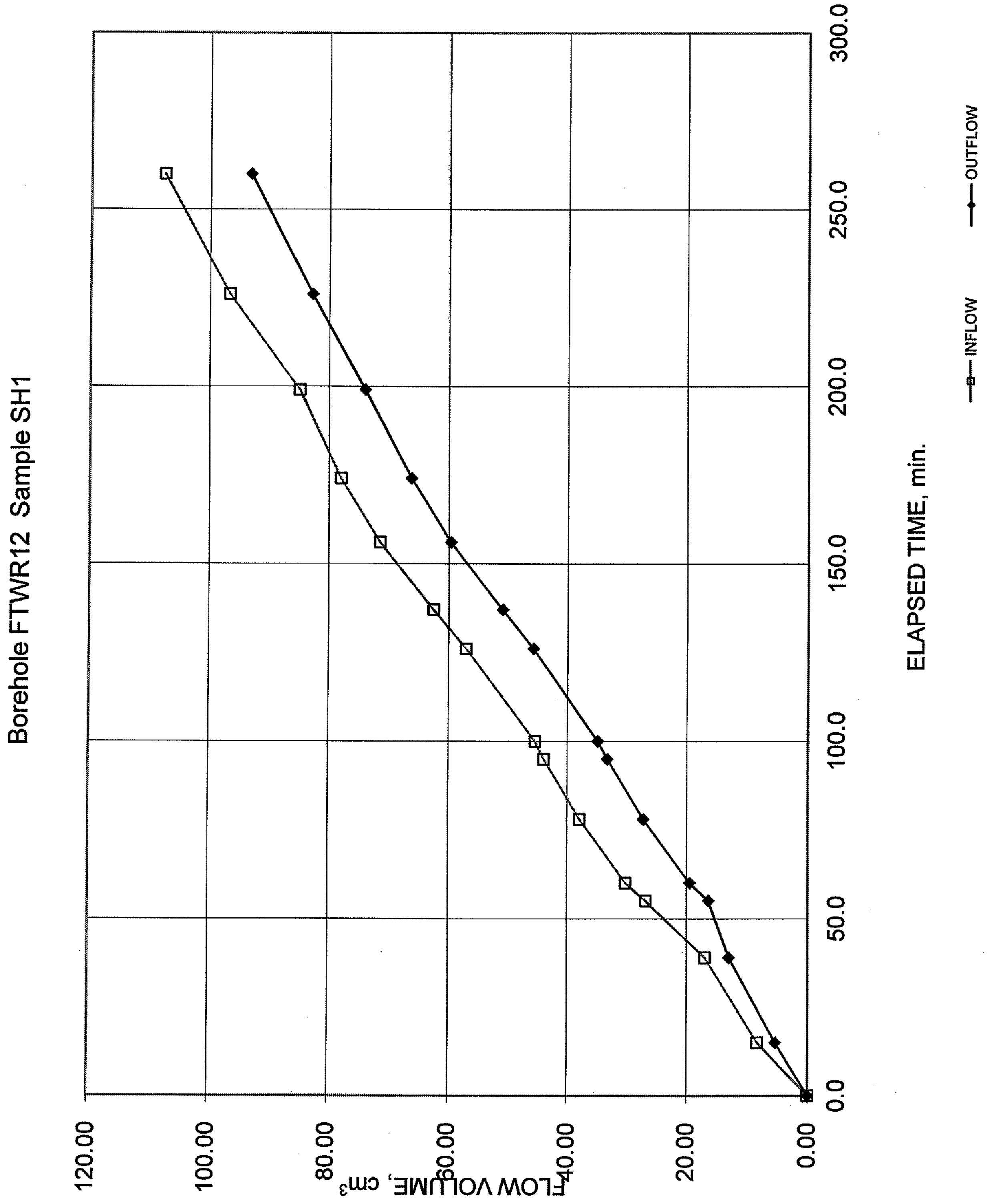
MIXING FLUID	
PERMEANT FLUID	Deaired tap water

Prepared By: MM

Golder Associates

Checked By:

HYDRAULIC CONDUCTIVITY TEST



Project No. 12-1183-0015
Prepared By: MM

Golder Associates

Checked By:

HYDRAULIC CONDUCTIVITY TEST

ASTM D 5084 (CONSTANT HEAD)

SAMPLE IDENTIFICATION

PROJECT NUMBER	12-1183-0015	SAMPLE	SH9
PROJECT TITLE	Foth / Testing / Victory Nickel	SAMPLE DEPTH, m	7.62-8.23
BOREHOLE NUMBER	FTWR16	DATE	03/20/2012

SPECIMEN PROPERTIES AND DIMENSIONS (INITIAL)

SAMPLE HEIGHT, cm	7.19	UNIT WEIGHT, kN/m^3	18.25
SAMPLE DIAMETER, cm	6.95	DRY UNIT WEIGHT, kN/m^3	13.68
SAMPLE AREA, cm^2	37.94	SPECIFIC GRAVITY, assumed	2.70
SAMPLE VOLUME, cm^3	272.76	VOLUME OF SOLIDS, cm^3	140.89
TOTAL MASS, g	507.66	VOLUME OF VOIDS, cm^3	131.87
DRY MASS, g	380.41	VOID RATIO	0.94
WATER CONTENT, %	33.45		

SATURATION STAGE

CELL PRESSURE, kPa	140	EFFECTIVE CONFINING STRESS, kPa	5
HEAD PRESSURE, kPa	135	DURATION, min	1,440
BACK PRESSURE, kPa	135	B COEFFICIENT	0.99

CONSOLIDATION STAGE

CELL PRESSURE, kPa	265	EFFECTIVE CONFINING STRESS, kPa	130
HEAD PRESSURE, kPa	135	DURATION, min	2,520
BACK PRESSURE, kPa	135	VOLUME CHANGE, cm^3	11.3
		DRAINAGE	Top and Bottom

HYDRAULIC CONDUCTIVITY TEST

CELL PRESSURE, kPa	279	EFFECTIVE CONFINING STRESS, kPa	130
HEAD PRESSURE, kPa	149	DURATION, min	3236
BACK PRESSURE, kPa	135	HYDRAULIC GRADIENT, i	20

SPECIMEN PROPERTIES AND DIMENSIONS (FINAL)

SAMPLE HEIGHT, cm	7.09	UNIT WEIGHT, kN/m^3	19.38
SAMPLE DIAMETER, cm	6.85	DRY UNIT WEIGHT, kN/m^3	14.26
SAMPLE AREA, cm^2	36.89	SPECIFIC GRAVITY, measured	2.70
SAMPLE VOLUME, cm^3	261.57	VOLUME OF SOLIDS, cm^3	140.89
TOTAL MASS, g	516.90	VOLUME OF VOIDS, cm^3	120.68
DRY MASS, g	380.41	VOID RATIO	0.86
WATER CONTENT, %	35.88		

TEST RESULTS

ELAPSED TIME TO STEADY STATE FLOW (min)	00
DURATION OF STEADY STATE FLOW (min)	3236
INFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	1.6
OUTFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	1.9
HYDRAULIC CONDUCTIVITY (INFLOW) (cm/s)	1.11E-08
HYDRAULIC CONDUCTIVITY (OUTFLOW) (cm/s)	1.32E-08
HYDRAULIC CONDUCTIVITY, K, cm/s	**1.21E-08**

NOTES:

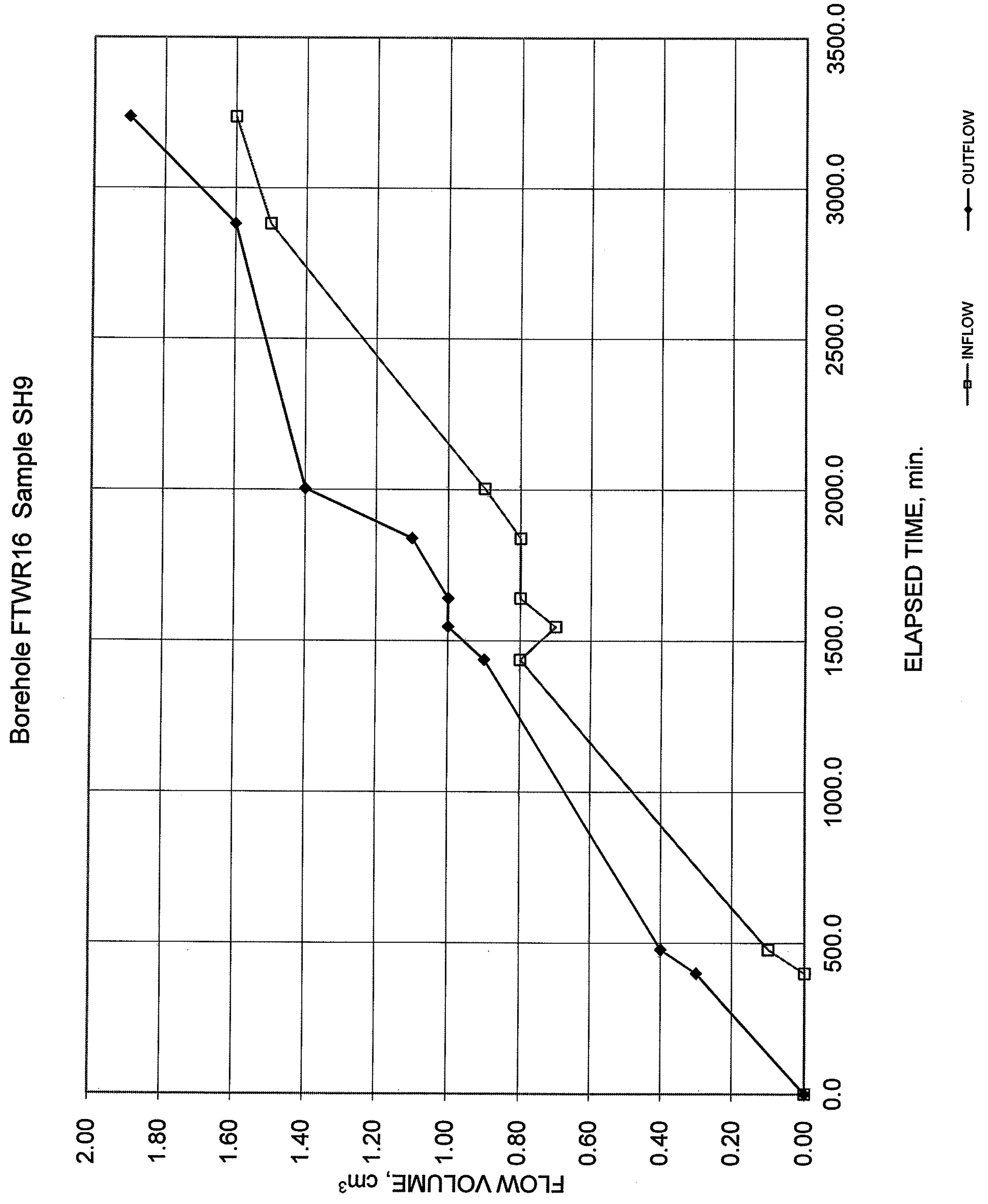
MIXING FLUID	
PERMEANT FLUID	Deaired tap water

Prepared By: MM

Golder Associates

Checked By:

HYDRAULIC CONDUCTIVITY TEST



Project No. 12-1183-0015
Prepared By: MM

Golder Associates

Checked By: ḡḡ

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 1 OF 4

FIGURE

TEST STAGE	A	B	C
BOREHOLE NUMBER	FPP4	FPP4	FPP4
SAMPLE	SH1	SH1	SH1
SPECIMEN DIAMETER, cm	4.97	5.00	5.02
SPECIMEN HEIGHT, cm	10.10	10.13	10.16
NATURAL WATER CONTENT, %	20.9	20.2	19.8
DRY DENSITY, Mg/m^3	1.75	1.75	1.77
WATER CONTENT AFTER SATURATION, %	23.0	22.9	22.2
CELL PRESSURE, σ_3, kPa	265.0	505.0	735.0
BACK PRESSURE, kPa	205.0	205.0	135.0
PORE PRESSURE PARAMETER "B"	0.99	0.97	0.96
CONSOLIDATION PRESSURE, σc, kPa	60.0	300.0	600.0
VOLUMETRIC STRAIN DURING CONSOLIDATION, %	2.4	4.9	8.9
WATER CONTENT AFTER CONSOLIDATION, %	21.6	20.1	17.2
AVERAGE RATE OF STRAIN, %/hr	0.5	0.5	0.5
TIME TO FAILURE, HOURS	27.4	30.9	25.4
WATER CONTENT AFTER TEST, %	21.6	19.8	17.8
MAX. DEVIATOR STRESS, $(\sigma_1-\sigma_3)$, kPa	206.1	432.9	666.5
AXIAL STRAIN AT $(\sigma_1-\sigma_3)$ maximum, %	13.7	15.5	12.7
MAX EFFECTIVE PRINCIPAL STRESS RATIO, (σ'_1/σ'_3) maximum	4.1	3.2	3.0
DEVIATOR STRESS AT (σ'_1/σ'_3) maximum, kPa	133.4	386.2	614.8
AXIAL STRAIN AT (σ'_1/σ'_3) maximum, %	4.1	8.7	7.3
PORE PRESSURE PARAMETER, Af, AT $(\sigma_1-\sigma_3)$ maximum	-0.128	0.21	0.40
PORE PRESSURE PARAMETER, Af, AT (σ'_1/σ'_3) maximum	0.13	0.31	0.48
FILTER DRAINS USED, y/n	y	y	y
TEST NOTES:			
CHANGED RATE OF STRAIN, %/hr	-	-	-
AXIAL STRAIN WHERE RATE OF STRAIN WAS CHANGED, %	-	-	-
FAILURE PLANE NUMBER	-	-	-
ANGLE OF FAILURE, DEGREES	BULGED	BULGED	BULGED

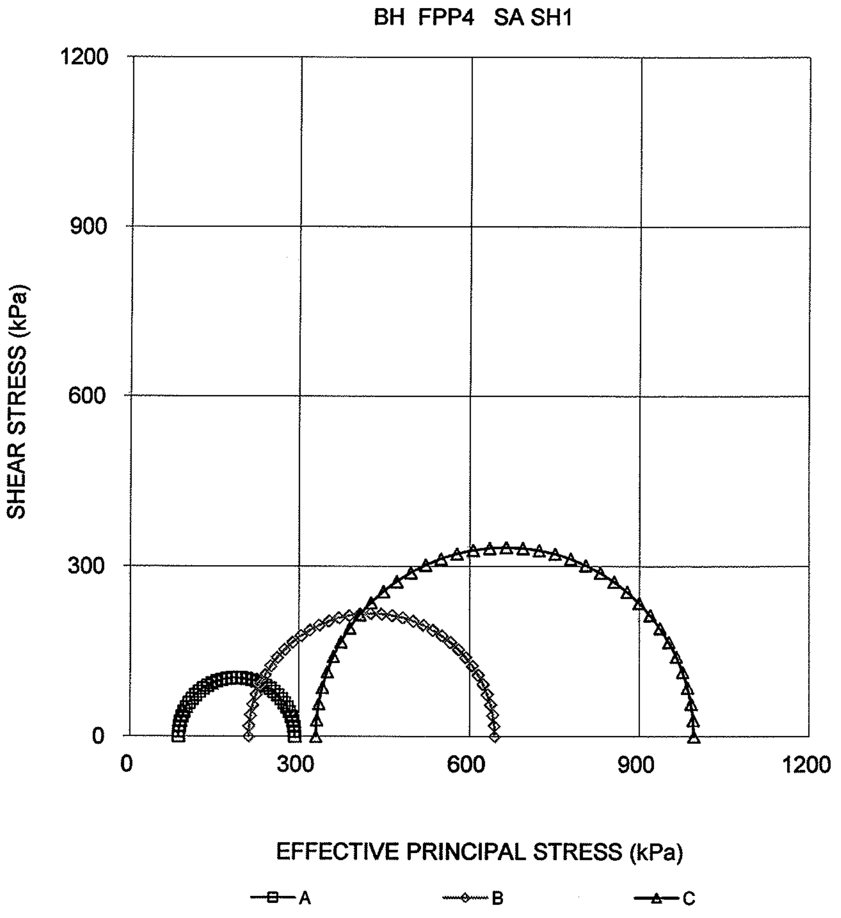
Date: 3/22/2012
Project No. 12-1183-0015

Golder Associates

Prepared By LH
Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 2 OF 4

FIGURE



Date: 3/22/2012

Project No. 12-1183-0015

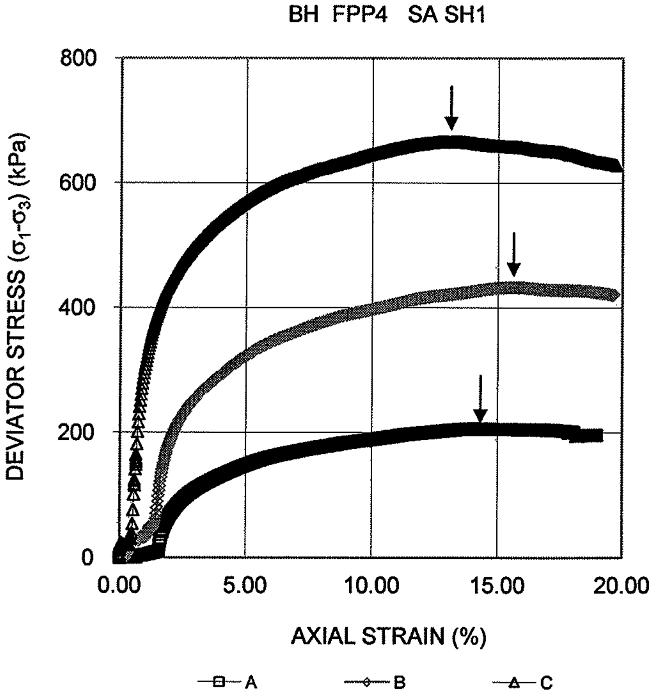
Golder Associates

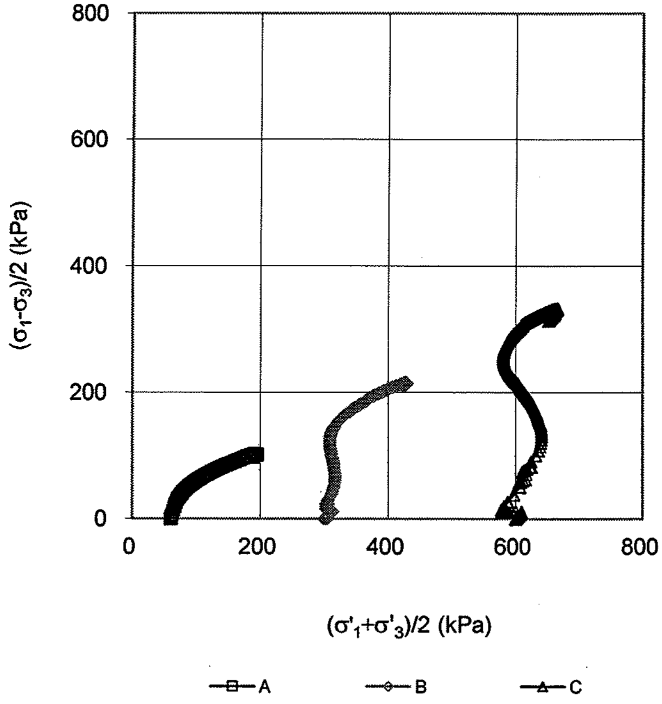
Prepared By LH

Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 3 OF 4

FIGURE





Date: 3/22/2012

Project No. 12-1183-0015

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Prepared By LH

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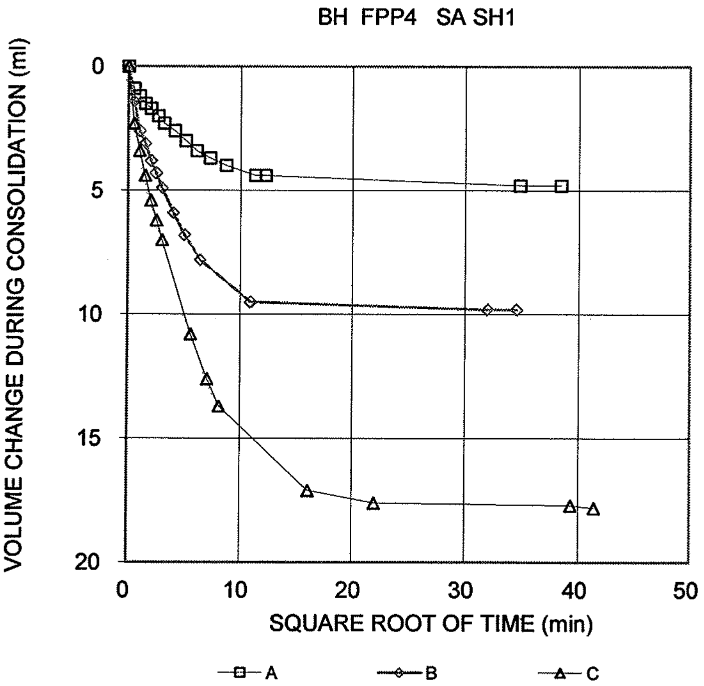
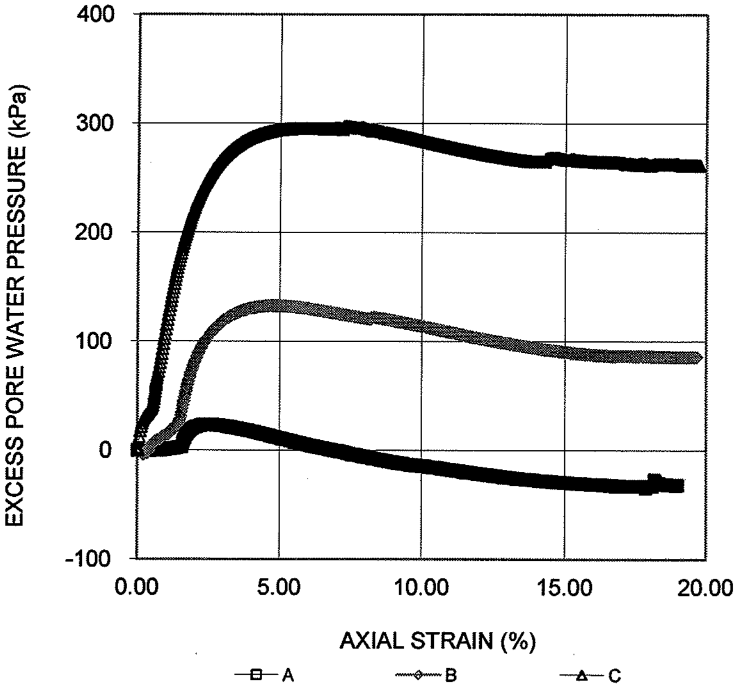
CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS SHEET 4 OF 4	FIGURE





Date: 3/22/2012

Project No. 12-1183-0015

Golder Associates

Prepared By LH

Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

SHEET 1 OF 4

FIGURE

TEST STAGE	A	B	C
BOREHOLE NUMBER	FPP4	FPP4	FPP4
SAMPLE	SH2	SH2	SH2
SPECIMEN DIAMETER, cm	5.01	4.99	5.04
SPECIMEN HEIGHT, cm	10.14	10.52	10.13
NATURAL WATER CONTENT, %	62.7	64.2	67.5
DRY DENSITY, Mg/m^3	1.01	0.99	0.95
WATER CONTENT AFTER SATURATION, %	65.1	67.5	70.6
CELL PRESSURE, σ_3, kPa	235.0	335.0	535.0
BACK PRESSURE, kPa	205.0	135.0	135.0
PORE PRESSURE PARAMETER "B"	0.97	0.98	0.96
CONSOLIDATION PRESSURE, σc, kPa	30.0	200.0	400.0
VOLUMETRIC STRAIN DURING CONSOLIDATION, %	1.5	11.1	22.0
WATER CONTENT AFTER CONSOLIDATION, %	64.2	56.3	47.5
AVERAGE RATE OF STRAIN, %/hr	0.5	0.5	0.5
TIME TO FAILURE, HOURS	7.2	8.9	19.3
WATER CONTENT AFTER TEST, %	63.2	57.1	49.5
MAX. DEVIATOR STRESS, $(\sigma_1-\sigma_3)$, kPa	57.6	123.7	208.6
AXIAL STRAIN AT $(\sigma_1-\sigma_3)$ maximum, %	3.6	4.5	9.6
MAX EFFECTIVE PRINCIPAL STRESS RATIO, (σ'_1/σ'_3) maximum	7.2	2.9	2.6
DEVIATOR STRESS AT (σ'_1/σ'_3) maximum, kPa	57.3	105.9	197.3
AXIAL STRAIN AT (σ'_1/σ'_3) maximum, %	3.5	13.7	16.4
PORE PRESSURE PARAMETER, Af, AT $(\sigma_1-\sigma_3)$ maximum	0.359	0.88	1.19
PORE PRESSURE PARAMETER, Af, AT (σ'_1/σ'_3) maximum	0.36	1.37	1.41
FILTER DRAINS USED, y/n	y	y	y
TEST NOTES:			
CHANGED RATE OF STRAIN, %/hr	-	-	-
AXIAL STRAIN WHERE RATE OF STRAIN WAS CHANGED, %	-	-	-
FAILURE PLANE NUMBER	-	1	1
ANGLE OF FAILURE, DEGREES	BULGED	65	65

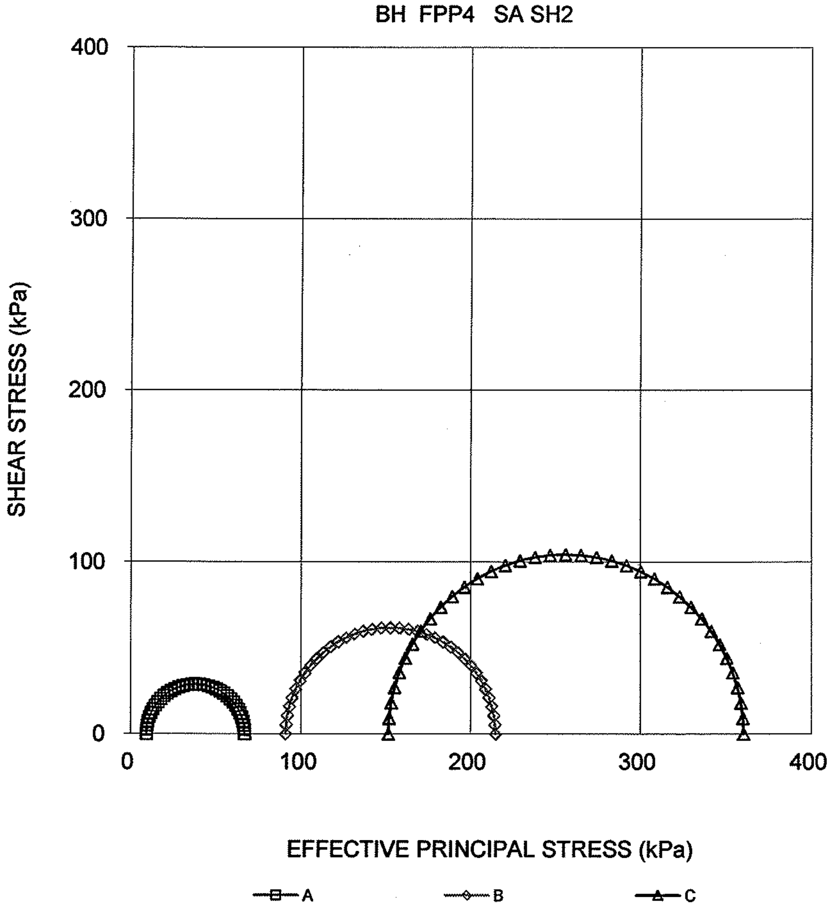
Date: 3/18/2012
Project No. 12-1183-0015

Golder Associates

Prepared By LH
Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 2 OF 4

FIGURE



Date: 3/18/2012
Project No. 12-1183-0015

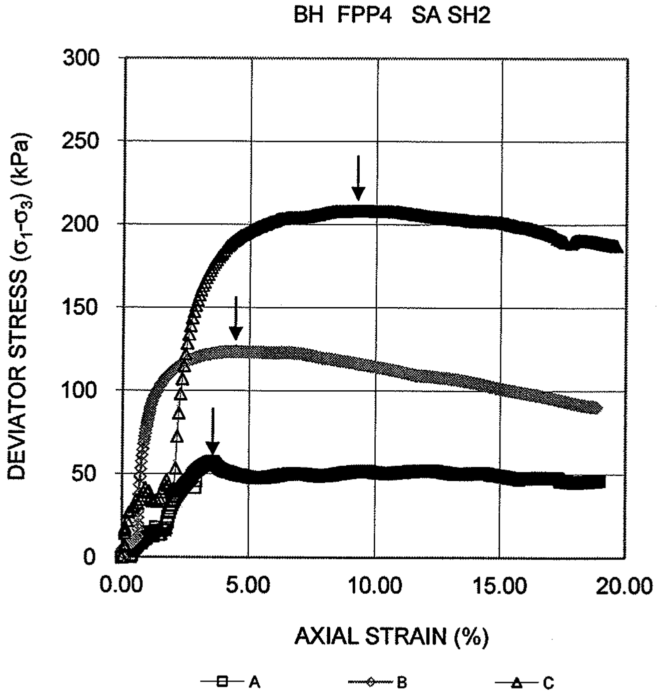
Golder Associates

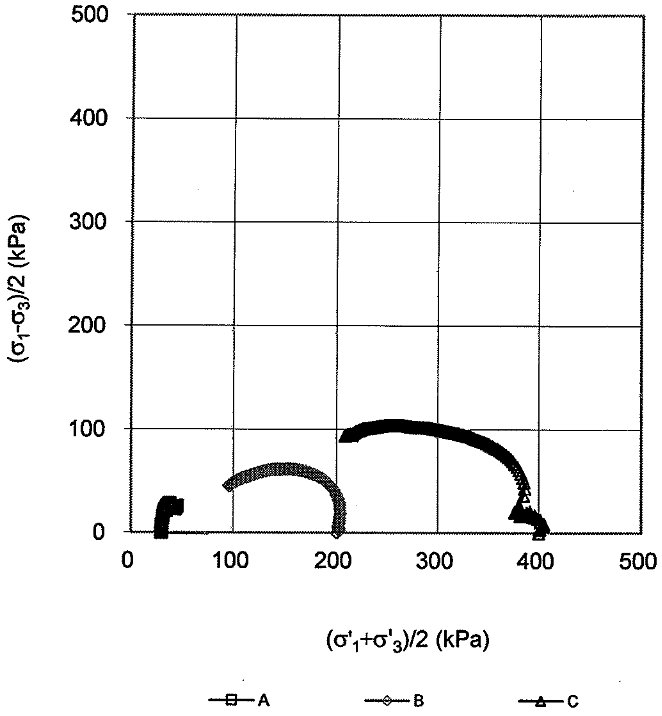
Prepared By LH
Checked By: MM

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

SHEET 3 OF 4

FIGURE





Date: 3/18/2012

Project No. 12-1183-0015

Golder Associates

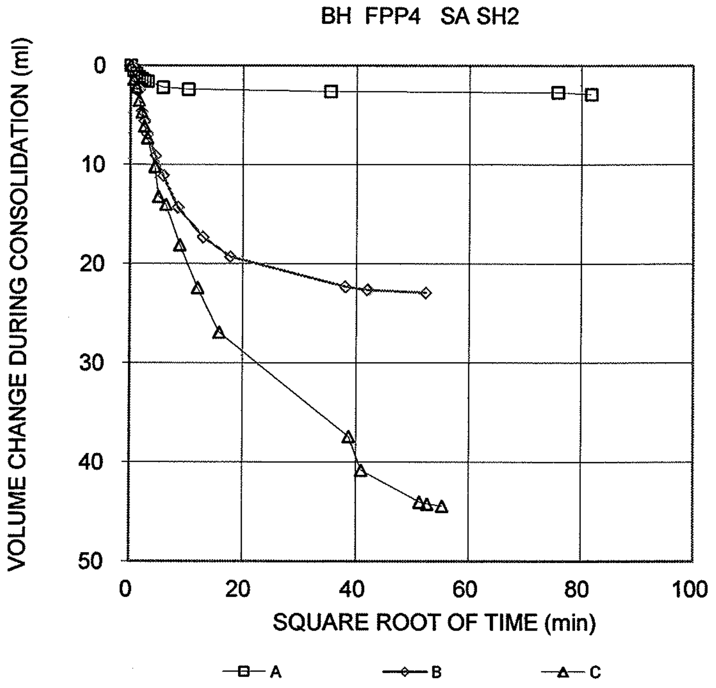
Prepared By LH

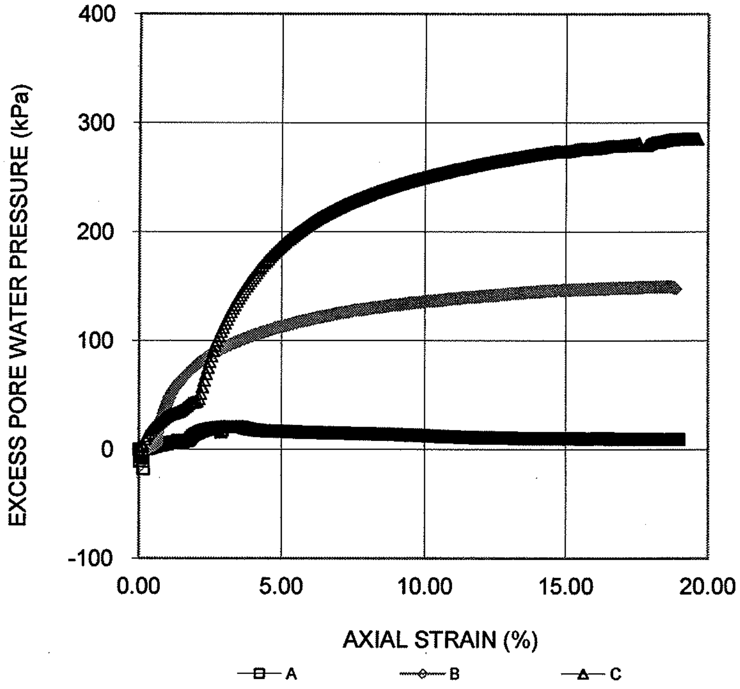
Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

SHEET 4 OF 4

FIGURE





Date: 3/18/2012

Project No. 12-1183-0015

Golder Associates

Prepared By LH

Checked By: MH

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 1 OF 4

FIGURE

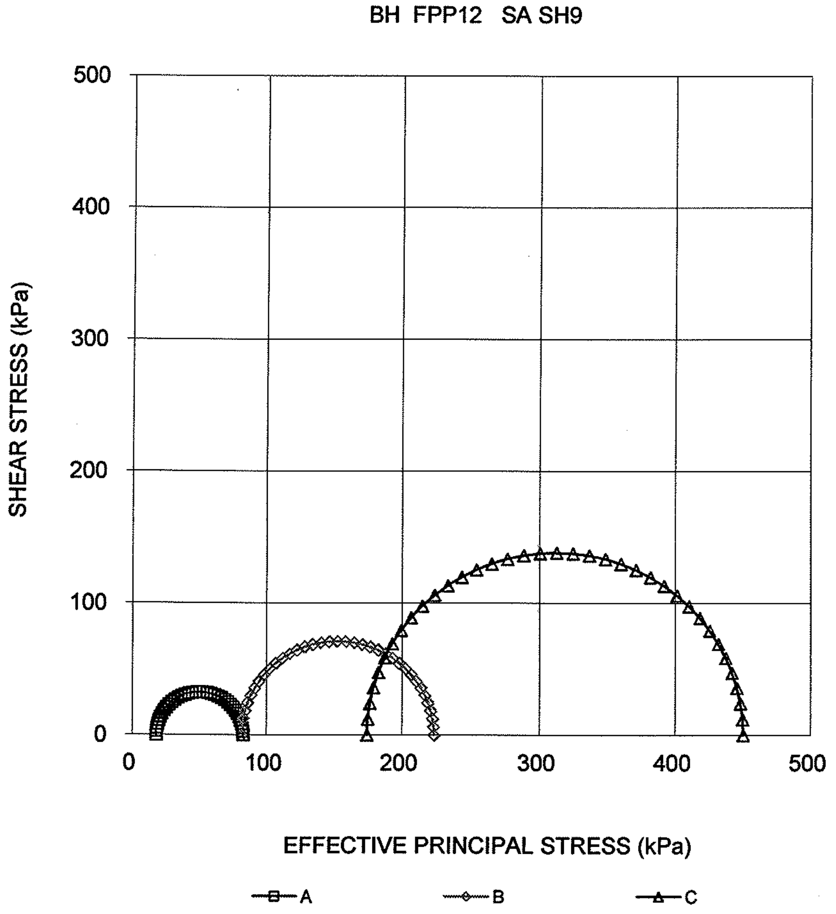
TEST STAGE	A	B	C
BOREHOLE NUMBER	FPP12	FPP12	FPP12
SAMPLE	SH9	SH9	SH9
SPECIMEN DIAMETER, cm	5.02	5.03	5.02
SPECIMEN HEIGHT, cm	10.16	10.18	10.23
NATURAL WATER CONTENT, %	40.2	40.9	41.3
DRY DENSITY, Mg/m^3	1.31	1.30	1.28
WATER CONTENT AFTER SATURATION, %	41.4	41.8	43.0
CELL PRESSURE, σ_3, kPa	165.0	405.0	535.0
BACK PRESSURE, kPa	135.0	205.0	135.0
PORE PRESSURE PARAMETER "B"	0.97	0.98	0.96
CONSOLIDATION PRESSURE, σc, kPa	30.0	200.0	400.0
VOLUMETRIC STRAIN DURING CONSOLIDATION, %	1.7	10.0	17.8
WATER CONTENT AFTER CONSOLIDATION, %	40.1	34.1	29.1
AVERAGE RATE OF STRAIN, %/hr	0.5	0.5	0.5
TIME TO FAILURE, HOURS	12.4	8.0	19.0
WATER CONTENT AFTER TEST, %	39.6	34.4	29.8
MAX. DEVIATOR STRESS, $(\sigma_1-\sigma_3)$, kPa	64.8	141.8	276.2
AXIAL STRAIN AT $(\sigma_1-\sigma_3)$ maximum, %	6.2	4.0	9.5
MAX EFFECTIVE PRINCIPAL STRESS RATIO, (σ'_1/σ'_3) maximum	4.3	3.0	2.7
DEVIATOR STRESS AT (σ'_1/σ'_3) maximum, kPa	58.1	131.8	263.7
AXIAL STRAIN AT (σ'_1/σ'_3) maximum, %	3.5	9.9	17.2
PORE PRESSURE PARAMETER, Af, AT $(\sigma_1-\sigma_3)$ maximum	0.190	0.84	0.82
PORE PRESSURE PARAMETER, Af, AT (σ'_1/σ'_3) maximum	0.22	1.03	0.94
FILTER DRAINS USED, y/n	y	y	y
TEST NOTES:			
CHANGED RATE OF STRAIN, %/hr	-	-	-
AXIAL STRAIN WHERE RATE OF STRAIN WAS CHANGED, %	-	-	-
FAILURE PLANE NUMBER	1.0	1.0	-
ANGLE OF FAILURE, DEGREES	65	70	BULGED

Date: 3/18/2012
Project No. 12-1183-0015

Golder Associates

Prepared By LH
Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL **WITH PORE PRESSURE MEASUREMENTS** **SHEET 2 OF 4**	**FIGURE**



Date: 3/18/2012

Project No. 12-1183-0015

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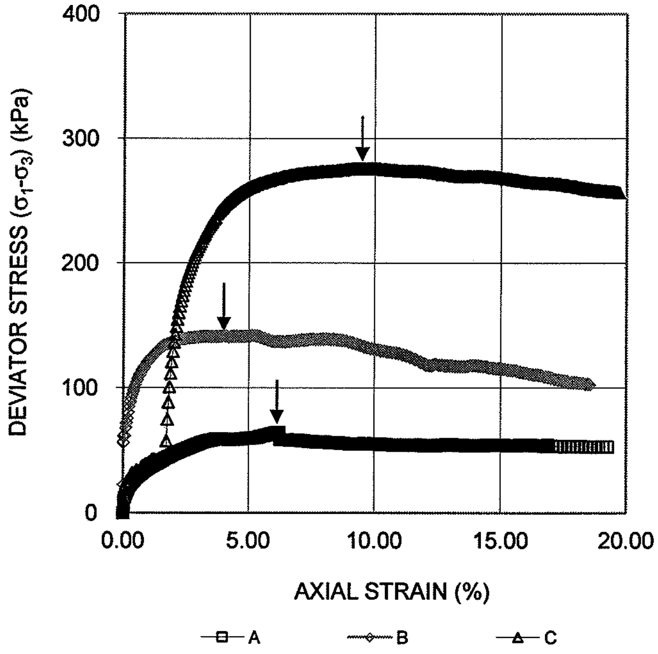
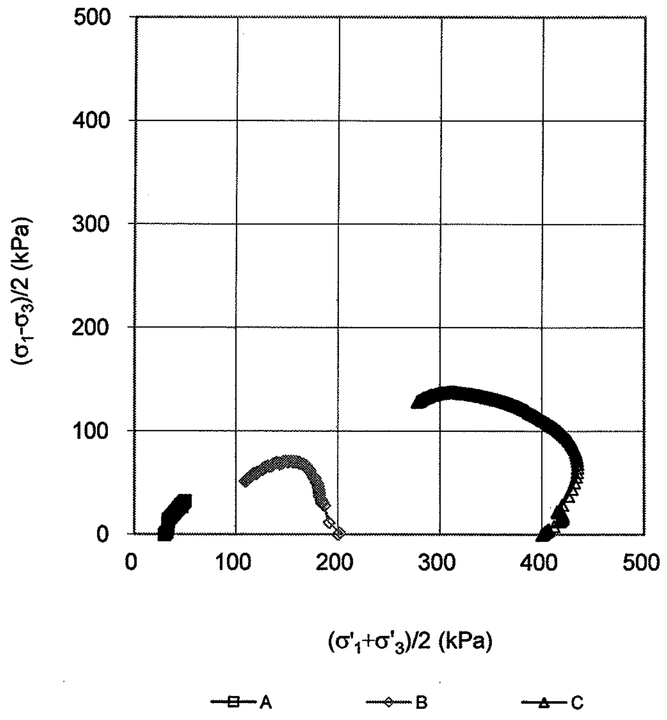
CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 3 OF 4

FIGURE

BH FPP12 SA SH9





Date: 3/18/2012
Project No. 12-1183-0015

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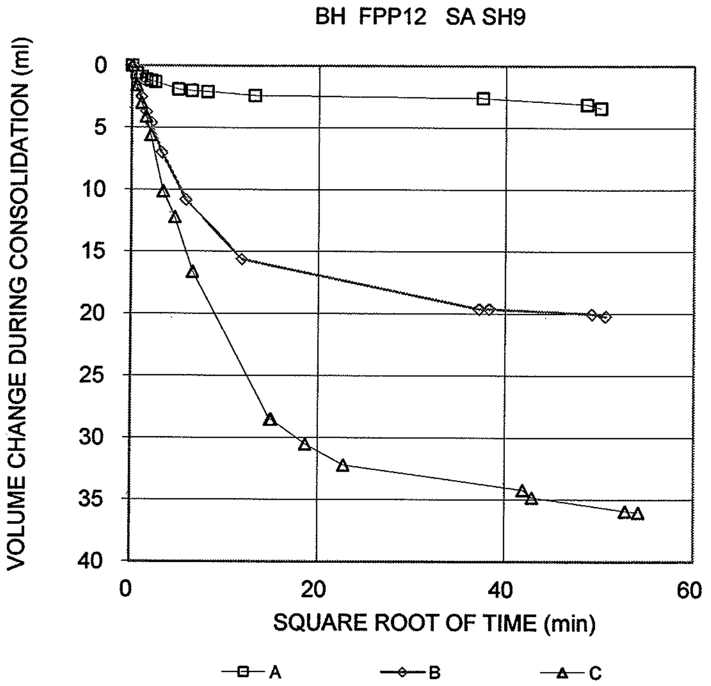
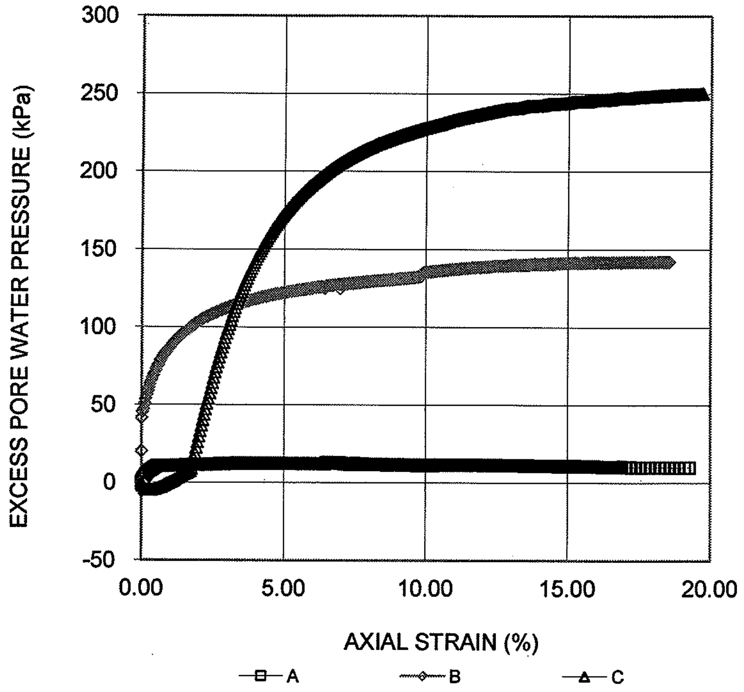
Prepared By LH
Checked By: MU

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 4 OF 4

FIGURE





Date: 3/18/2012

Project No. 12-1183-0015

Golder Associates

Prepared By LH

Checked By: ltll

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 1 OF 4

FIGURE

TEST STAGE	A	B	C
BOREHOLE NUMBER	FPP14	FPP14	FPP14
SAMPLE	SH10	SH10	SH10
SPECIMEN DIAMETER, cm	5.03	5.01	5.00
SPECIMEN HEIGHT, cm	10.18	10.09	10.07
NATURAL WATER CONTENT, %	32.3	35.2	30.7
DRY DENSITY, Mg/m^3	1.46	1.40	1.50
WATER CONTENT AFTER SATURATION, %	34.2	36.7	33.3
CELL PRESSURE, σ_3, kPa	165.0	335.0	535.0
BACK PRESSURE, kPa	135.0	135.0	135.0
PORE PRESSURE PARAMETER "B"	0.96	0.96	0.96
CONSOLIDATION PRESSURE, σc, kPa	30.0	200.0	400.0
VOLUMETRIC STRAIN DURING CONSOLIDATION, %	1.4	7.2	10.6
WATER CONTENT AFTER CONSOLIDATION, %	33.3	31.8	26.2
AVERAGE RATE OF STRAIN, %/hr	0.5	0.5	0.5
TIME TO FAILURE, HOURS	19.8	11.6	13.1
WATER CONTENT AFTER TEST, %	32.7	32.4	26.1
MAX. DEVIATOR STRESS, $(\sigma_1-\sigma_3)$, kPa	77.7	194.3	290.5
AXIAL STRAIN AT $(\sigma_1-\sigma_3)$ maximum, %	9.9	5.8	6.6
MAX EFFECTIVE PRINCIPAL STRESS RATIO, (σ'_1/σ'_3) maximum	3.8	2.8	3.1
DEVIATOR STRESS AT (σ'_1/σ'_3) maximum, kPa	63.2	189.2	284.0
AXIAL STRAIN AT (σ'_1/σ'_3) maximum, %	2.9	7.9	13.1
PORE PRESSURE PARAMETER, Af, AT $(\sigma_1-\sigma_3)$ maximum	-0.045	0.47	0.85
PORE PRESSURE PARAMETER, Af, AT (σ'_1/σ'_3) maximum	0.12	0.52	0.92
FILTER DRAINS USED, y/n	y	y	y
TEST NOTES:			
CHANGED RATE OF STRAIN, %/hr	-	-	-
AXIAL STRAIN WHERE RATE OF STRAIN WAS CHANGED, %	-	-	-
FAILURE PLANE NUMBER	1.0	1.0	-
ANGLE OF FAILURE, DEGREES	65.0	73	BULGED

Date: 3/19/2012
Project No. 12-1183-0015

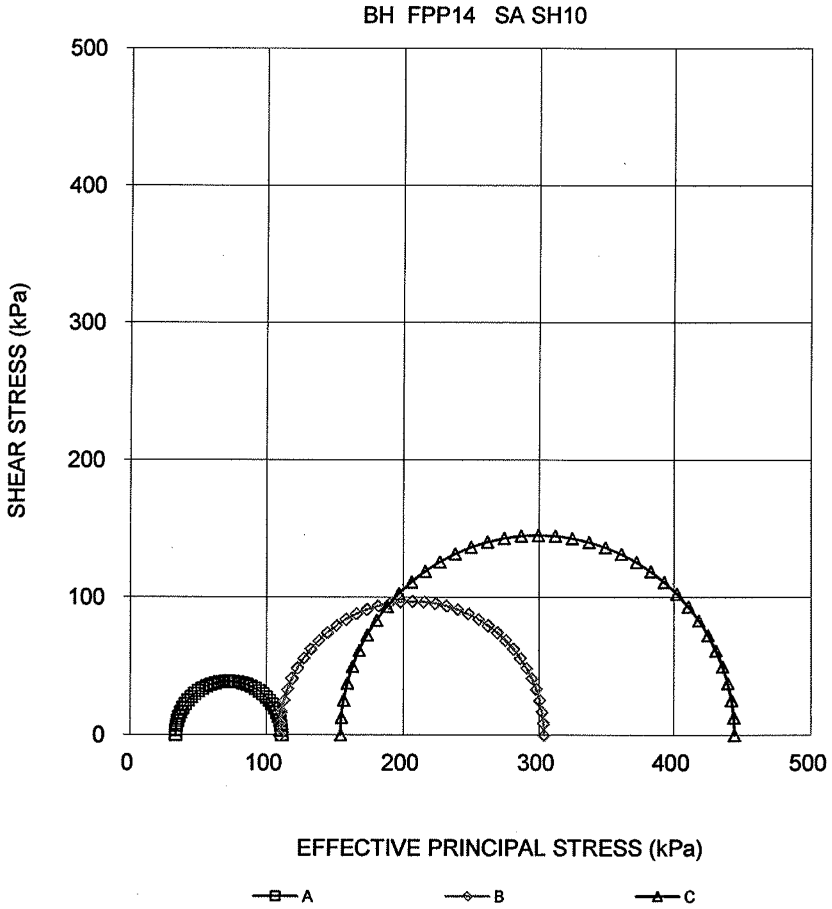
Golder Associates

Prepared By LH
Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS

SHEET 2 OF 4

FIGURE



Date: 3/19/2012

Project No. 12-1183-0015

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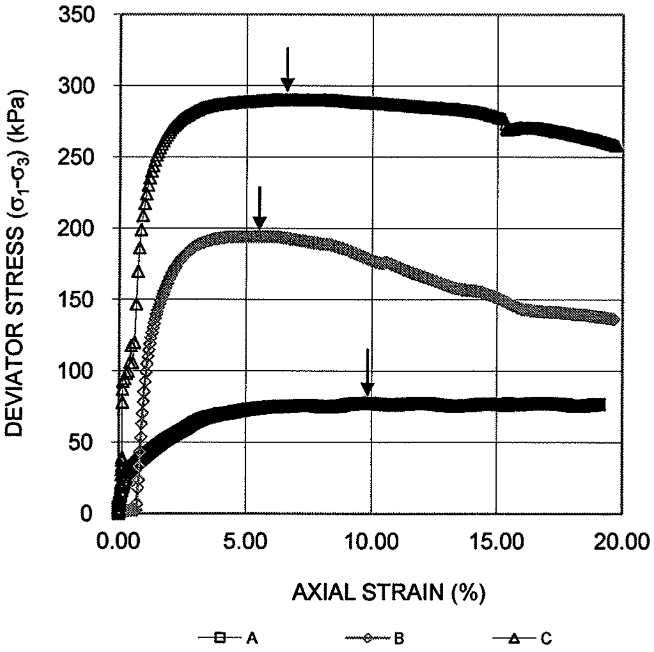
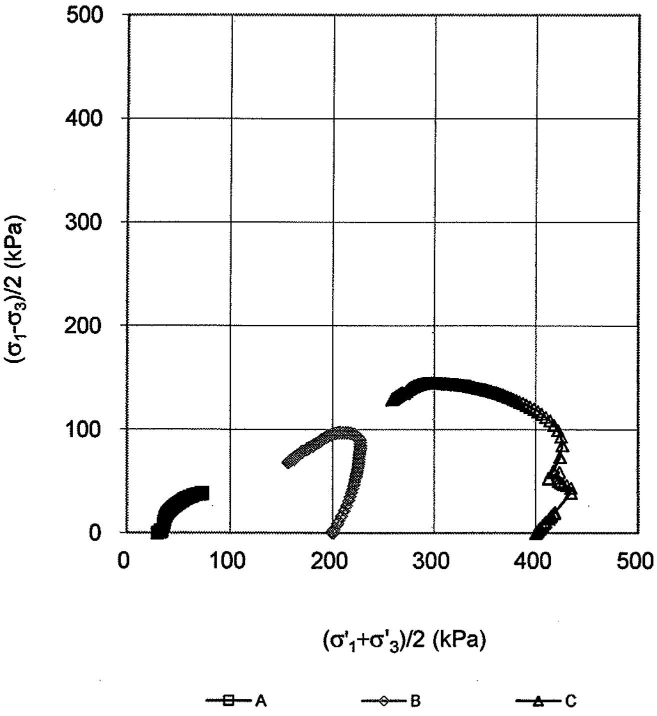
CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS SHEET 3 OF 4	FIGURE

BH FPP14 SA SH10





Date: 3/19/2012

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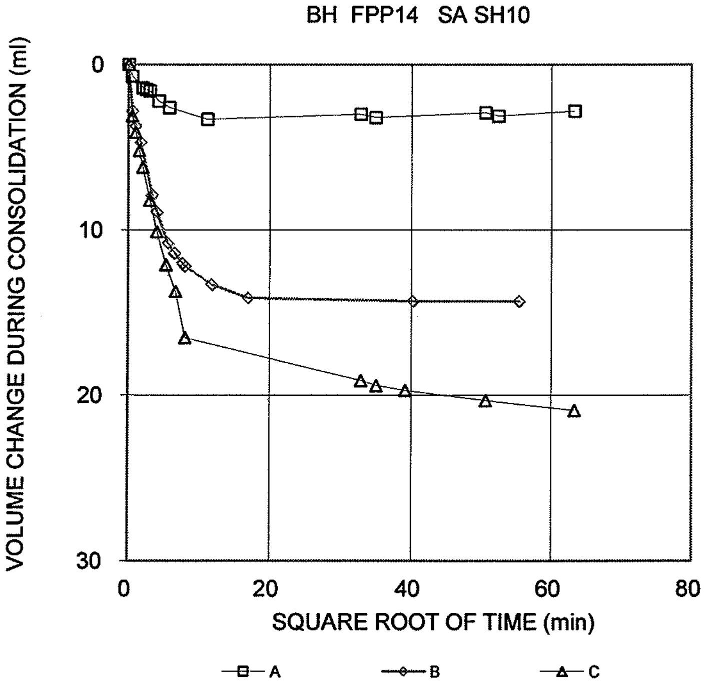
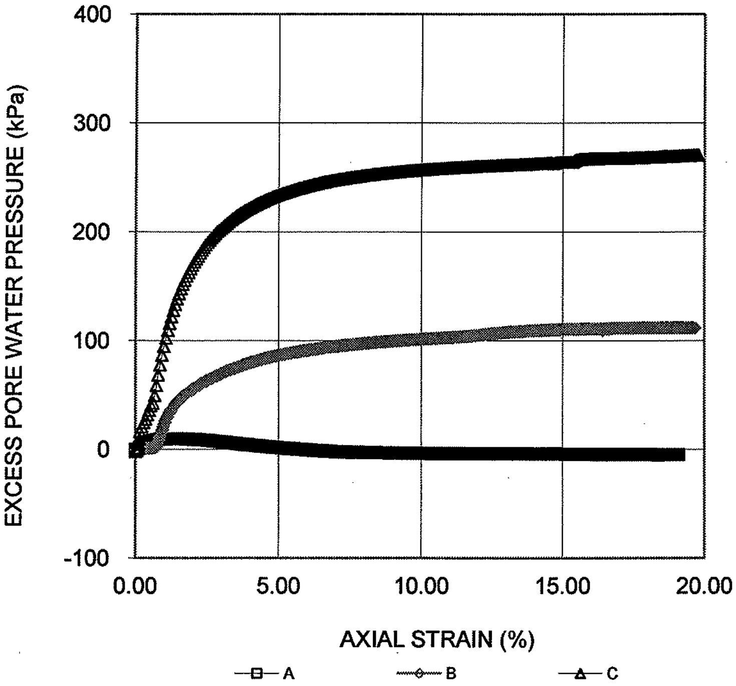
CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS SHEET 4 OF 4	FIGURE





Date: 3/19/2012
Project No. 12-1183-0015

Golder Associates

Prepared By LH
Checked By: llly

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS

SHEET 1 OF 4

FIGURE

TEST STAGE	A	B	C
BOREHOLE NUMBER	FTWR11	FTWR11	FTWR11
SAMPLE	SH4	SH4	SH4
SPECIMEN DIAMETER, cm	5.02	5.00	4.99
SPECIMEN HEIGHT, cm	10.15	10.16	10.11
NATURAL WATER CONTENT, %	22.2	22.3	21.8
DRY DENSITY, Mg/m^3	1.70	1.73	1.71
WATER CONTENT AFTER SATURATION, %	25.3	25.5	22.4
CELL PRESSURE, σ_3, kPa	195.0	575.0	805.0
BACK PRESSURE, kPa	135.0	275.0	205.0
PORE PRESSURE PARAMETER "B"	0.97	0.97	0.97
CONSOLIDATION PRESSURE, σc, kPa	60.0	300.0	600.0
VOLUMETRIC STRAIN DURING CONSOLIDATION, %	1.8	5.1	8.9
WATER CONTENT AFTER CONSOLIDATION, %	24.3	22.6	17.2
AVERAGE RATE OF STRAIN, %/hr	0.5	0.5	0.5
TIME TO FAILURE, HOURS	38.5	11.4	17.5
WATER CONTENT AFTER TEST, %	24.0	21.0	20.8
MAX. DEVIATOR STRESS, $(\sigma_1-\sigma_3)$, kPa	203.1	467.2	666.2
AXIAL STRAIN AT $(\sigma_1-\sigma_3)$ maximum, %	19.3	5.7	8.7
MAX EFFECTIVE PRINCIPAL STRESS RATIO, (σ'_1/σ'_3) maximum	4.9	3.3	2.9
DEVIATOR STRESS AT (σ'_1/σ'_3) maximum, kPa	125.1	460.0	657.2
AXIAL STRAIN AT (σ'_1/σ'_3) maximum, %	2.0	4.6	7.1
PORE PRESSURE PARAMETER, Af, AT $(\sigma_1-\sigma_3)$ maximum	-0.147	0.21	0.37
PORE PRESSURE PARAMETER, Af, AT (σ'_1/σ'_3) maximum	0.22	0.22	0.39
FILTER DRAINS USED, y/n	y	y	y
TEST NOTES:			
CHANGED RATE OF STRAIN, %/hr	-	-	-
AXIAL STRAIN WHERE RATE OF STRAIN WAS CHANGED, %	-	-	-
FAILURE PLANE NUMBER	1.0	1.0	1.0
ANGLE OF FAILURE, DEGREES	65	60	70

Date: 3/25/2012

Project No. 12-1183-0015

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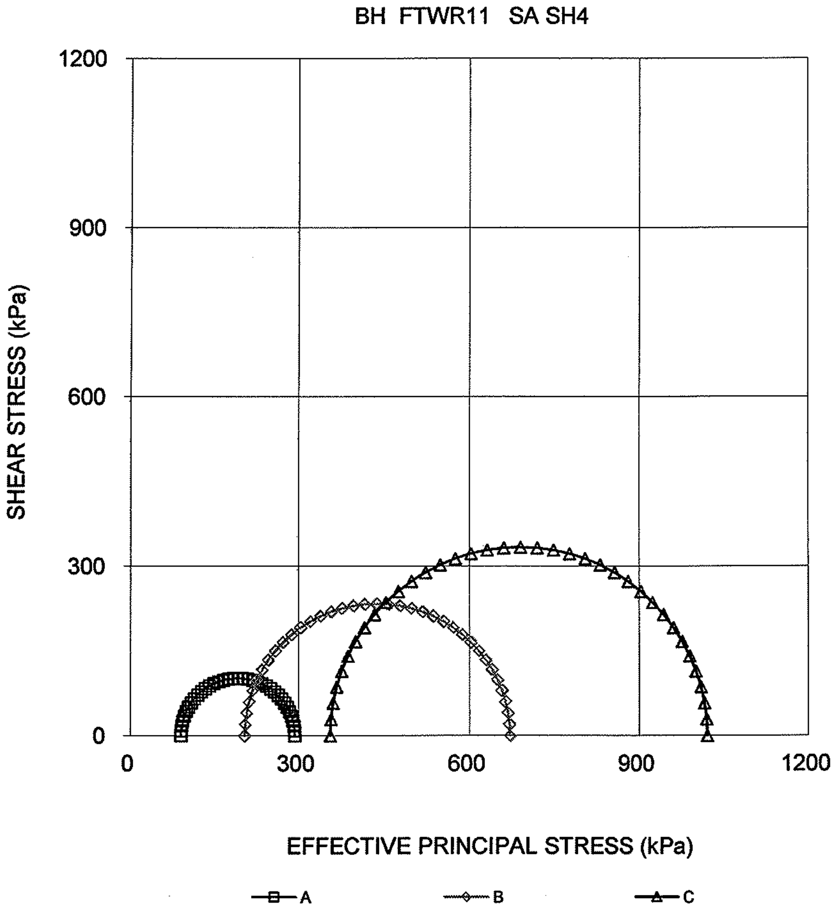
CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS SHEET 2 OF 4	FIGURE



Date: 3/25/2012
Project No. 12-1183-0015

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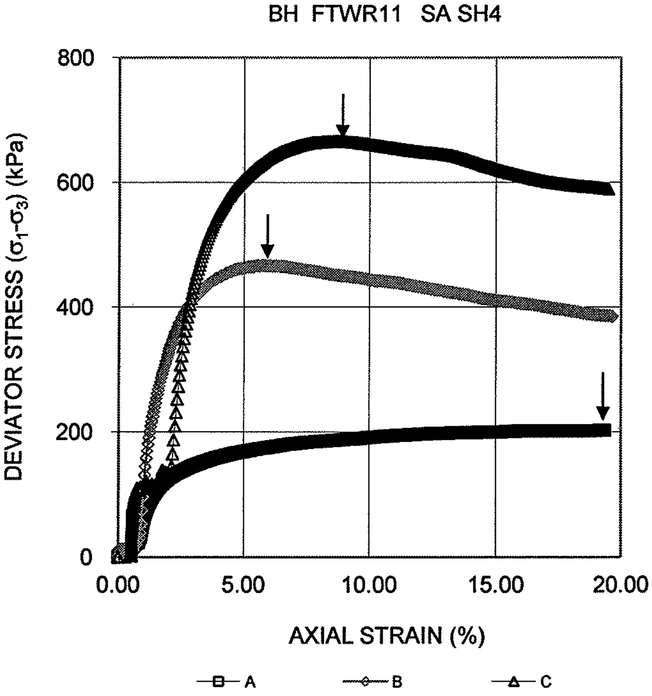
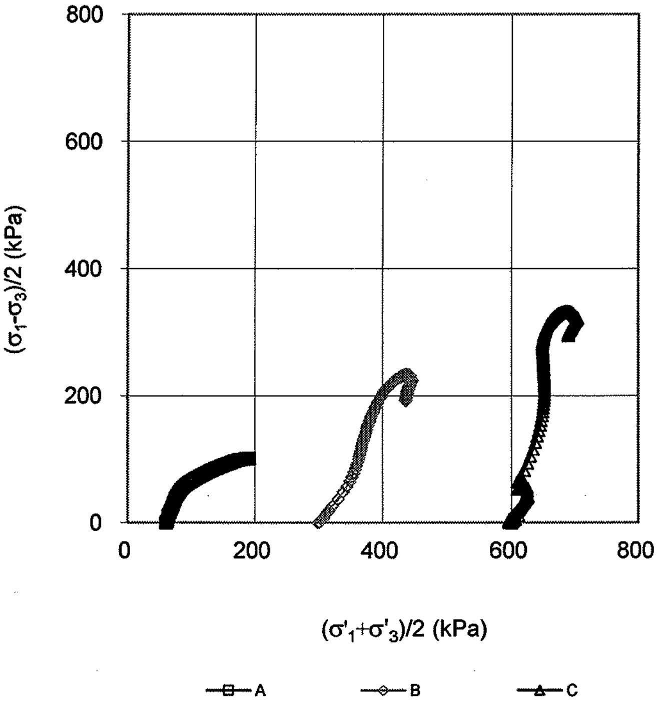
CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 3 OF 4

FIGURE





Date: 3/25/2012
Project No. 12-1183-0015

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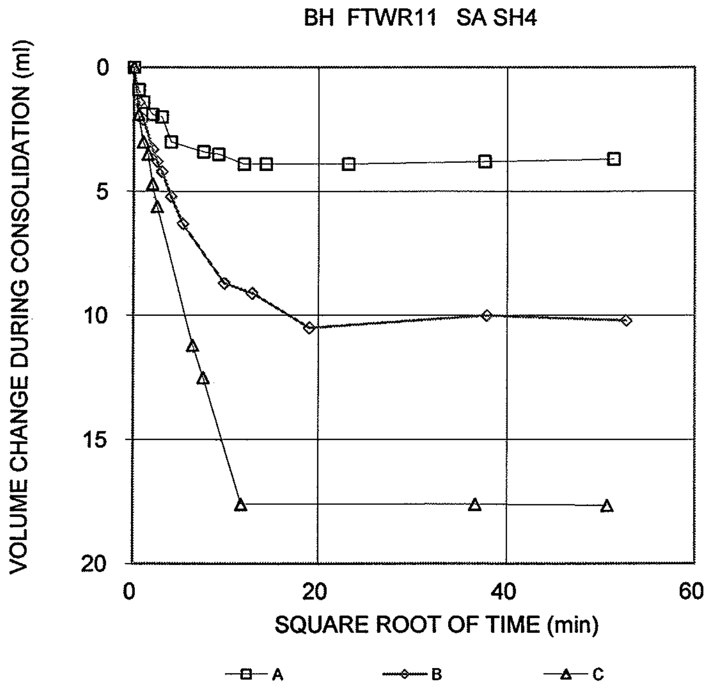
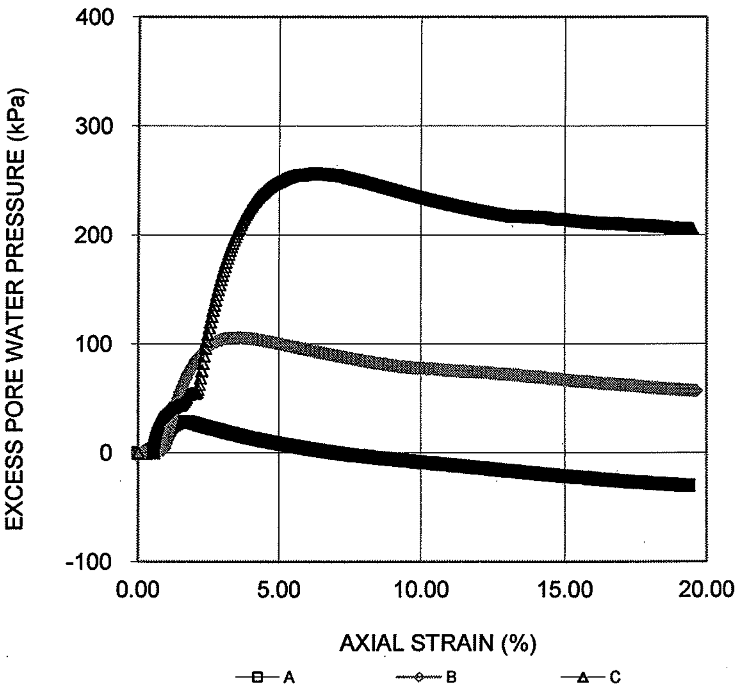
CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 4 OF 4

FIGURE





Date: 3/25/2012

Project No. 12-1183-0015

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CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 1 OF 4

FIGURE

TEST STAGE	A	B	C
BOREHOLE NUMBER	FTWR30	FTWR30	FTWR30
SAMPLE	SH7	SH7	SH7
SPECIMEN DIAMETER, cm	5.01	5.02	5.00
SPECIMEN HEIGHT, cm	10.61	10.13	10.12
NATURAL WATER CONTENT, %	32.5	31.6	35.0
DRY DENSITY, Mg/m^3	1.46	1.46	1.41
WATER CONTENT AFTER SATURATION, %	34.3	33.6	36.8
CELL PRESSURE, σ_3, kPa	165.0	335.0	535.0
BACK PRESSURE, kPa	135.0	135.0	135.0
PORE PRESSURE PARAMETER "B"	0.96	0.92	0.98
CONSOLIDATION PRESSURE, σc, kPa	30.0	200.0	400.0
VOLUMETRIC STRAIN DURING CONSOLIDATION, %	1.3	5.2	9.5
WATER CONTENT AFTER CONSOLIDATION, %	33.4	30.0	30.1
AVERAGE RATE OF STRAIN, %/hr	0.5	0.5	0.5
TIME TO FAILURE, HOURS	6.7	10.1	14.6
WATER CONTENT AFTER TEST, %	33.5	30.1	30.9
MAX. DEVIATOR STRESS, (σ_1-σ_3), kPa	82.9	204.7	309.2
AXIAL STRAIN AT (σ_1-σ_3) maximum, %	3.4	5.1	7.3
MAX EFFECTIVE PRINCIPAL STRESS RATIO, (σ'_1/σ'_3) maximum	3.9	2.8	2.9
DEVIATOR STRESS AT (σ'_1/σ'_3) maximum, kPa	75.8	204.3	306.7
AXIAL STRAIN AT (σ'_1/σ'_3) maximum, %	2.4	6.9	9.7
PORE PRESSURE PARAMETER, Af, AT (σ_1-σ_3) maximum	0.01	0.40	0.73
PORE PRESSURE PARAMETER, Af, AT (σ'_1/σ'_3) maximum	0.06	0.42	0.77
FILTER DRAINS USED, y/n	y	y	y
TEST NOTES:			
CHANGED RATE OF STRAIN, %/hr	-	-	-
AXIAL STRAIN WHERE RATE OF STRAIN WAS CHANGED, %	-	-	-
FAILURE PLANE NUMBER	1.0	2.0	1.0
ANGLE OF FAILURE, DEGREES	70	70	60

Date: 3/25/2012
Project No. 12-1183-0015

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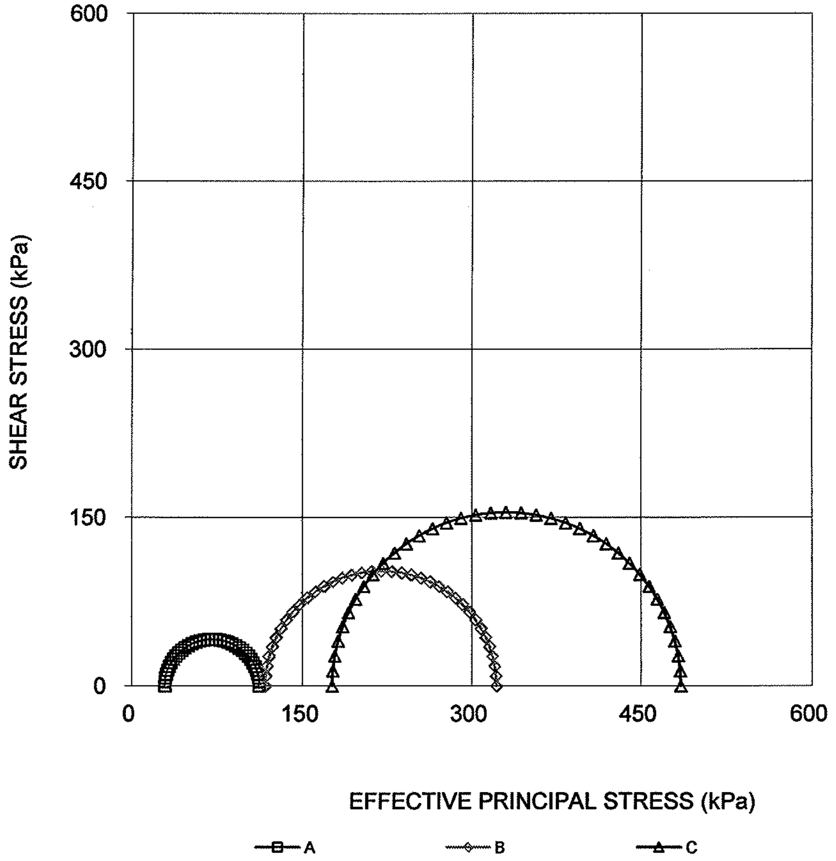
CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 2 OF 4

FIGURE

BH FTWR30 SA SH7



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Project No. 12-1183-0015

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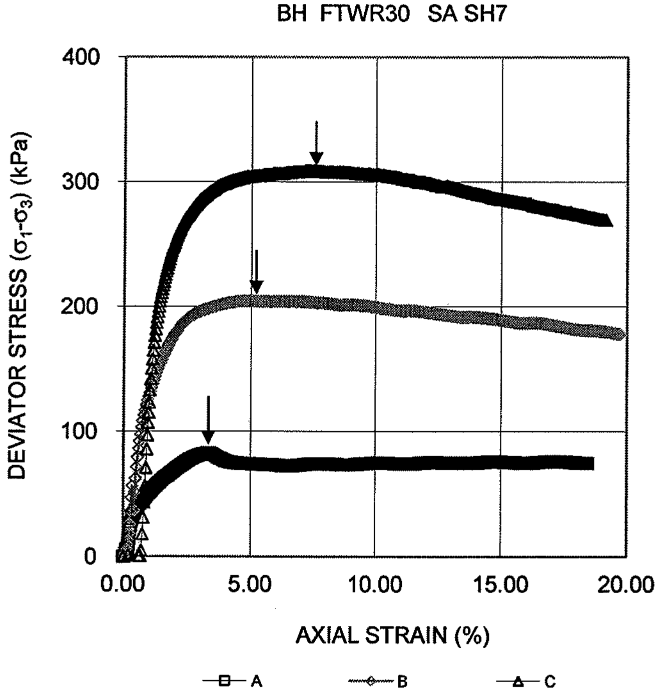
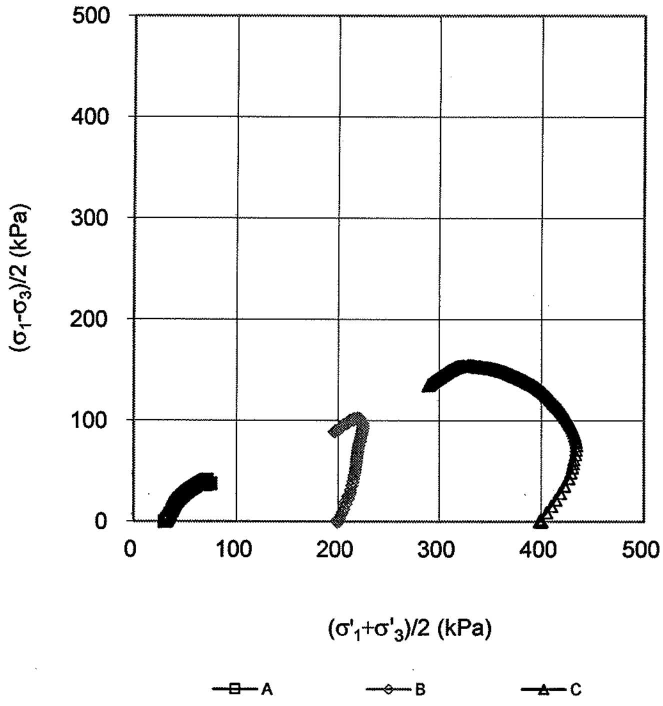
CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS SHEET 3 OF 4	FIGURE





Date: 3/25/2012
Project No. 12-1183-0015

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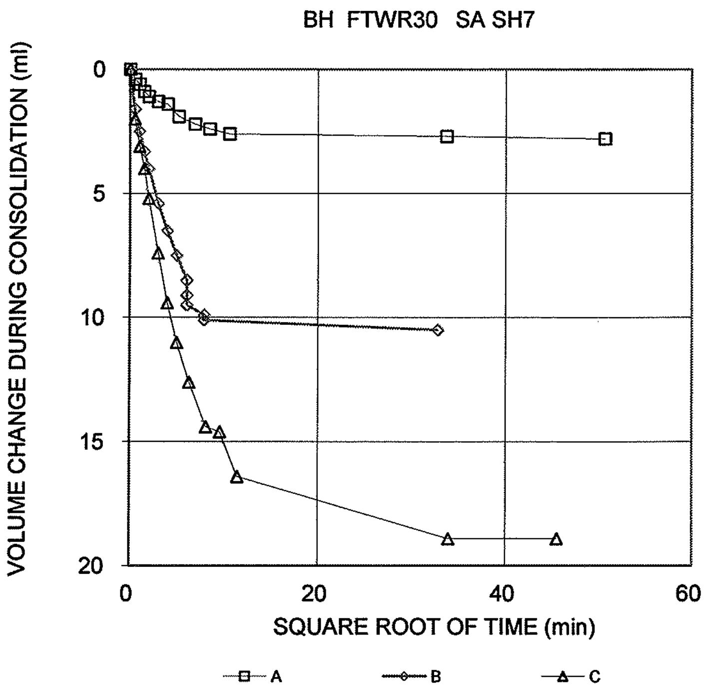
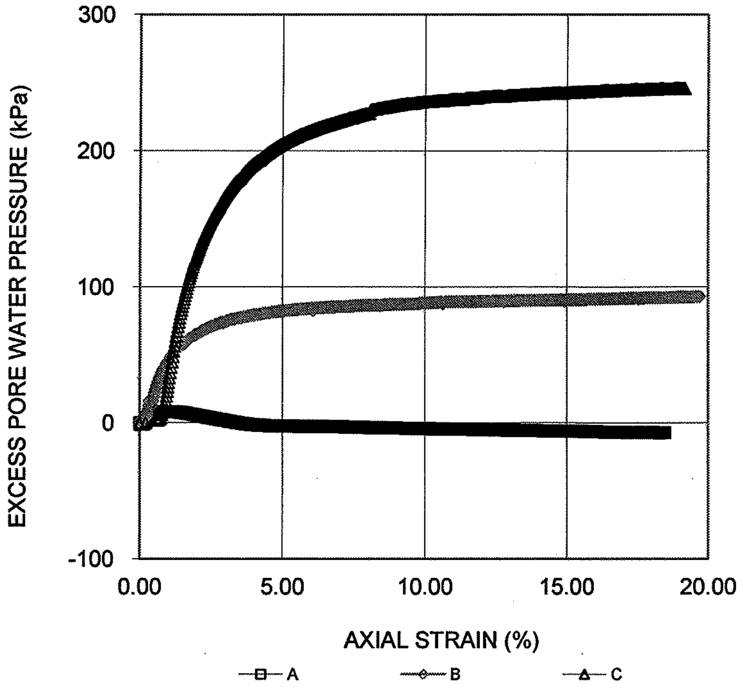
CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS SHEET 4 OF 4	FIGURE





Date: 3/25/2012
Project No. 12-1183-0015

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Prepared By LH
Checked By:

CONSOLIDATION TEST SUMMARY

FIGURE

SAMPLE IDENTIFICATION

Project Number	12-1183-0015	Sample Number	SH1
Borehole Number	FPP4	Sample Depth, m	6.1-6.7

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	9		
Date Started	2/20/2012		
Date Completed	2/29/2012		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m^3	20.55
Sample Diameter, cm	6.33	Dry Unit Weight, kN/m^3	16.72
Area, cm^2	31.43	Specific Gravity, measured	2.65
Volume, cm^3	59.65	Solids Height, cm	1.221
Water Content, %	22.89	Volume of Solids, cm^3	38.39
Wet Mass, g	125.02	Volume of Voids, cm^3	21.27
Dry Mass, g	101.73	Degree of Saturation, %	109.5

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	c_v cm^2/s	m_v m^2/kN	k cm/s
0.00	1.898	0.554	1.898				
6.45	1.917	0.570	1.908				
11.16	1.916	0.569	1.917	39	2.00E-02	1.12E-04	2.19E-07
20.99	1.913	0.566	1.915	577	1.35E-03	1.61E-04	2.12E-08
40.57	1.908	0.562	1.911	821	9.43E-04	1.35E-04	1.24E-08
79.70	1.896	0.552	1.902	759	1.01E-03	1.62E-04	1.60E-08
157.55	1.876	0.536	1.886	653	1.15E-03	1.35E-04	1.53E-08
312.94	1.852	0.516	1.864	673	1.09E-03	8.17E-05	8.76E-09
623.98	1.809	0.481	1.830	759	9.36E-04	7.27E-05	6.66E-09
1247.09	1.752	0.434	1.781	1070	6.28E-04	4.82E-05	2.97E-09
2497.28	1.679	0.375	1.715	778	8.02E-04	3.08E-05	2.42E-09
391.05	1.715	0.404	1.697				
99.09	1.751	0.434	1.733				
25.85	1.789	0.465	1.770				

Note:

k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

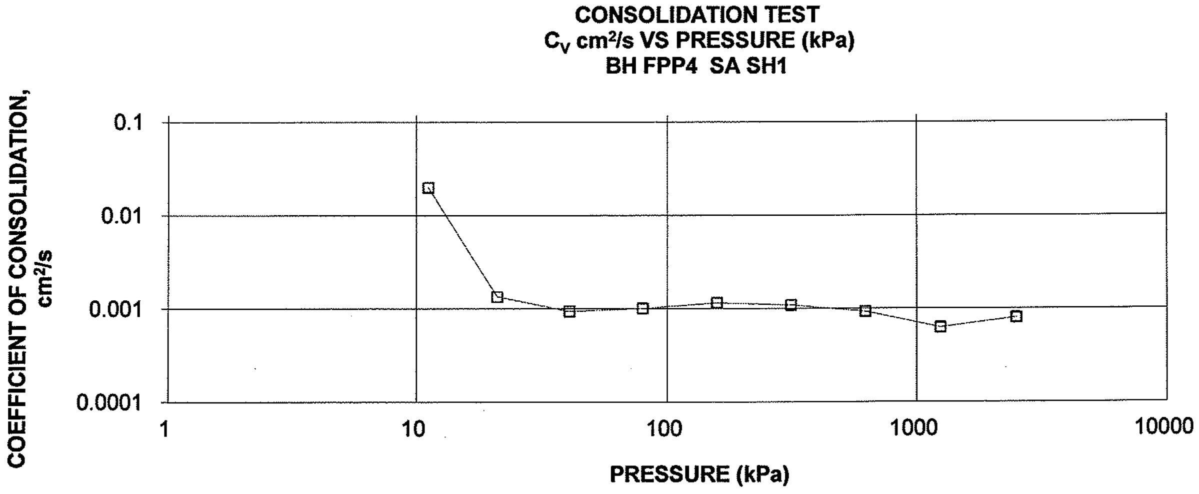
Sample Height, cm	1.79	Unit Weight, kN/m^3	21.34
Sample Diameter, cm	6.33	Dry Unit Weight, kN/m^3	17.74
Area, cm^2	31.43	Specific Gravity, measured	2.65
Volume, cm^3	56.23	Solids Height, cm	1.221
Water Content, %	20.30	Volume of Solids, cm^3	38.39
Wet Mass, g	122.38	Volume of Voids, cm^3	17.84
Dry Mass, g	101.73		

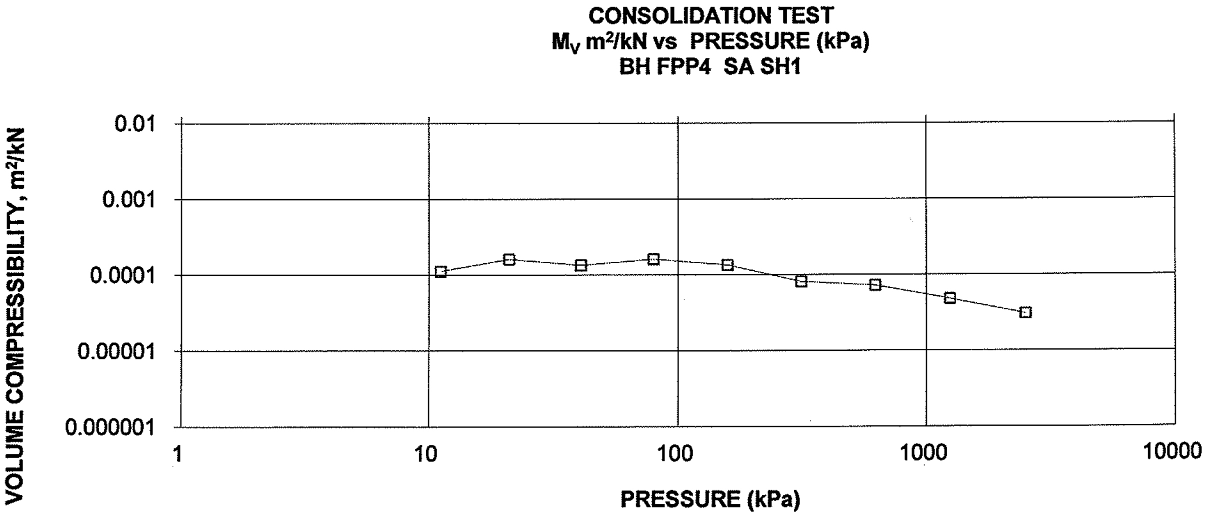
Prepared By: LFG

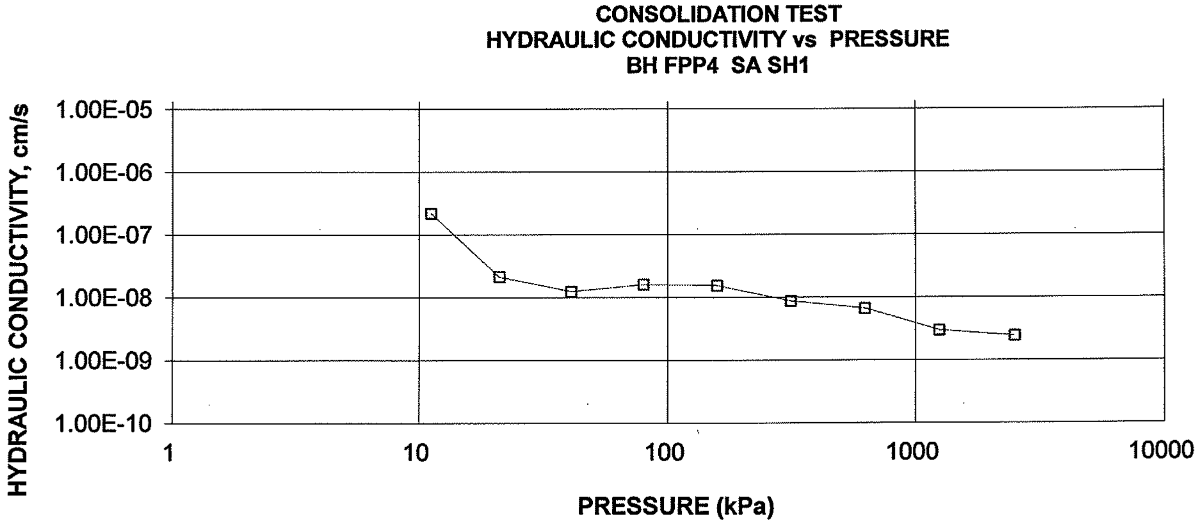
Golder Associates

Checked By:

CONSOLIDATION TEST SUMMARY	FIGURE







Project No. 12-1183-0015

Prepared By: LFG

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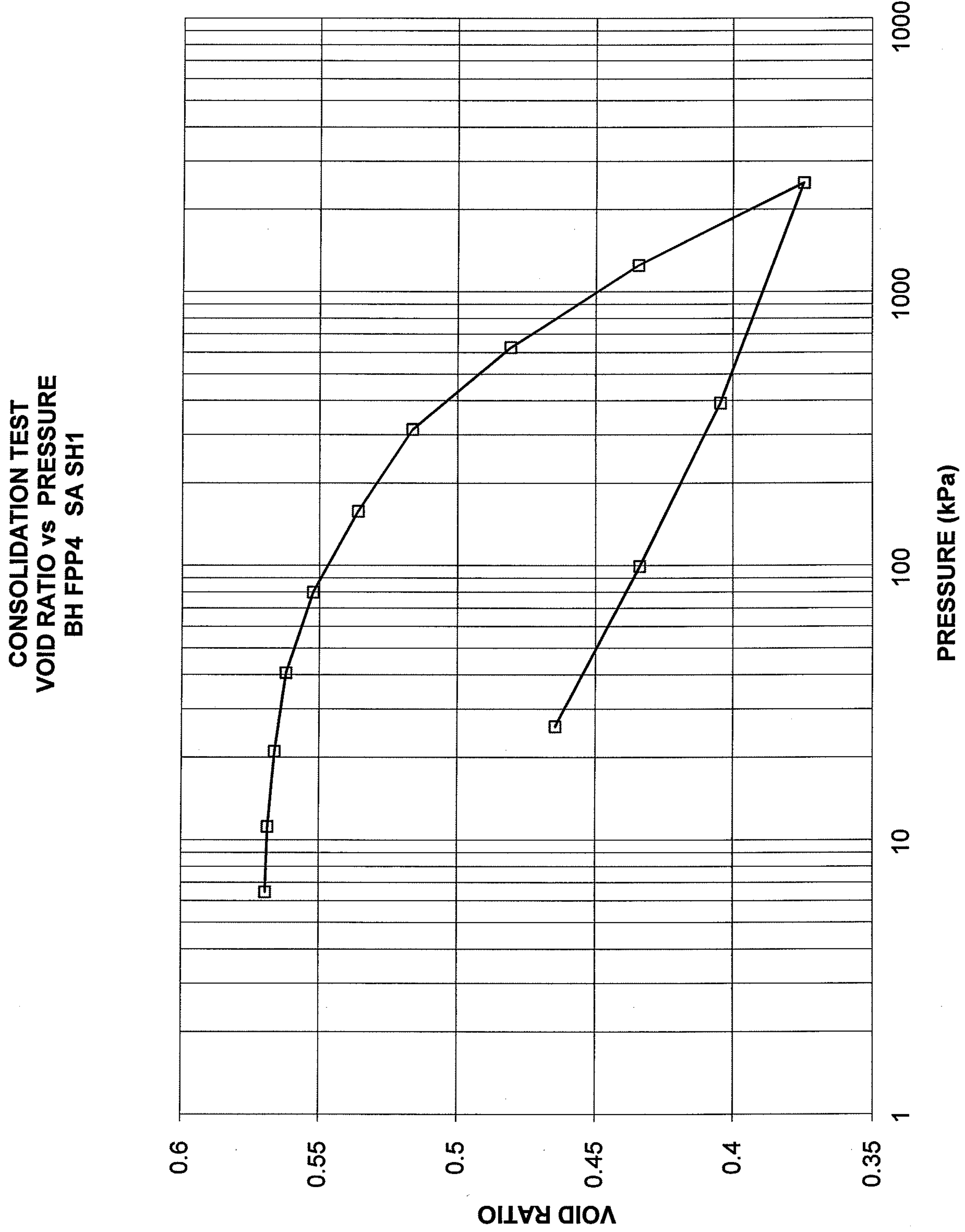
Checked By:

CONSOLIDATION TEST
VOID RATIO VS LOG PRESSURE

FIGURE



Project No. 12-1183-0015

Prepared By: LFG

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CONSOLIDATION TEST SUMMARY	FIGURE

SAMPLE IDENTIFICATION

Project Number	12-1183-0015	Sample Number	SH4
Borehole Number	FTWR11	Sample Depth, m	3.0-3.7

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	2		
Date Started	2/19/2012		
Date Completed	3/02/2012		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.54	Unit Weight, kN/m^3	20.24
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	16.53
Area, cm^2	31.58	Specific Gravity, measured	2.67
Volume, cm^3	80.09	Solids Height, cm	1.601
Water Content, %	22.47	Volume of Solids, cm^3	50.55
Wet Mass, g	165.31	Volume of Voids, cm^3	29.53
Dry Mass, g	134.98	Degree of Saturation, %	102.7

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	c_v cm^2/s	m_v m^2/kN	k cm/s
0.00	2.536	0.584	2.536				
6.12	2.535	0.584	2.536				
10.98	2.535	0.584	2.535				
20.72	2.535	0.584	2.535	27	5.05E-02		
40.20	2.531	0.581	2.533	156	8.72E-03	8.10E-05	6.92E-08
79.01	2.523	0.576	2.527	673	2.01E-03	8.28E-05	1.63E-08
156.42	2.506	0.565	2.514	1098	1.22E-03	8.58E-05	1.03E-08
312.19	2.458	0.535	2.482	1500	8.70E-04	1.23E-04	1.05E-08
622.22	2.411	0.506	2.434	1098	1.14E-03	5.86E-05	6.58E-09
1242.85	2.345	0.465	2.378	1370	8.75E-04	4.25E-05	3.64E-09
2481.97	2.270	0.418	2.307	1622	6.96E-04	2.36E-05	1.61E-09
389.79	2.322	0.451	2.296				
98.32	2.376	0.484	2.349				
25.42	2.419	0.511	2.398				

Note:

k calculated using cv based on t_{90} values.

Specimen swelled under 20.7kPa

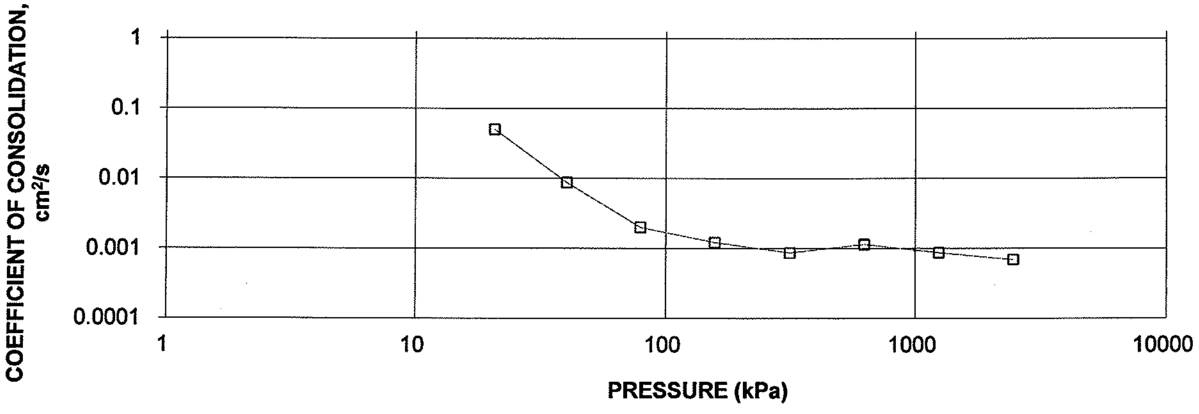
SAMPLE DIMENSIONS AND PROPERTIES - FINAL

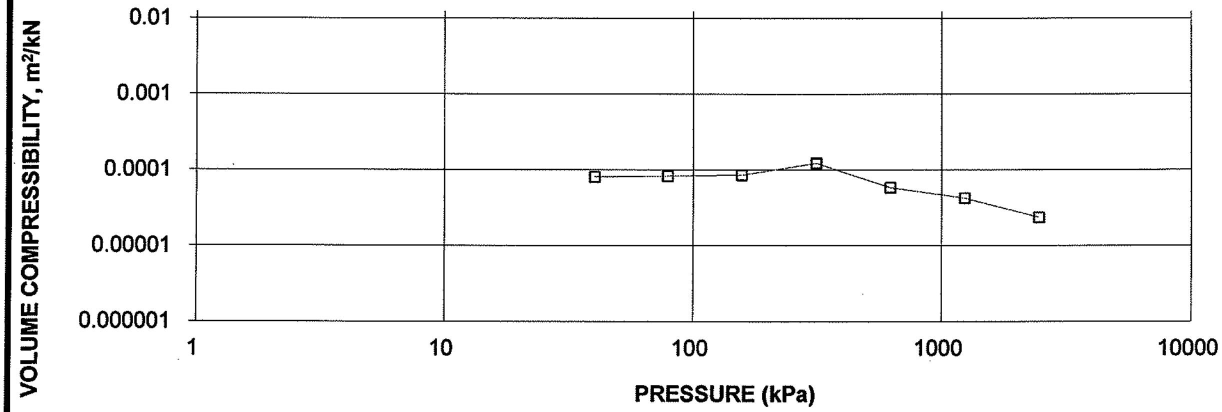
Sample Height, cm	2.42	Unit Weight, kN/m^3	21.11
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	17.33
Area, cm^2	31.58	Specific Gravity, measured	2.67
Volume, cm^3	76.39	Solids Height, cm	1.601
Water Content, %	21.80	Volume of Solids, cm ^{3}	50.55
Wet Mass, g	164.41	Volume of Voids, cm ^{3}	25.83
Dry Mass, g	134.98		

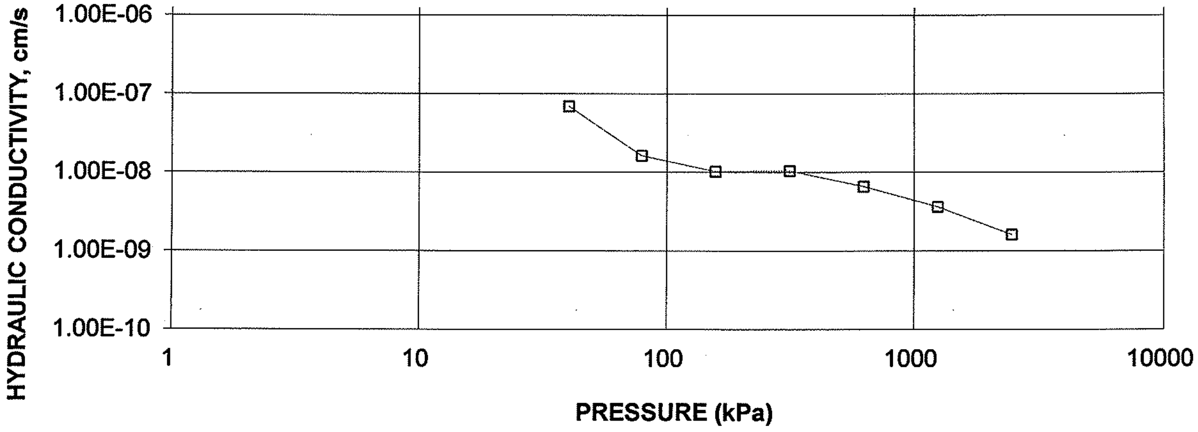
Prepared By: LFG **Golder Associates** Checked By: MU

CONSOLIDATION TEST SUMMARY

FIGURE


CONSOLIDATION TEST
C_V cm²/s VS PRESSURE (kPa)
BH FTWR11 SA SH4


CONSOLIDATION TEST
M_V m²/kN vs PRESSURE (kPa)
BH FTWR11 SA SH4


CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH FTWR11 SA SH4

Project No. 12-1183-0015

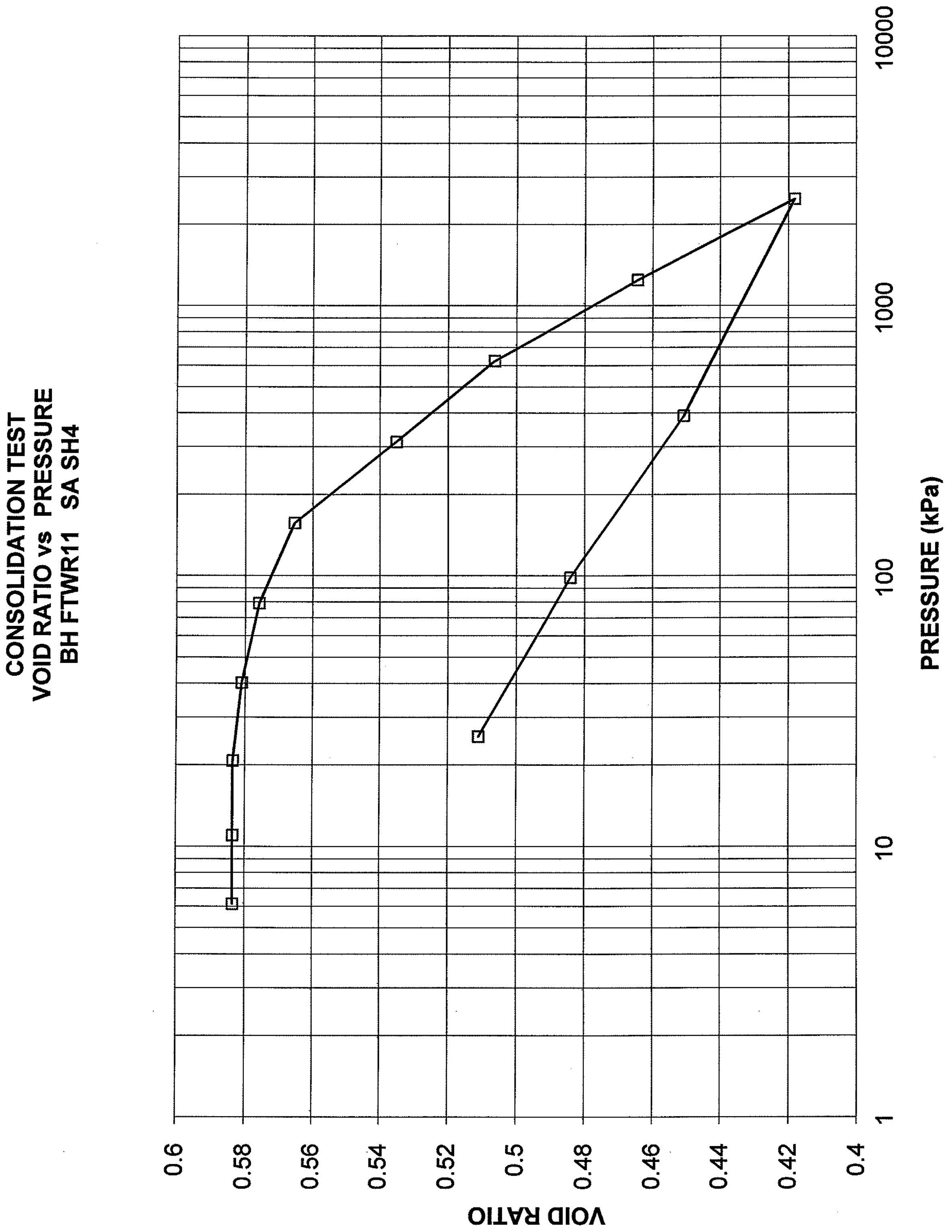
Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST
VOID RATIO VS LOG PRESSURE

FIGURE



CONSOLIDATION TEST
VOID RATIO vs PRESSURE
BH FTWR11 SA SH4

Project No. 12-1183-0015

Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST SUMMARY

FIGURE

SAMPLE IDENTIFICATION

Project Number	12-1183-0015	Sample Number	SH1
Borehole Number	FTWR12	Sample Depth, m	3.0-3.7

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	6		
Date Started	2/20/2012		
Date Completed	3/16/2012		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m^3	8.01
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	1.30
Area, cm^2	31.55	Specific Gravity, measured	1.65
Volume, cm^3	59.88	Solids Height, cm	0.152
Water Content, %	516.71	Volume of Solids, cm^3	4.81
Wet Mass, g	48.93	Volume of Voids, cm^3	55.07
Dry Mass, g	7.934	Degree of Saturation, %	74.4

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	c_v cm^2/s	m_v m^2/kN	k cm/s
0.00	1.898	11.453	1.898				
5.86	1.792	10.758	1.845	923	7.82E-04	9.52E-03	7.30E-07
10.67	1.690	10.091	1.741	254	2.53E-03	1.11E-02	2.76E-06
20.66	1.535	9.072	1.613	807	6.83E-04	8.19E-03	5.48E-07
40.12	1.357	7.906	1.446	628	7.06E-04	4.81E-03	3.33E-07
78.90	1.150	6.543	1.253	427	7.80E-04	2.82E-03	2.16E-07
156.46	0.908	4.960	1.029	501	4.48E-04	1.64E-03	7.19E-08
311.99	0.709	3.650	0.809	360	3.85E-04	6.76E-04	2.55E-08
622.31	0.561	2.678	0.635	305	2.80E-04	2.52E-04	6.90E-09
1243.22	0.450	1.952	0.505	279	1.94E-04	9.38E-05	1.78E-09
2482.47	0.368	1.414	0.409	279	1.27E-04	3.49E-05	4.34E-10
399.38	0.474	2.110	0.421				
98.09	0.604	2.960	0.539				
25.50	0.729	3.784	0.666				

Note:

k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

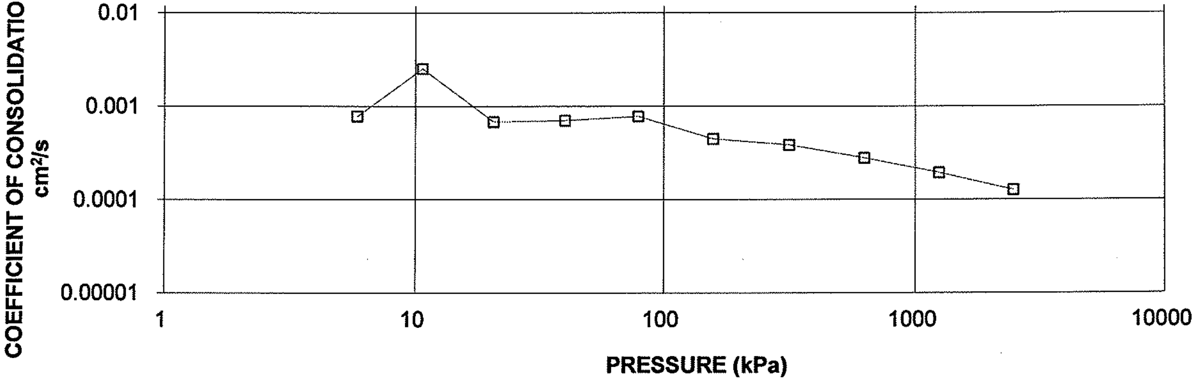
Sample Height, cm	0.73	Unit Weight, kN/m^3	12.28
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	3.38
Area, cm^2	31.55	Specific Gravity, measured	1.65
Volume, cm^3	23.01	Solids Height, cm	0.152
Water Content, %	262.99	Volume of Solids, cm ^{3}	4.81
Wet Mass, g	28.80	Volume of Voids, cm ^{3}	18.20
Dry Mass, g	7.934		

Prepared By: LFG

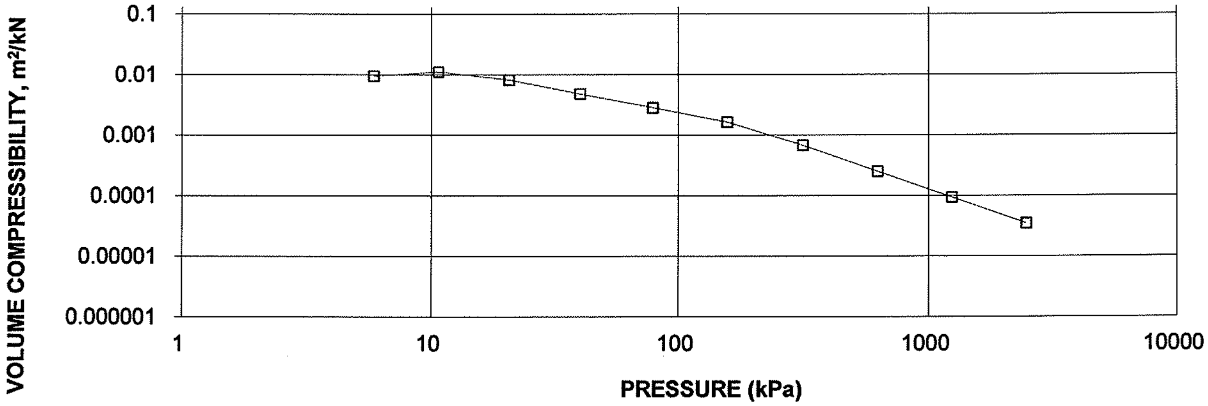
Golder Associates

Checked By:

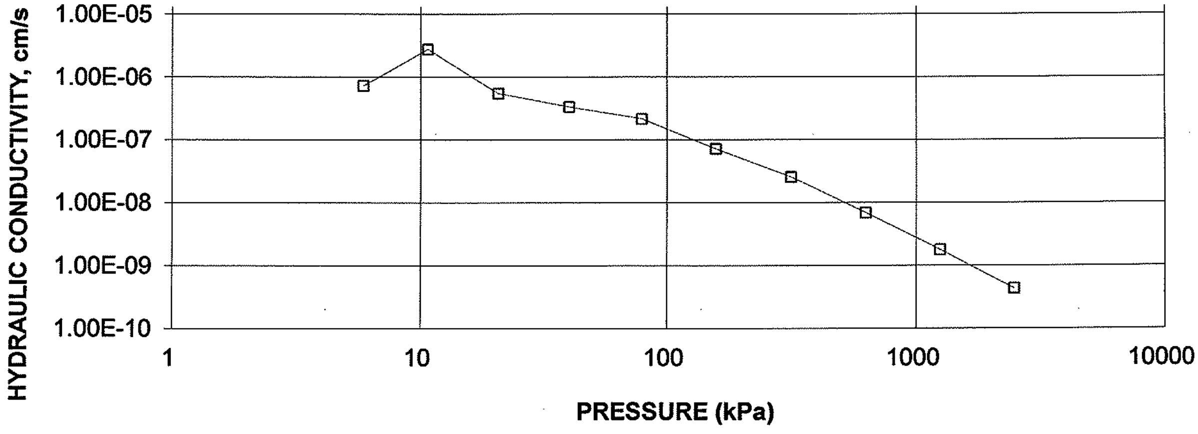
CONSOLIDATION TEST SUMMARY	FIGURE



CONSOLIDATION TEST
C_V cm²/s VS PRESSURE (kPa)
BH FTWR12 SA SH1



CONSOLIDATION TEST
M_V m²/kN vs PRESSURE (kPa)
BH FTWR12 SA SH1



CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH FTWR12 SA SH1

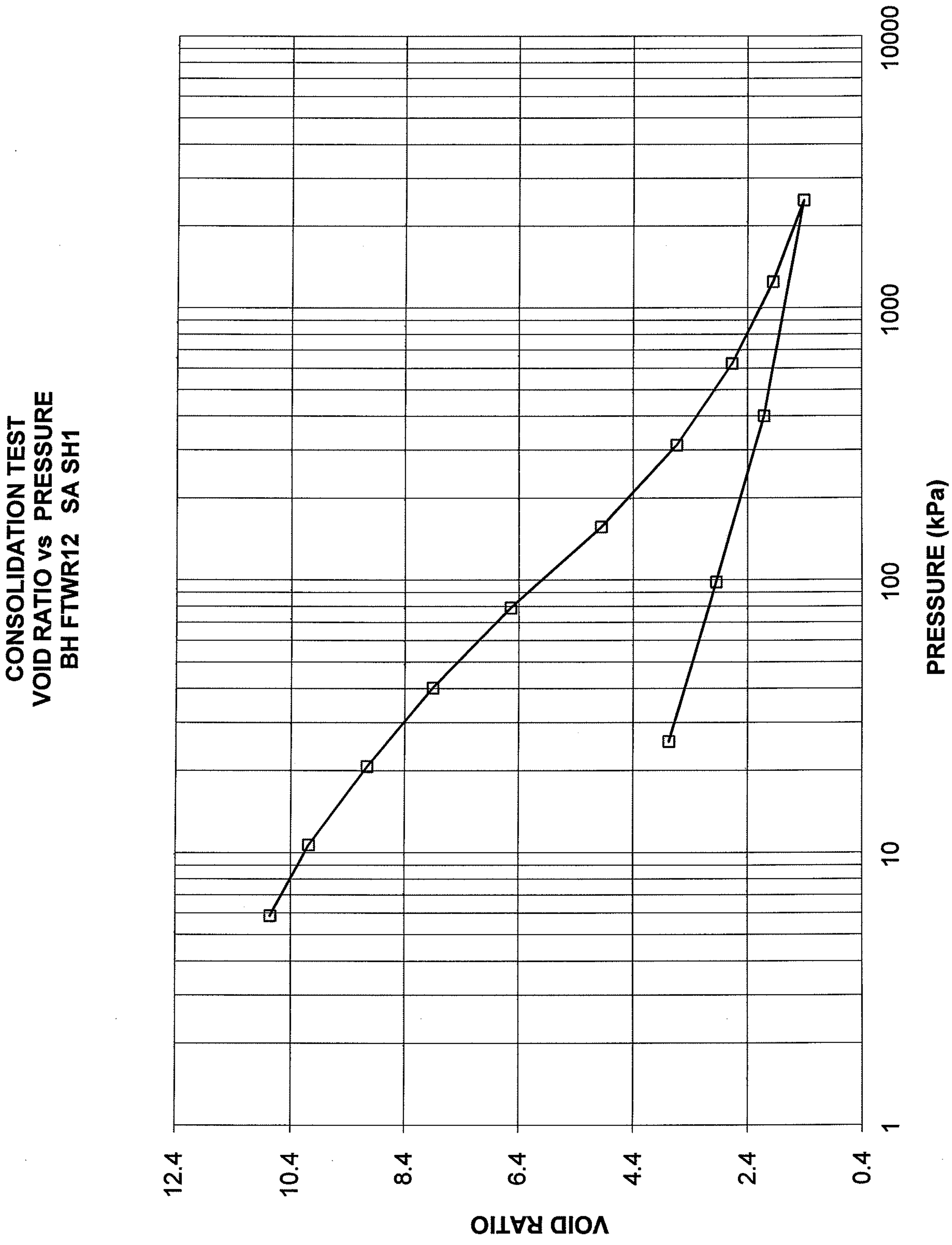
Project No. 12-1183-0015
Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST
VOID RATIO VS LOG PRESSURE

FIGURE


CONSOLIDATION TEST
VOID RATIO vs PRESSURE
BH FTWR12 SA SH1

Project No. 12-1183-0015

Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST SUMMARY

FIGURE

SAMPLE IDENTIFICATION

Project Number	12-1183-0015	Sample Number	SH6
Borehole Number	FTWR14	Sample Depth, m	19.8-20.4

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	5		
Date Started	2/20/2012		
Date Completed	3/6/2012		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	1.90	Unit Weight, kN/m^3	16.99
Sample Diameter, cm	6.33	Dry Unit Weight, kN/m^3	2.80
Area, cm^2	31.47	Specific Gravity, measured	2.67
Volume, cm^3	59.79	Solids Height, cm	0.812
Water Content, %	51.88	Volume of Solids, cm^3	25.55
Wet Mass, g	103.61	Volume of Voids, cm^3	34.24
Dry Mass, g	68.22	Degree of Saturation, %	103.4

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	c_v cm^2/s	m_v m^2/kN	k cm/s
0.00	1.900	1.340	1.900				
5.94	1.899	1.339	1.900	1	7.65E-01	7.18E-05	5.38E-06
10.67	1.898	1.338	1.899	36	2.12E-02	1.44E-04	2.99E-07
20.53	1.894	1.333	1.896	1500	5.08E-04	2.19E-04	1.09E-08
40.29	1.882	1.318	1.888	759	9.95E-04	3.20E-04	3.12E-08
79.17	1.863	1.294	1.872	735	1.01E-03	2.59E-04	2.56E-08
156.71	1.824	1.246	1.843	712	1.01E-03	2.64E-04	2.62E-08
310.66	1.747	1.151	1.785	1307	5.17E-04	2.64E-04	1.34E-08
621.85	1.539	0.896	1.643	4335	1.32E-04	3.51E-04	4.54E-09
1244.18	1.403	0.728	1.471	2306	1.99E-04	1.16E-04	2.25E-09
2487.48	1.290	0.588	1.346	1188	3.23E-04	4.78E-05	1.52E-09
390.52	1.389	0.711	1.339				
98.54	1.443	0.777	1.416				
25.32	1.531	0.886	1.487				

Note:
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	1.53	Unit Weight, kN/m^3	18.86
Sample Diameter, cm	6.33	Dry Unit Weight, kN/m^3	13.89
Area, cm^2	31.47	Specific Gravity, measured	2.67
Volume, cm^3	48.18	Solids Height, cm	0.812
Water Content, %	35.80	Volume of Solids, cm ^{3}	25.55
Wet Mass, g	92.64	Volume of Voids, cm ^{3}	22.63
Dry Mass, g	68.22		

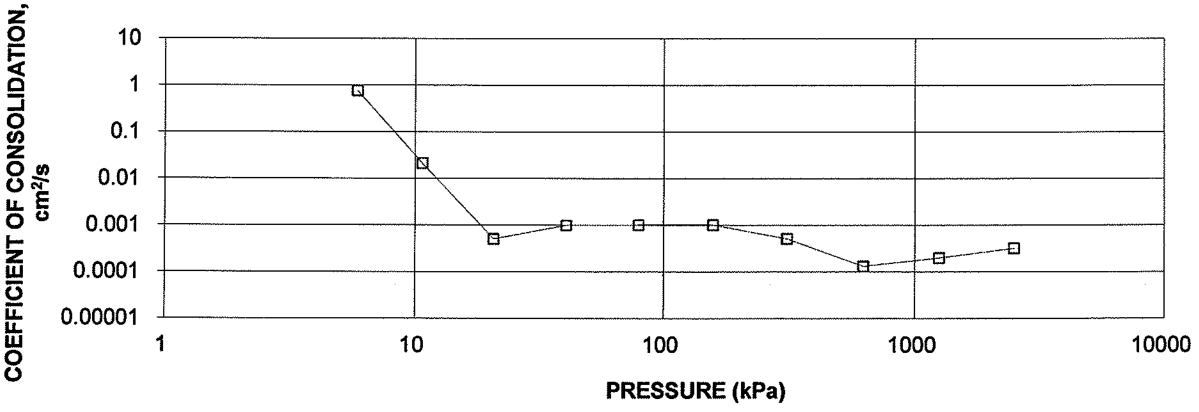
Prepared By: LFG

Golder Associates

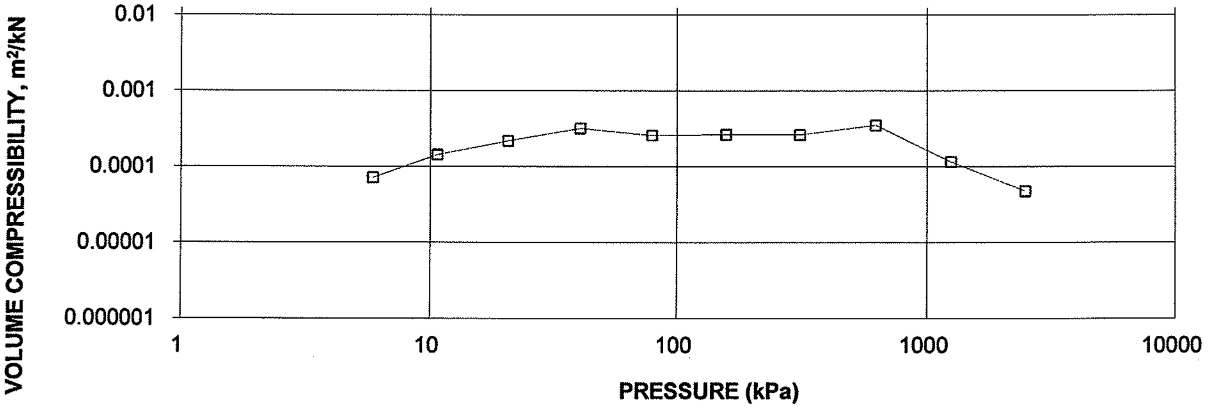
Checked By:

CONSOLIDATION TEST SUMMARY	FIGURE

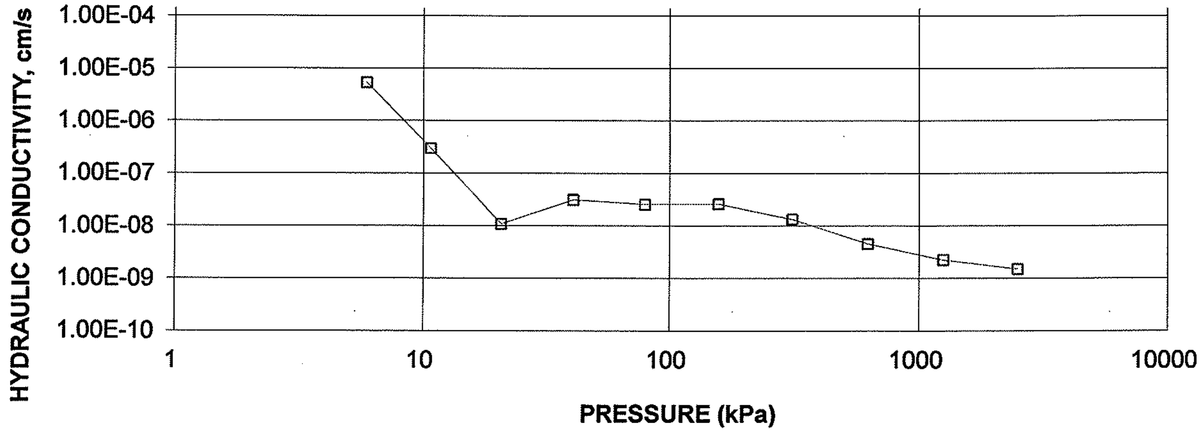
CONSOLIDATION TEST
C_V cm²/s VS PRESSURE (kPa)
BH FTWR14 SA SH6



CONSOLIDATION TEST
M_V m²/kN vs PRESSURE (kPa)
BH FTWR14 SA SH6



CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH FTWR14 SA SH6



Project No. 12-1183-0015

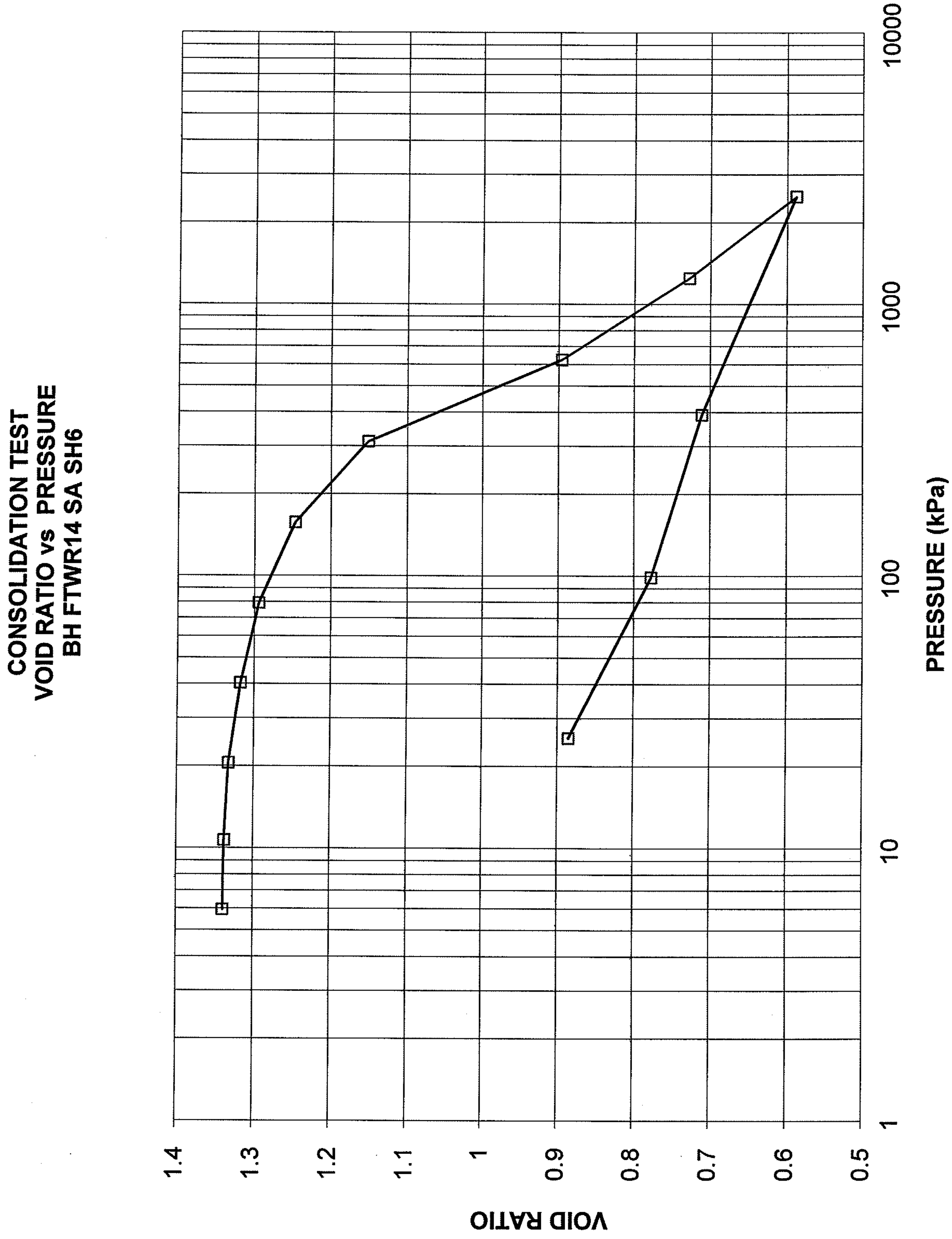
Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST
VOID RATIO VS LOG PRESSURE

FIGURE



Project No. 12-1183-0015

Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST SUMMARY

FIGURE

SAMPLE IDENTIFICATION

Project Number	12-1183-0015	Sample Number	SH3
Borehole Number	FTWR30	Sample Depth, m	3.5-4.1

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	12		
Date Started	2/19/2012		
Date Completed	3/03/2012		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.55	Unit Weight, kN/m^3	19.73
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	15.85
Area, cm^2	31.58	Specific Gravity, measured	2.68
Volume, cm^3	80.46	Solids Height, cm	1.537
Water Content, %	24.51	Volume of Solids, cm^3	48.53
Wet Mass, g	161.92	Volume of Voids, cm^3	31.94
Dry Mass, g	130.05	Degree of Saturation, %	99.8

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	c_v cm^2/s	m_v m^2/kN	k cm/s
0.00	2.548	0.658	2.548				
5.93	2.547	0.657	2.547	7	1.97E-01	8.60E-05	1.66E-06
10.79	2.545	0.656	2.546	49	2.80E-02	1.37E-04	3.77E-07
20.77	2.543	0.655	2.544	554	2.48E-03	9.83E-05	2.39E-08
39.96	2.533	0.648	2.538	778	1.75E-03	1.98E-04	3.41E-08
78.83	2.515	0.637	2.524	831	1.63E-03	1.77E-04	2.81E-08
156.34	2.485	0.617	2.500	277	4.78E-03	1.56E-04	7.31E-08
311.26	2.429	0.581	2.457	267	4.79E-03	1.41E-04	6.63E-08
621.71	2.373	0.544	2.401	807	1.51E-03	7.02E-05	1.04E-08
1241.66	2.301	0.497	2.337	1058	1.09E-03	4.60E-05	4.94E-09
2484.29	2.222	0.446	2.261	1084	1.00E-03	2.48E-05	2.43E-09
388.87	2.254	0.467	2.238				
98.38	2.295	0.493	2.275				
25.47	2.333	0.518	2.314				

Note:

k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	2.33	Unit Weight, kN/m^3	21.26
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	17.31
Area, cm^2	31.58	Specific Gravity, measured	2.68
Volume, cm^3	73.66	Solids Height, cm	1.537
Water Content, %	22.80	Volume of Solids, cm^3	48.53
Wet Mass, g	159.70	Volume of Voids, cm^3	25.13
Dry Mass, g	130.05		

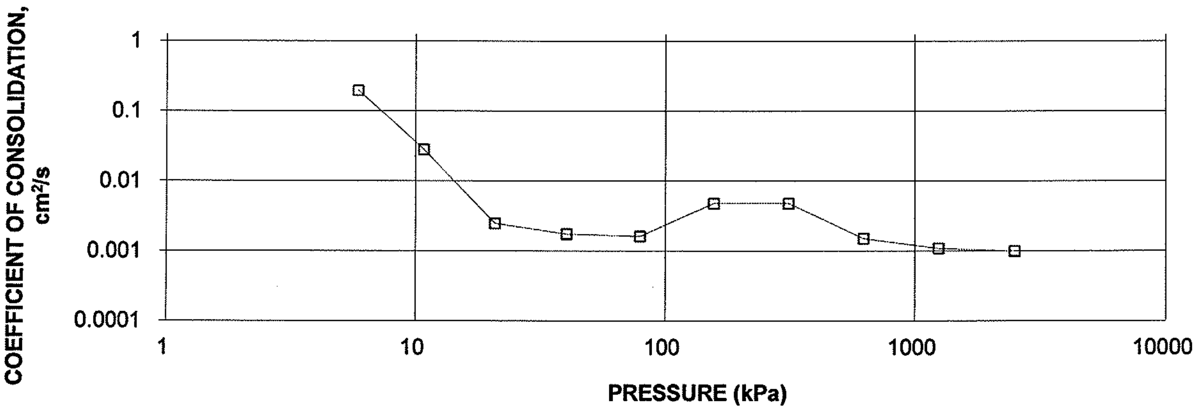
Prepared By: LFG

Golder Associates

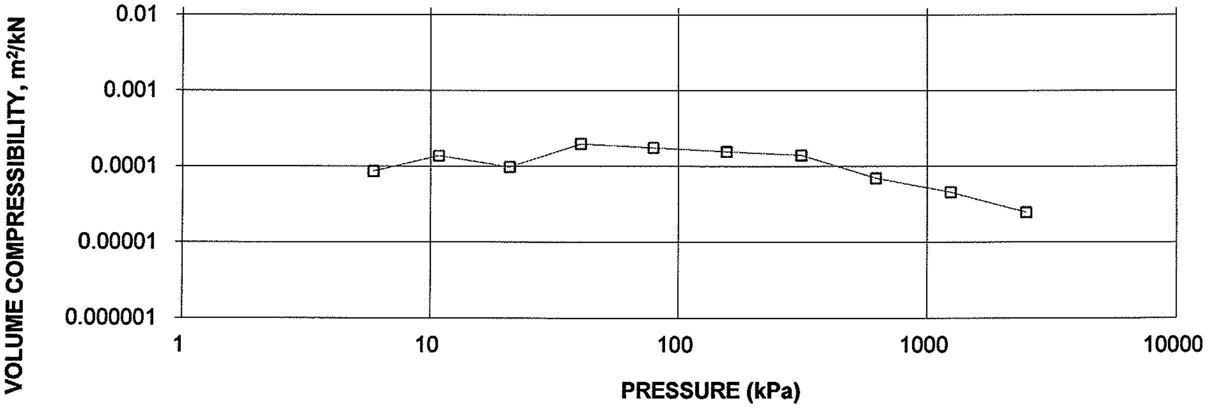
Checked By:

CONSOLIDATION TEST SUMMARY

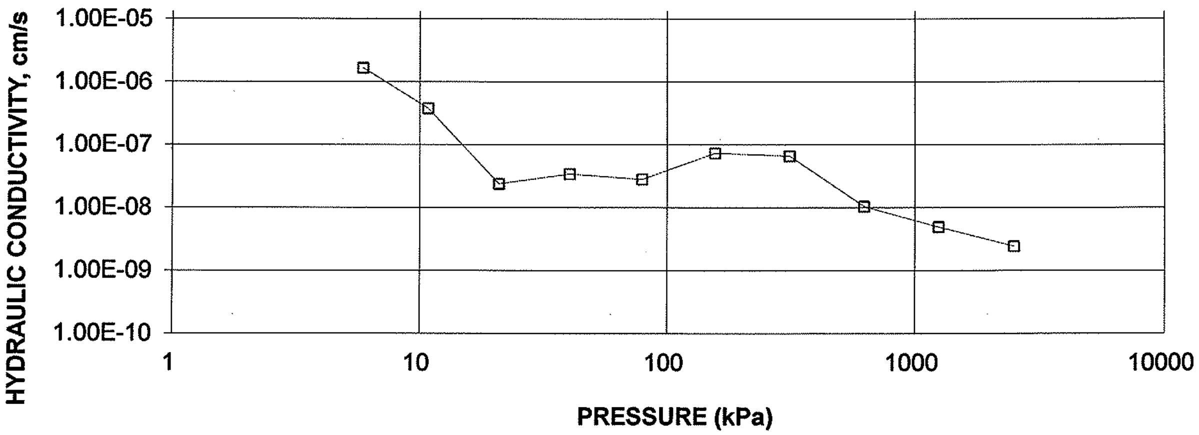
FIGURE



CONSOLIDATION TEST
C_V cm^2/s VS PRESSURE (kPa)
BH FTWR30 SA SH3



CONSOLIDATION TEST
M_V m^2/kN vs PRESSURE (kPa)
BH FTWR30 SA SH3



CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH FTWR30 SA SH3

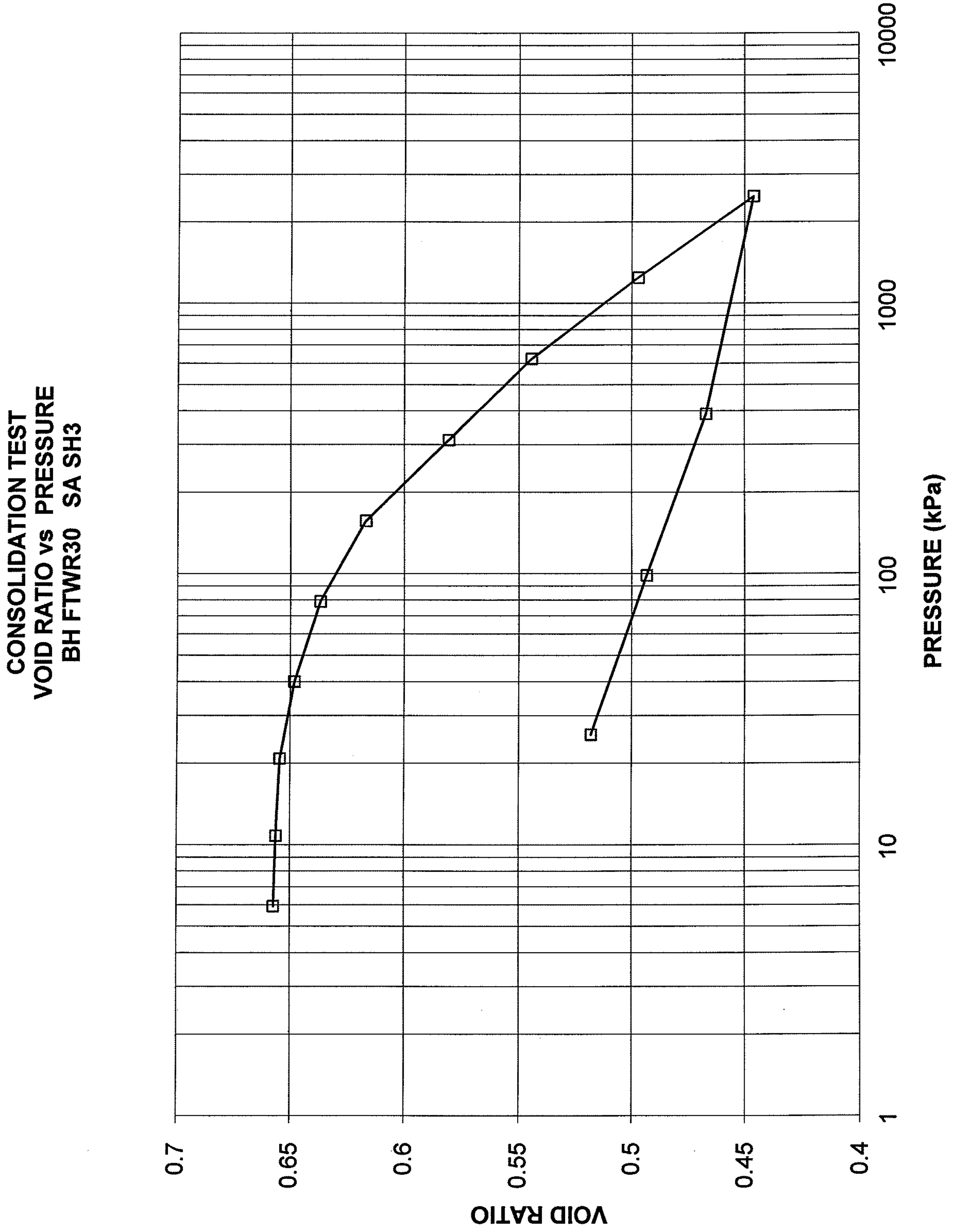
Project No. 12-1183-0015
Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST
VOID RATIO VS LOG PRESSURE

FIGURE


CONSOLIDATION TEST
VOID RATIO vs PRESSURE
BH FTWR30 SA SH3

Project No. 12-1183-0015

Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST SUMMARY

FIGURE

SAMPLE IDENTIFICATION

Project Number	12-1183-0015	Sample Number	SH7
Borehole Number	FTWR30	Sample Depth, m	8.5-9.1

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	10		
Date Started	2/19/2012		
Date Completed	3/03/2012		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.54	Unit Weight, kN/m^3	18.88
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	14.49
Area, cm^2	31.53	Specific Gravity, measured	2.67
Volume, cm^3	80.02	Solids Height, cm	1.404
Water Content, %	30.31	Volume of Solids, cm^3	44.28
Wet Mass, g	154.05	Volume of Voids, cm^3	35.75
Dry Mass, g	118.22	Degree of Saturation, %	100.2

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	c_v cm^2/s	m_v m^2/kN	k cm/s
0.00	2.538	0.807	2.538				
6.00	2.528	0.800	2.533	53	2.57E-02	6.44E-04	1.62E-06
10.80	2.522	0.796	2.525	343	3.94E-03	4.93E-04	1.90E-07
20.59	2.514	0.790	2.518	1017	1.32E-03	3.18E-04	4.12E-08
40.09	2.489	0.772	2.501	1370	9.68E-04	5.21E-04	4.95E-08
78.95	2.460	0.751	2.474	1815	7.15E-04	2.93E-04	2.05E-08
156.57	2.418	0.722	2.439	1278	9.87E-04	2.10E-04	2.03E-08
311.74	2.352	0.675	2.385	1534	7.86E-04	1.69E-04	1.30E-08
622.27	2.236	0.593	2.294	2146	5.20E-04	1.46E-04	7.44E-09
1245.09	2.108	0.501	2.172	2381	4.20E-04	8.11E-05	3.34E-09
2488.90	1.992	0.418	2.050	1591	5.60E-04	3.68E-05	2.02E-09
389.46	2.040	0.453	2.016				
98.32	2.097	0.493	2.068				
25.37	2.164	0.541	2.131				

Note:

k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	2.16	Unit Weight, kN/m^3	21.36
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	16.99
Area, cm^2	31.53	Specific Gravity, measured	2.67
Volume, cm^3	68.24	Solids Height, cm	1.404
Water Content, %	25.70	Volume of Solids, cm^3	44.28
Wet Mass, g	148.60	Volume of Voids, cm^3	23.96
Dry Mass, g	118.22		

Prepared By: LFG

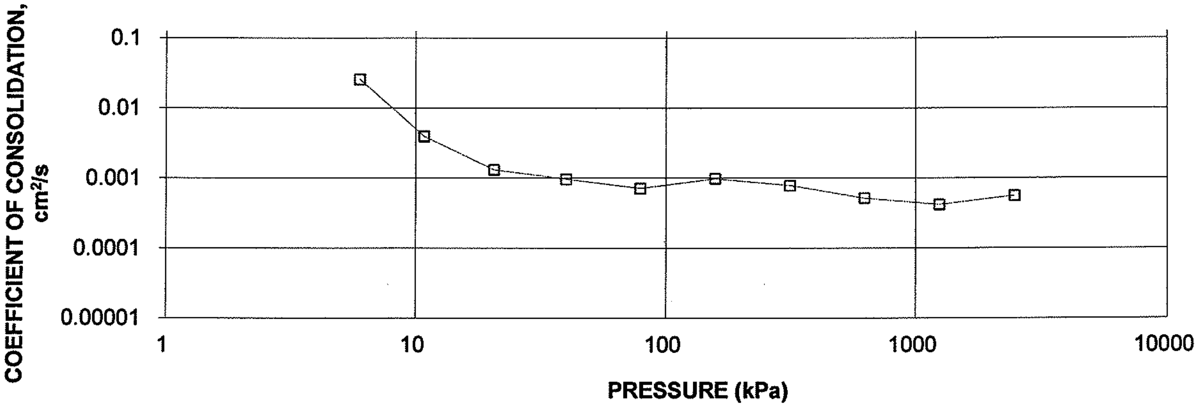
Golder Associates

Checked By:

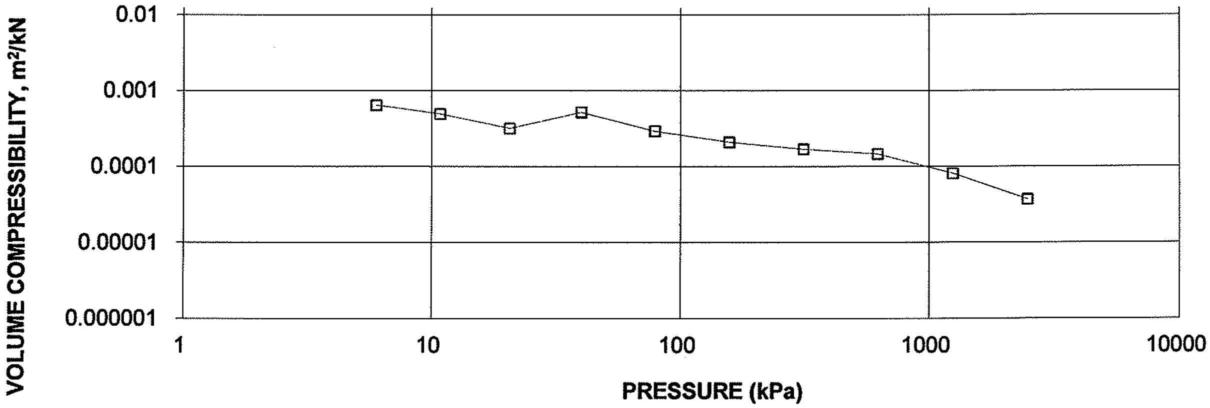
CONSOLIDATION TEST SUMMARY

FIGURE

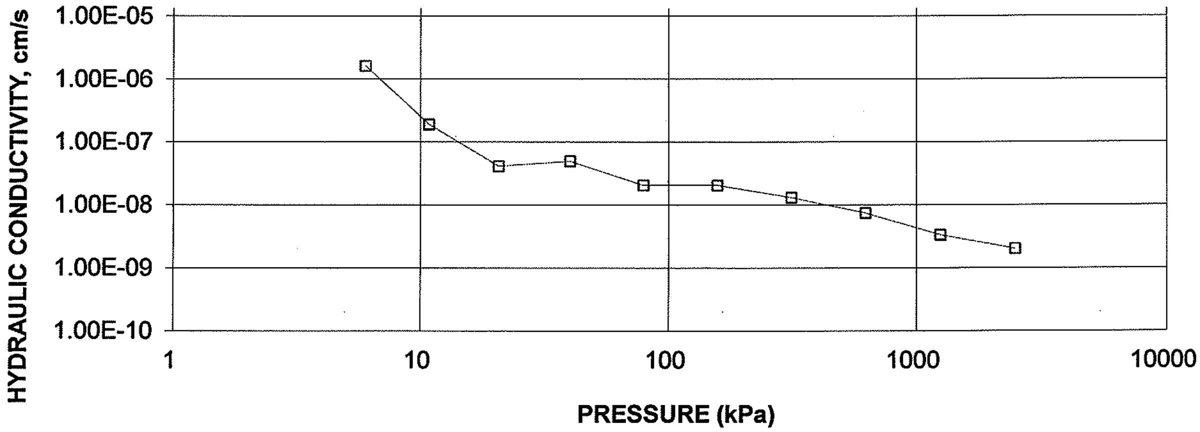
CONSOLIDATION TEST
C_V cm²/s VS PRESSURE (kPa)
BH FTWR30 SA SH7



CONSOLIDATION TEST
M_V m²/kN vs PRESSURE (kPa)
BH FTWR30 SA SH7



CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
BH FTWR30 SA SH7



Project No. 12-1183-0015

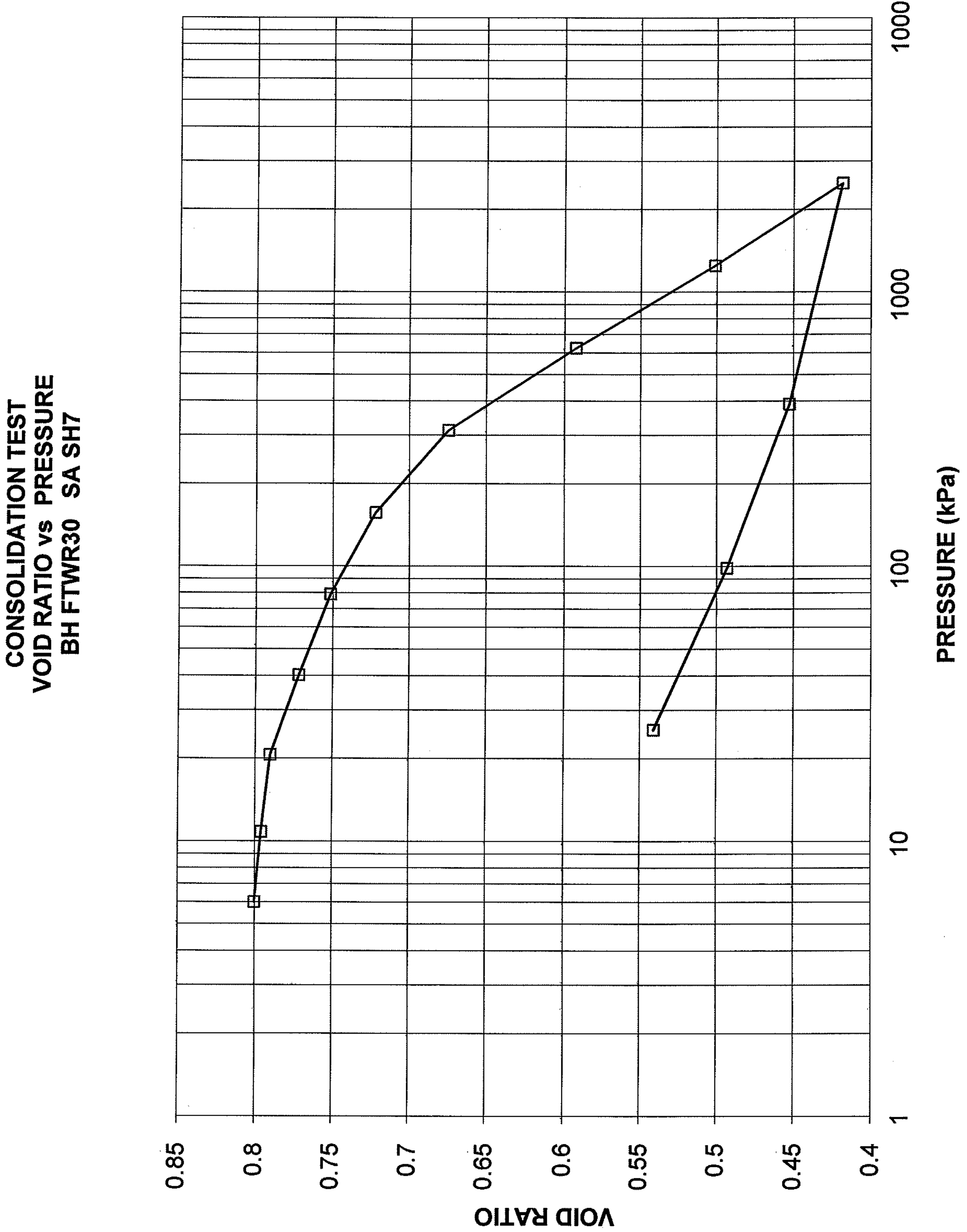
Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST
VOID RATIO VS LOG PRESSURE

FIGURE



Project No. 12-1183-0015

Prepared By: LFG

Golder Associates

Checked By:

H-2

Geotechnical Laboratory Results – Part 2

Golder Associates

June 25, 2012

Project No. 12-1183-0015

Jeremy Haynes
Foth Infrastructure & Environment, LLC
14 Corporate Woods, Suite 650
8717 West 110th Street
Overland Park, Kansas
66210

RE: GEOTECHNICAL LABORATORY TESTING

Dear Sir

This letter reports the results of laboratory testing carried out on the samples received at our office in Mississauga. The results of the tests are summarized in the attached tables and figures.

The testing services reported herein have been performed in accordance with the indicated recognized standard, unless noted otherwise. This report is for the sole use of the designated client. This report constitutes a testing service only and does not represent any results interpretation or opinion regarding specification compliance or material suitability.

We trust that the results are sufficient for your current requirements. If you have any questions, please do not hesitate to call us.

Yours truly

GOLDER ASSOCIATES LTD.

Marijana Manojlovic

Marijana Manojlovic
Laboratory Manager

MM/lg

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Golder Associates: Operations in Africa, Asia, Australasia, Europe, North America and South America

CONSOLIDATION TEST SUMMARY

FIGURE

SAMPLE IDENTIFICATION

Project Number	12-1183-0015	Bag Number	1
Sample Number	FCD11-BS01	Sample Depth, m	2.0

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	11		
Date Started	5/01/2012		
Date Completed	5/15/2012		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.55	Unit Weight, kN/m^3	19.06
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	15.30
Area, cm^2	31.60	Specific Gravity, measured	2.76
Volume, cm^3	80.42	Solids Height, cm	1.438
Water Content, %	24.62	Volume of Solids, cm^3	45.45
Wet Mass, g	156.34	Volume of Voids, cm^3	34.97
Dry Mass, g	125.45	Degree of Saturation, %	88.3

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	c_v cm^2/s	m_v m^2/kN	k cm/s
0.00	2.545	0.769	2.545				
6.05	2.542	0.767	2.543	277	4.95E-03	2.01E-04	9.77E-08
10.70	2.531	0.760	2.536	6970	1.96E-04	9.30E-04	1.78E-08
20.75	2.513	0.747	2.522	3197	4.22E-04	7.04E-04	2.91E-08
39.99	2.479	0.723	2.496	1848	7.15E-04	6.94E-04	4.86E-08
78.89	2.432	0.691	2.455	1949	6.56E-04	4.76E-04	3.06E-08
156.31	2.363	0.643	2.397	1567	7.77E-04	3.51E-04	2.67E-08
310.92	2.282	0.586	2.322	1370	8.35E-04	2.06E-04	1.68E-08
620.15	2.194	0.525	2.238	1882	5.64E-04	1.12E-04	6.19E-09
1239.90	2.110	0.467	2.152	1162	8.45E-04	5.30E-05	4.39E-09
2479.93	2.032	0.413	2.071	1135	8.01E-04	2.48E-05	1.95E-09
1239.90	2.038	0.417	2.035				
310.92	2.070	0.439	2.054				
78.89	2.112	0.468	2.091				
20.75	2.145	0.491	2.128				
6.05	2.165	0.505	2.155				

Note:

Specimen compacted as per client's instruction, at target dry density of 1.6Mg/m^3 and water content of 22.8%.
Consolidation loading and unloading schedule asigned by the client.
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	2.17	Unit Weight, kN/m^3	21.44
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	17.98
Area, cm^2	31.60	Specific Gravity, measured	2.76
Volume, cm^3	68.41	Solids Height, cm	1.438
Water Content, %	19.22	Volume of Solids, cm ^{3}	45.45
Wet Mass, g	149.56	Volume of Voids, cm ^{3}	22.96
Dry Mass, g	125.45		

Prepared By: LFG

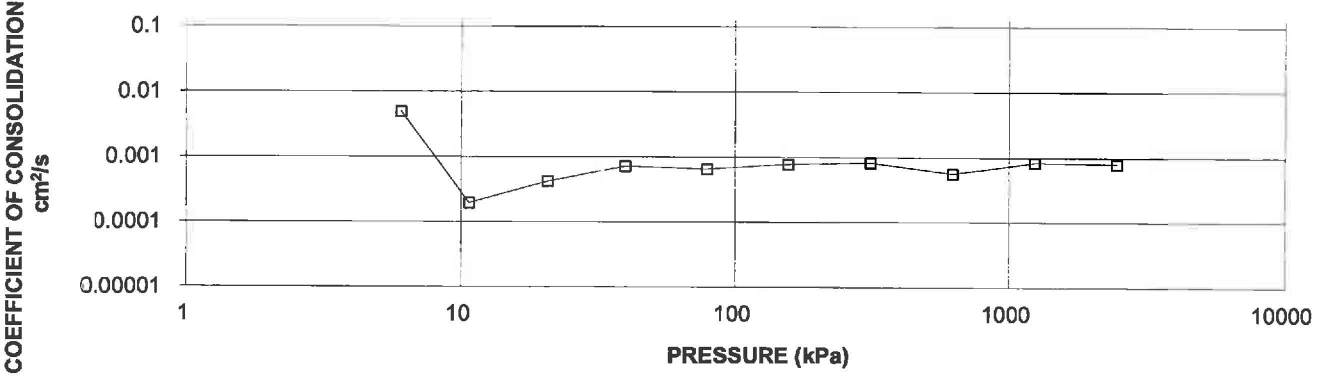
Golder Associates

Checked By:

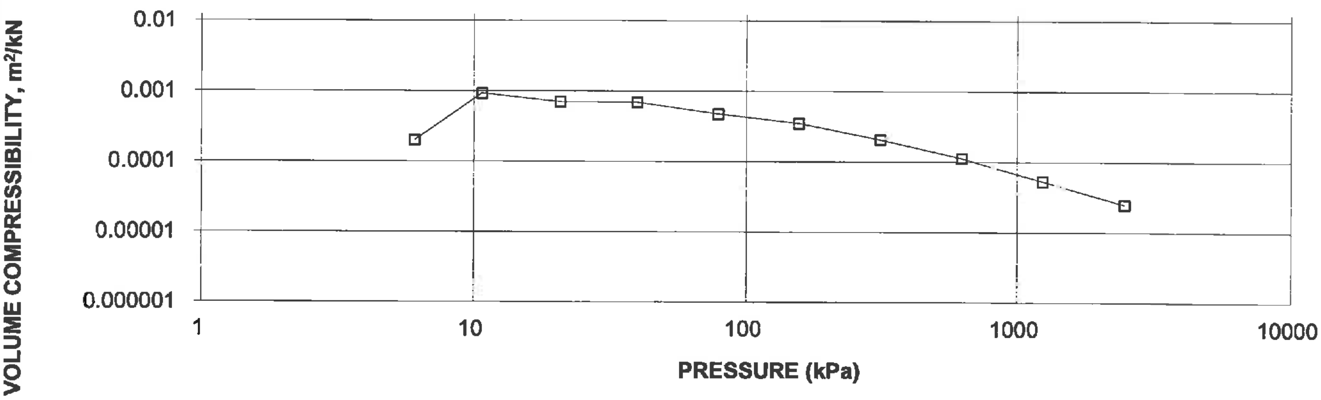
CONSOLIDATION TEST SUMMARY

FIGURE

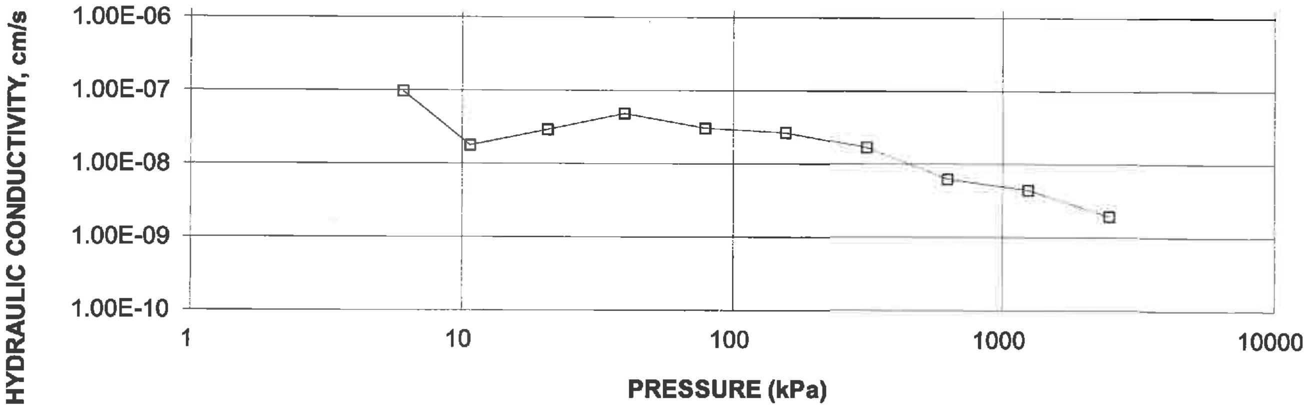
CONSOLIDATION TEST
C_V cm^2/s VS PRESSURE (kPa)
FCD11-BS01 Bag 1



CONSOLIDATION TEST
M_V m^2/kN vs PRESSURE (kPa)
FCD11-BS01 Bag 1



CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
FCD11-BS01 Bag 1



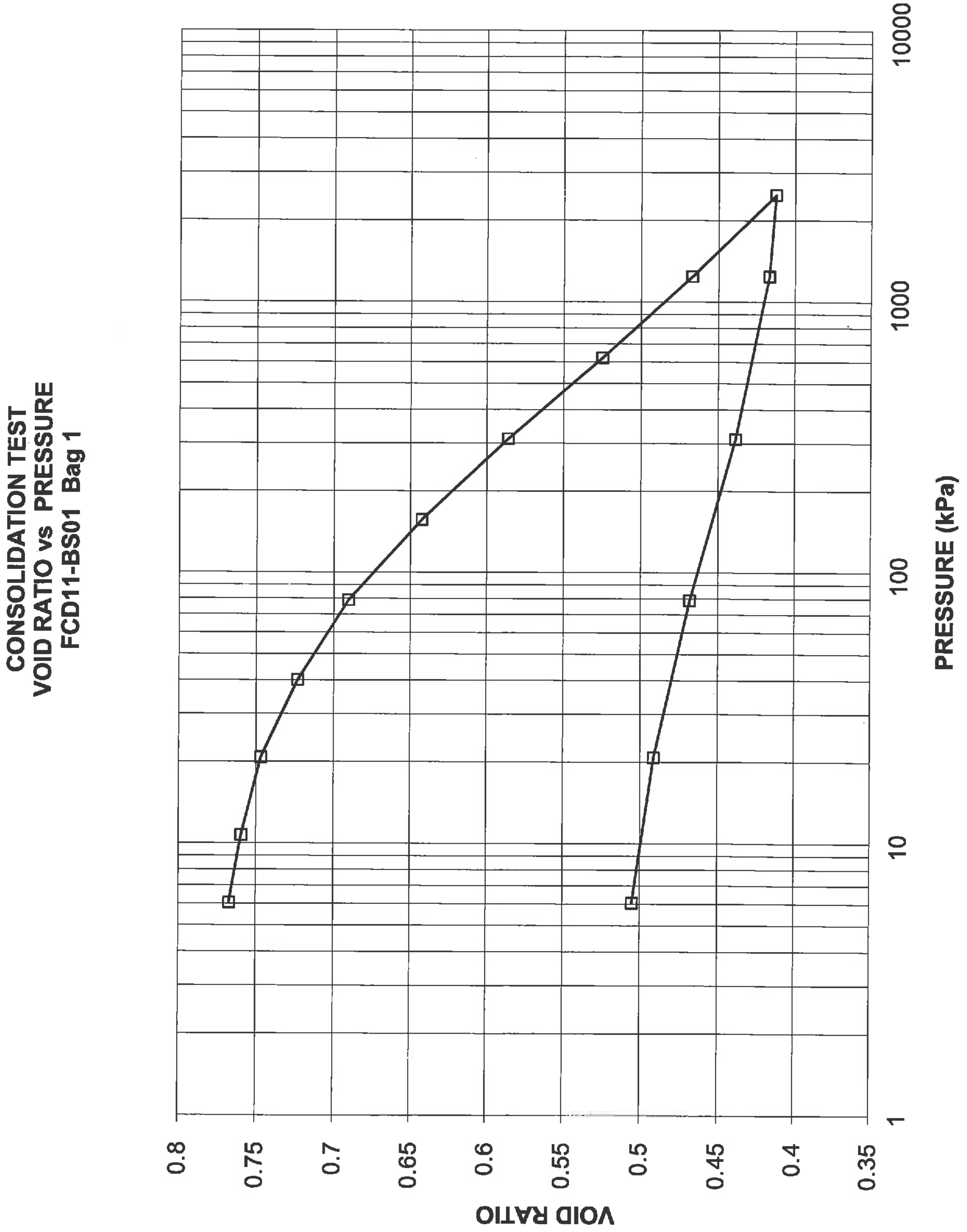
Project No. 12-1183-0015
Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST
VOID RATIO VS LOG PRESSURE

FIGURE



Project No. 12-1183-0015

Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST SUMMARY

FIGURE

SAMPLE IDENTIFICATION

Project Number	12-1183-0015	Bag Number	1
Sample Number	FCD11-BS02	Sample Depth, m	6.1

TEST CONDITIONS

Test Type	Standard	Load Duration, hr	24
Oedometer Number	12		
Date Started	5/01/2012		
Date Completed	5/15/2012		

SAMPLE DIMENSIONS AND PROPERTIES - INITIAL

Sample Height, cm	2.55	Unit Weight, kN/m^3	18.99
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	15.17
Area, cm^2	31.58	Specific Gravity, measured	2.78
Volume, cm^3	80.46	Solids Height, cm	1.418
Water Content, %	25.16	Volume of Solids, cm^3	44.78
Wet Mass, g	155.81	Volume of Voids, cm^3	35.68
Dry Mass, g	124.49	Degree of Saturation, %	87.8

TEST COMPUTATIONS

Pressure kPa	Corr. Height cm	Void Ratio	Average Height cm	t_{90} sec	c_v cm^2/s	m_v m^2/kN	k cm/s
0.00	2.548	0.797	2.548				
5.99	2.540	0.791	2.544	653	2.10E-03	5.31E-04	1.09E-07
10.79	2.534	0.787	2.537	1185	1.15E-03	5.15E-04	5.81E-08
20.28	2.519	0.776	2.526	1500	9.02E-04	6.24E-04	5.52E-08
40.01	2.487	0.754	2.503	2124	6.25E-04	6.31E-04	3.86E-08
78.94	2.433	0.716	2.460	2802	4.58E-04	5.39E-04	2.42E-08
156.41	2.361	0.665	2.397	1672	7.28E-04	3.69E-04	2.63E-08
312.01	2.269	0.600	2.315	1622	7.00E-04	2.31E-04	1.59E-08
622.28	2.181	0.538	2.225	1984	5.29E-04	1.11E-04	5.74E-09
1242.45	2.094	0.476	2.137	1297	7.47E-04	5.55E-05	4.06E-09
2483.26	2.001	0.411	2.047	1135	7.83E-04	2.93E-05	2.25E-09
1242.45	2.014	0.420	2.007				
312.01	2.051	0.446	2.032				
78.94	2.092	0.475	2.071				
20.76	2.117	0.493	2.104				
5.93	2.136	0.506	2.126				

Note:

Specimen compacted as per client's instruction, at target dry density of 1.57Mg/m^3 and water content of 24.5%.
Consolidation loading and unloading schedule asigned by the client.
k calculated using cv based on t_{90} values.

SAMPLE DIMENSIONS AND PROPERTIES - FINAL

Sample Height, cm	2.14	Unit Weight, kN/m^3	21.53
Sample Diameter, cm	6.34	Dry Unit Weight, kN/m^3	18.10
Area, cm^2	31.58	Specific Gravity, measured	2.78
Volume, cm^3	67.44	Solids Height, cm	1.418
Water Content, %	18.92	Volume of Solids, cm ^{3}	44.78
Wet Mass, g	148.04	Volume of Voids, cm ^{3}	22.66
Dry Mass, g	124.49		

Prepared By: LFG

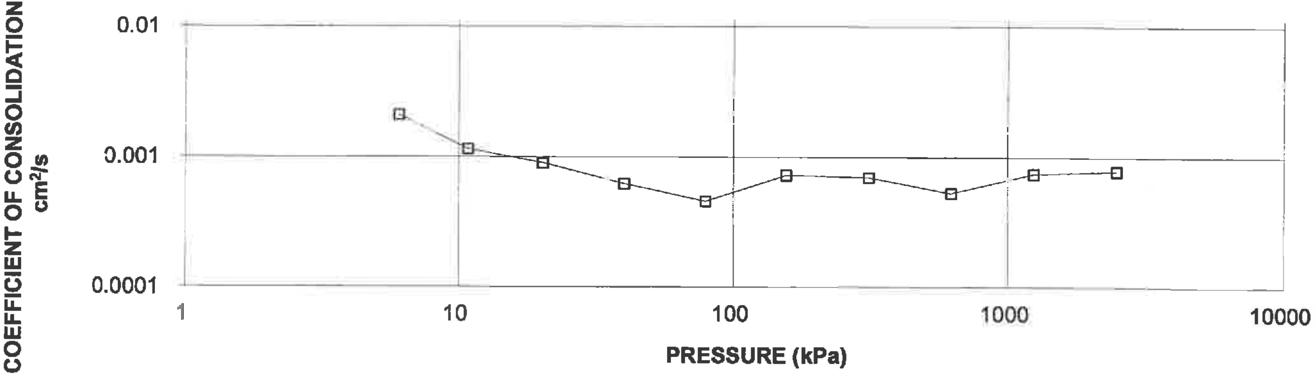
Golder Associates

Checked By:

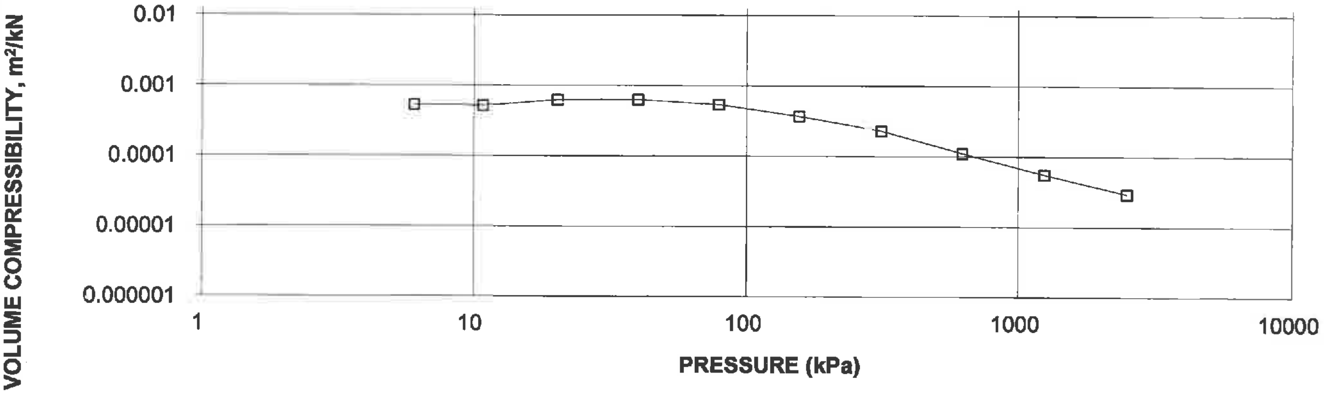
CONSOLIDATION TEST SUMMARY

FIGURE

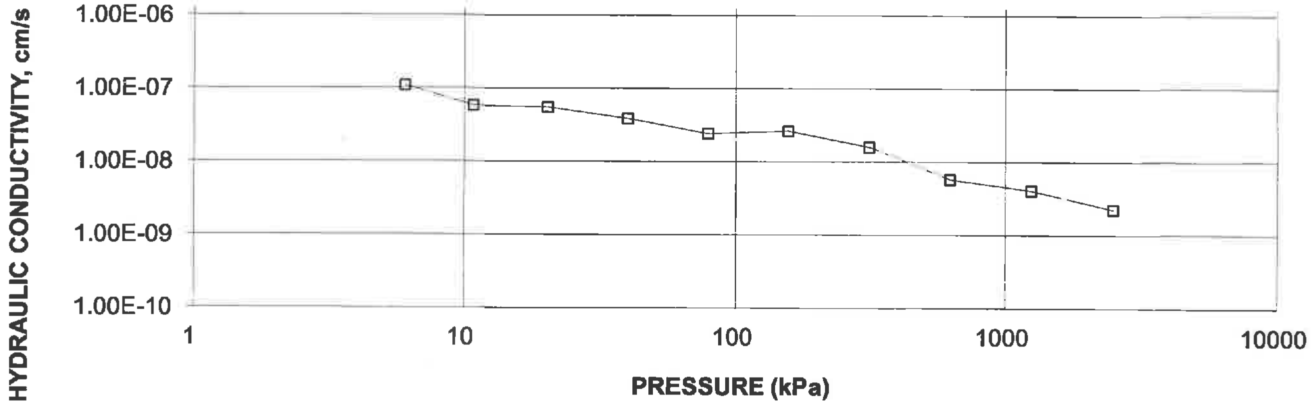
CONSOLIDATION TEST
C_V cm²/s VS PRESSURE (kPa)
FCD11-BS02 Bag 1



CONSOLIDATION TEST
M_V m²/kN vs PRESSURE (kPa)
FCD11-BS02 Bag 1



CONSOLIDATION TEST
HYDRAULIC CONDUCTIVITY vs PRESSURE
FCD11-BS02 Bag 1



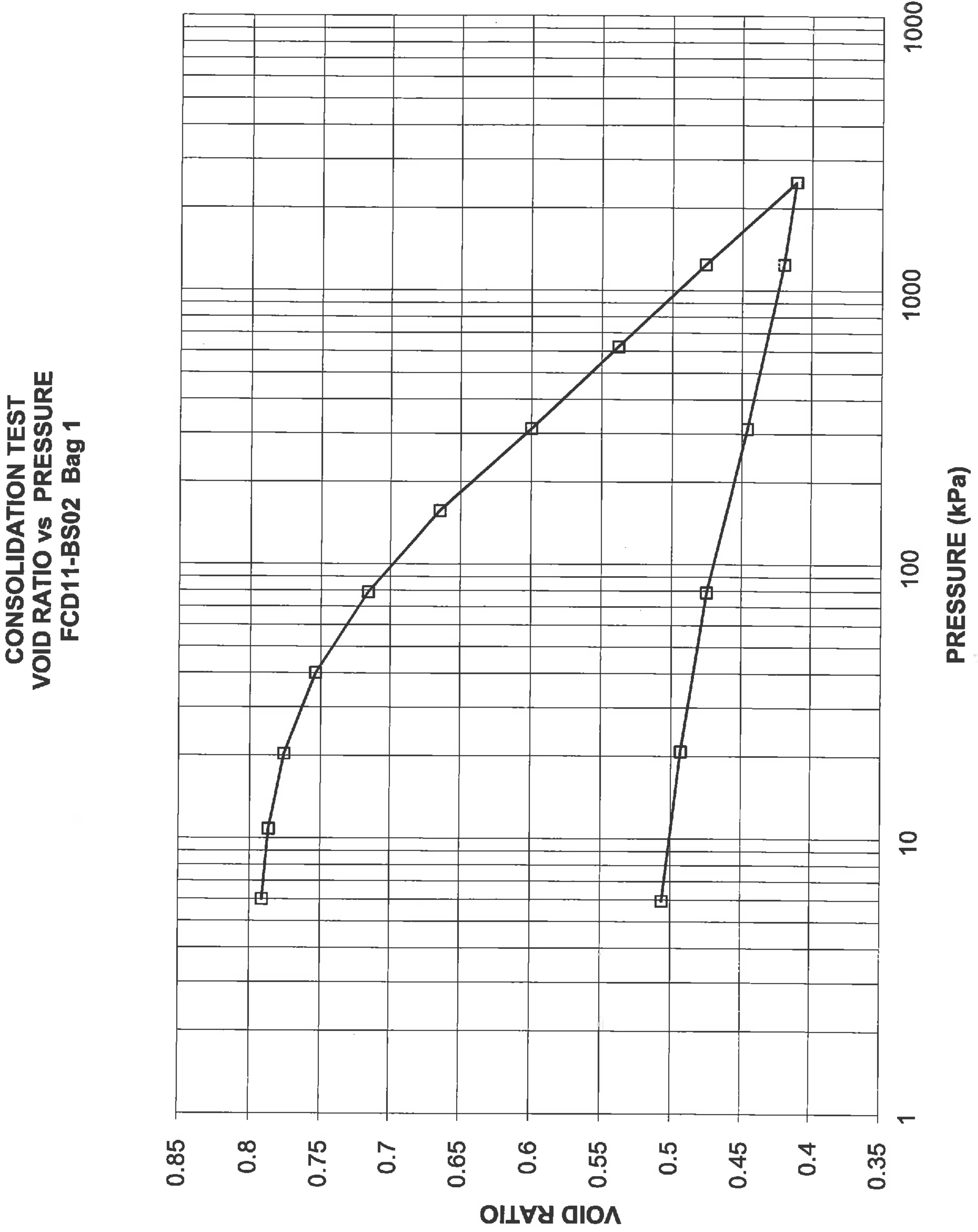
Project No. 12-1183-0015
Prepared By: LFG

Golder Associates

Checked By:

CONSOLIDATION TEST
VOID RATIO VS LOG PRESSURE

FIGURE



Project No. 12-1183-0015

Prepared By: LFG

Golder Associates

Checked By:

HYDRAULIC CONDUCTIVITY TEST

ASTM D 5084 (CONSTANT HEAD)

SAMPLE IDENTIFICATION

PROJECT NUMBER	12-1183-0015	BAG NUMBER	-
PROJECT TITLE	Foth / Testing / Victory Nicke	SAMPLE DEPTH, m	2.00
BOREHOLE NUMBER	FCD11-BS01	DATE	05/09/2012

SPECIMEN PROPERTIES AND DIMENSIONS (INITIAL)

SAMPLE HEIGHT, cm	6.07	UNIT WEIGHT, kN/m^3	19.82
SAMPLE DIAMETER, cm	4.87	DRY UNIT WEIGHT, kN/m^3	16.01
SAMPLE AREA, cm^2	18.65	SPECIFIC GRAVITY, measured	2.76
SAMPLE VOLUME, cm^3	113.21	VOLUME OF SOLIDS, cm^3	66.97
TOTAL MASS, g	228.82	VOLUME OF VOIDS, cm^3	46.24
DRY MASS, g	184.83	VOID RATIO	0.69
WATER CONTENT, %	23.80		

SATURATION STAGE

CELL PRESSURE, kPa	210	EFFECTIVE CONFINING STRESS, kPa	5
HEAD PRESSURE, kPa	205	DURATION, min	2,880
BACK PRESSURE, kPa	205	B COEFFICIENT	0.97

CONSOLIDATION STAGE

CELL PRESSURE, kPa	305	EFFECTIVE CONFINING STRESS, kPa	100
HEAD PRESSURE, kPa	205	DURATION, min	1,440
BACK PRESSURE, kPa	205	VOLUME CHANGE, cm^3	4.3
		DRAINAGE	Top and Bottom

HYDRAULIC CONDUCTIVITY TEST

CELL PRESSURE, kPa	317	EFFECTIVE CONFINING STRESS, kPa	100
HEAD PRESSURE, kPa	217	DURATION, min	5331
BACK PRESSURE, kPa	205	HYDRAULIC GRADIENT, i	20

SPECIMEN PROPERTIES AND DIMENSIONS (FINAL)

SAMPLE HEIGHT, cm	5.99	UNIT WEIGHT, kN/m^3	20.20
SAMPLE DIAMETER, cm	4.81	DRY UNIT WEIGHT, kN/m^3	16.63
SAMPLE AREA, cm^2	18.18	SPECIFIC GRAVITY, measured	2.76
SAMPLE VOLUME, cm^3	108.99	VOLUME OF SOLIDS, cm^3	66.97
TOTAL MASS, g	224.45	VOLUME OF VOIDS, cm^3	42.02
DRY MASS, g	184.83	VOID RATIO	0.63
WATER CONTENT, %	21.44		

TEST RESULTS

ELAPSED TIME TO STEADY STATE FLOW (min)	00
DURATION OF STEADY STATE FLOW (min)	5331
INFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	1.3
OUTFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	1.3
HYDRAULIC CONDUCTIVITY (INFLOW) (cm/s)	1.05E-08
HYDRAULIC CONDUCTIVITY (OUTFLOW) (cm/s)	1.09E-08
HYDRAULIC CONDUCTIVITY, K, cm/s	**1.07E-08**

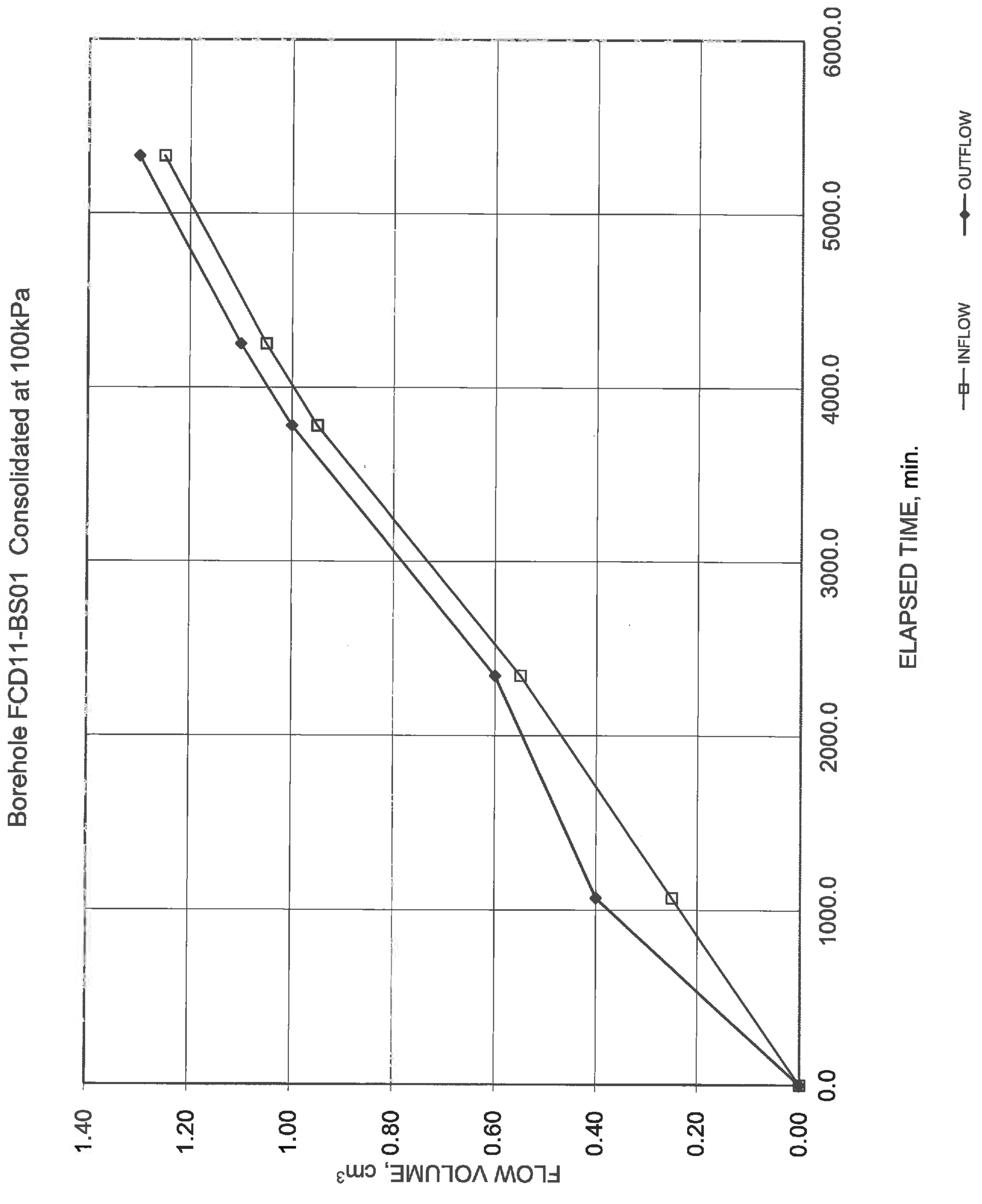
NOTES:

Specimen compacted as per client's instruction; dry density of 1.6Mg/m^3 at 22.8% water content.

Consolidation pressure 100kPa.

PERMEANT FLUID Deaired tap water

HYDRAULIC CONDUCTIVITY TEST



Project No. 12-1183-0015
Prepared By: MM

Golder Associates

Checked By:

HYDRAULIC CONDUCTIVITY TEST

ASTM D 5084 (CONSTANT HEAD)

SAMPLE IDENTIFICATION

PROJECT NUMBER	12-1183-0015	BAG NUMBER	-
PROJECT TITLE	Foth / Testing / Victory Nickel	SAMPLE DEPTH, m	2.00
BOREHOLE NUMBER	FCD11-BS01	DATE	05/16/2012

SPECIMEN PROPERTIES AND DIMENSIONS (INITIAL)

SAMPLE HEIGHT, cm	5.99	UNIT WEIGHT, kN/m^3	20.22
SAMPLE DIAMETER, cm	4.81	DRY UNIT WEIGHT, kN/m^3	16.65
SAMPLE AREA, cm^2	18.17	SPECIFIC GRAVITY, measured	2.76
SAMPLE VOLUME, cm^3	108.84	VOLUME OF SOLIDS, cm^3	66.97
TOTAL MASS, g	224.45	VOLUME OF VOIDS, cm^3	41.88
DRY MASS, g	184.83	VOID RATIO	0.63
WATER CONTENT, %	21.44		

SATURATION STAGE

CELL PRESSURE, kPa	-	EFFECTIVE CONFINING STRESS, kPa	-
HEAD PRESSURE, kPa	-	DURATION, min	-
BACK PRESSURE, kPa	-	B COEFFICIENT	-

CONSOLIDATION STAGE

CELL PRESSURE, kPa	655	EFFECTIVE CONFINING STRESS, kPa	450
HEAD PRESSURE, kPa	205	DURATION, min	1,440
BACK PRESSURE, kPa	205	VOLUME CHANGE, cm^3	5.8
		DRAINAGE	Top and Bottom

HYDRAULIC CONDUCTIVITY TEST

CELL PRESSURE, kPa	667	EFFECTIVE CONFINING STRESS, kPa	450
HEAD PRESSURE, kPa	217	DURATION, min	7150
BACK PRESSURE, kPa	205	HYDRAULIC GRADIENT, i	20

SPECIMEN PROPERTIES AND DIMENSIONS (FINAL)

SAMPLE HEIGHT, cm	5.88	UNIT WEIGHT, kN/m^3	20.98
SAMPLE DIAMETER, cm	4.72	DRY UNIT WEIGHT, kN/m^3	17.58
SAMPLE AREA, cm^2	17.53	SPECIFIC GRAVITY, measured	2.76
SAMPLE VOLUME, cm^3	103.11	VOLUME OF SOLIDS, cm^3	66.97
TOTAL MASS, g	220.60	VOLUME OF VOIDS, cm^3	36.15
DRY MASS, g	184.83	VOID RATIO	0.54
WATER CONTENT, %	19.35		

TEST RESULTS

ELAPSED TIME TO STEADY STATE FLOW (min)	2645
DURATION OF STEADY STATE FLOW (min)	4505
INFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	0.5
OUTFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	0.6
HYDRAULIC CONDUCTIVITY (INFLOW) (cm/s)	5.30E-09
HYDRAULIC CONDUCTIVITY (OUTFLOW) (cm/s)	6.35E-09
HYDRAULIC CONDUCTIVITY, K, cm/s	**5.83E-09**

NOTES:

Specimen compacted as per client's instruction; dry density of 1.6Mg/m^3 at 22.8% water content.

Consolidation pressure 450kPa.

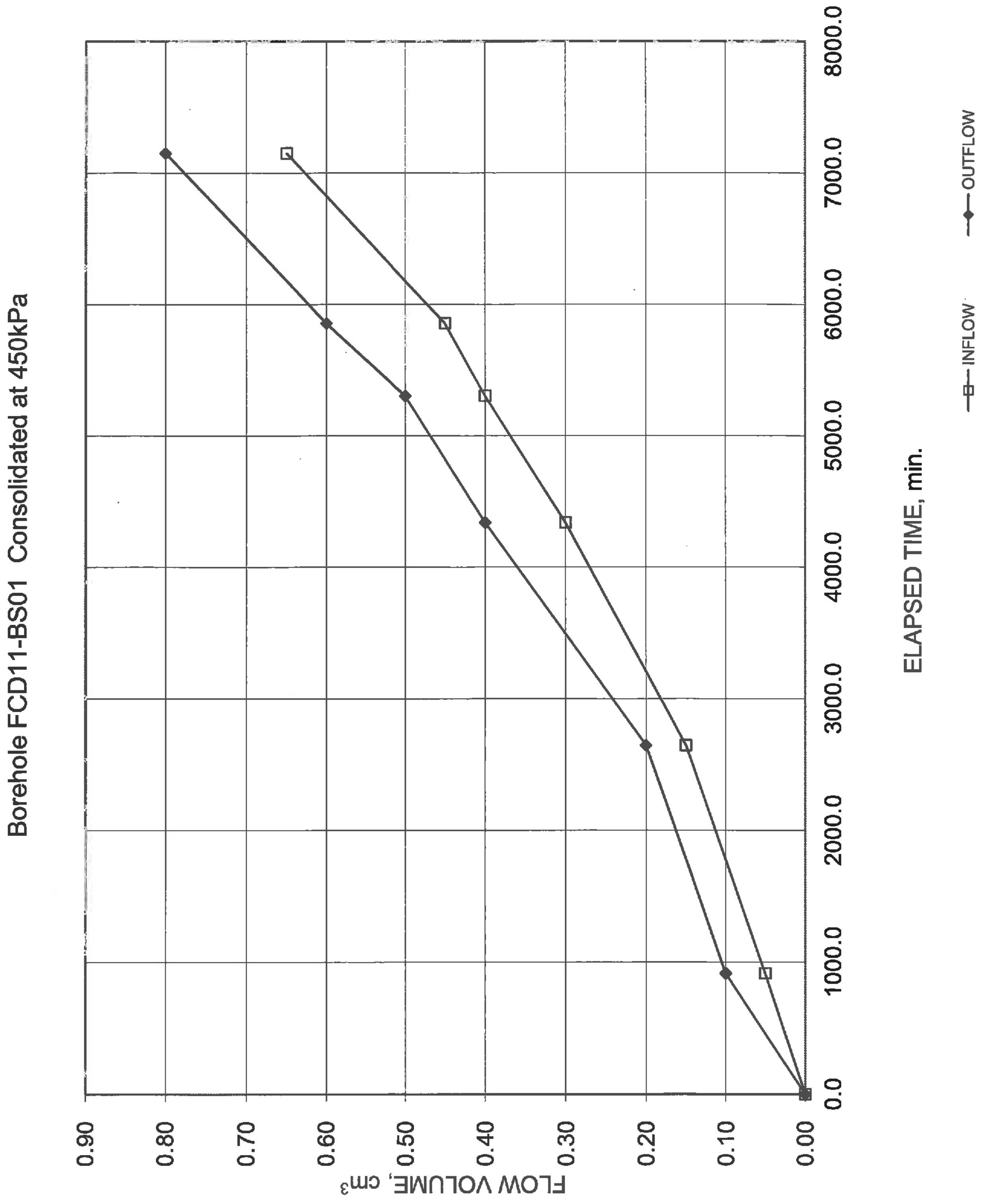
PERMEANT FLUID Deaired tap water

Prepared By: MM

Golder Associates

Checked By:

HYDRAULIC CONDUCTIVITY TEST



Borehole FCD11-BS01 Consolidated at 450kPa

Project No. 12-1183-0015
Prepared By: MM

Golder Associates

Checked By:

HYDRAULIC CONDUCTIVITY TEST

ASTM D 5084 (CONSTANT HEAD)

SAMPLE IDENTIFICATION

PROJECT NUMBER	12-1183-0015	BAG NUMBER	-
PROJECT TITLE	Foth / Testing / Victory Nickel	SAMPLE DEPTH, m	6.10
BOREHOLE NUMBER	FCD11-BS02	DATE	05/09/2012

SPECIMEN PROPERTIES AND DIMENSIONS (INITIAL)

SAMPLE HEIGHT, cm	5.92	UNIT WEIGHT, kN/m^3	19.65
SAMPLE DIAMETER, cm	4.91	DRY UNIT WEIGHT, kN/m^3	15.84
SAMPLE AREA, cm^2	18.93	SPECIFIC GRAVITY, measured	2.78
SAMPLE VOLUME, cm^3	112.09	VOLUME OF SOLIDS, cm^3	65.11
TOTAL MASS, g	224.60	VOLUME OF VOIDS, cm^3	46.98
DRY MASS, g	181.01	VOID RATIO	0.72
WATER CONTENT, %	24.08		

SATURATION STAGE

CELL PRESSURE, kPa	140	EFFECTIVE CONFINING STRESS, kPa	5
HEAD PRESSURE, kPa	135	DURATION, min	2,880
BACK PRESSURE, kPa	135	B COEFFICIENT	0.97

CONSOLIDATION STAGE

CELL PRESSURE, kPa	235	EFFECTIVE CONFINING STRESS, kPa	100
HEAD PRESSURE, kPa	135	DURATION, min	1,440
BACK PRESSURE, kPa	135	VOLUME CHANGE, cm^3	4.5
		DRAINAGE	Top and Bottom

HYDRAULIC CONDUCTIVITY TEST

CELL PRESSURE, kPa	247	EFFECTIVE CONFINING STRESS, kPa	100
HEAD PRESSURE, kPa	147	DURATION, min	4257
BACK PRESSURE, kPa	135	HYDRAULIC GRADIENT, i	21

SPECIMEN PROPERTIES AND DIMENSIONS (FINAL)

SAMPLE HEIGHT, cm	5.84	UNIT WEIGHT, kN/m^3	20.06
SAMPLE DIAMETER, cm	4.84	DRY UNIT WEIGHT, kN/m^3	16.49
SAMPLE AREA, cm^2	18.43	SPECIFIC GRAVITY, measured	2.78
SAMPLE VOLUME, cm^3	107.63	VOLUME OF SOLIDS, cm^3	65.11
TOTAL MASS, g	220.14	VOLUME OF VOIDS, cm^3	42.52
DRY MASS, g	181.01	VOID RATIO	0.65
WATER CONTENT, %	21.62		

TEST RESULTS

ELAPSED TIME TO STEADY STATE FLOW (min)	00
DURATION OF STEADY STATE FLOW (min)	4257
INFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	1.1
OUTFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	1.0
HYDRAULIC CONDUCTIVITY (INFLOW) (cm/s)	1.12E-08
HYDRAULIC CONDUCTIVITY (OUTFLOW) (cm/s)	1.01E-08
HYDRAULIC CONDUCTIVITY, K, cm/s	**1.06E-08**

NOTES:

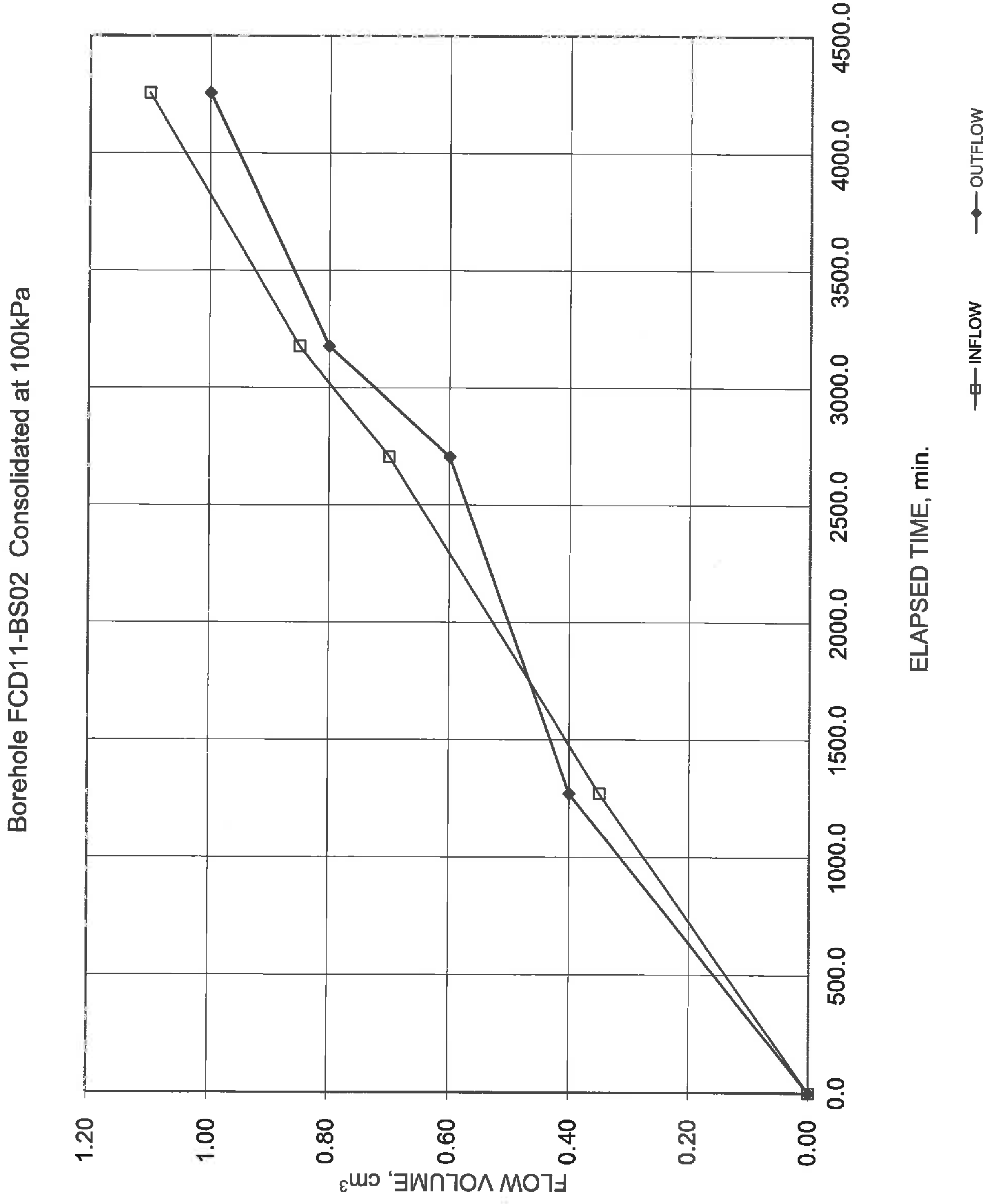
Specimen compacted as per client's instruction; dry density of 1.57Mg/m^3 at 24.5% water content.

Consolidation pressure 100kPa.

PERMEANT FLUID Deaired tap water

Prepared By: MM **Golder Associates** Checked By:

HYDRAULIC CONDUCTIVITY TEST



Borehole FCD11-BS02 Consolidated at 100kPa

Project No. 12-1183-0015
Prepared By: MM

Golder Associates

Checked By:

HYDRAULIC CONDUCTIVITY TEST

ASTM D 5084 (CONSTANT HEAD)

SAMPLE IDENTIFICATION

PROJECT NUMBER	12-1183-0015	BAG NUMBER	-
PROJECT TITLE	Foth / Testing / Victory Nickel	SAMPLE DEPTH, m	6.10
BOREHOLE NUMBER	FCD11-BS02	DATE	05/16/2012

SPECIMEN PROPERTIES AND DIMENSIONS (INITIAL)

SAMPLE HEIGHT, cm	5.84	UNIT WEIGHT, kN/m^3	20.09
SAMPLE DIAMETER, cm	4.84	DRY UNIT WEIGHT, kN/m^3	16.52
SAMPLE AREA, cm^2	18.40	SPECIFIC GRAVITY, measured	2.78
SAMPLE VOLUME, cm^3	107.45	VOLUME OF SOLIDS, cm^3	65.11
TOTAL MASS, g	220.14	VOLUME OF VOIDS, cm^3	42.34
DRY MASS, g	181.01	VOID RATIO	0.65
WATER CONTENT, %	**21.62**		

SATURATION STAGE

CELL PRESSURE, kPa	-	EFFECTIVE CONFINING STRESS, kPa	-
HEAD PRESSURE, kPa	-	DURATION, min	-
BACK PRESSURE, kPa	-	B COEFFICIENT	-

CONSOLIDATION STAGE

CELL PRESSURE, kPa	585	EFFECTIVE CONFINING STRESS, kPa	450
HEAD PRESSURE, kPa	135	DURATION, min	1,560
BACK PRESSURE, kPa	135	VOLUME CHANGE, cm^3	5.9
		DRAINAGE	Top and Bottom

HYDRAULIC CONDUCTIVITY TEST

CELL PRESSURE, kPa	596	EFFECTIVE CONFINING STRESS, kPa	450
HEAD PRESSURE, kPa	146	DURATION, min	8166
BACK PRESSURE, kPa	135	HYDRAULIC GRADIENT, i	20

SPECIMEN PROPERTIES AND DIMENSIONS (FINAL)

SAMPLE HEIGHT, cm	5.73	UNIT WEIGHT, kN/m^3	20.91
SAMPLE DIAMETER, cm	4.75	DRY UNIT WEIGHT, kN/m^3	17.47
SAMPLE AREA, cm^2	17.72	SPECIFIC GRAVITY, measured	2.78
SAMPLE VOLUME, cm^3	101.62	VOLUME OF SOLIDS, cm^3	65.11
TOTAL MASS, g	216.71	VOLUME OF VOIDS, cm^3	36.51
DRY MASS, g	181.01	VOID RATIO	0.56
WATER CONTENT, %	**19.72**		

TEST RESULTS

ELAPSED TIME TO STEADY STATE FLOW (min)	00
DURATION OF STEADY STATE FLOW (min)	8166
INFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	0.9
OUTFLOW VOLUME UNDER STEADY STATE FLOW (cm^3)	0.7
HYDRAULIC CONDUCTIVITY (INFLOW) (cm/s)	4.91E-09
HYDRAULIC CONDUCTIVITY (OUTFLOW) (cm/s)	4.05E-09
HYDRAULIC CONDUCTIVITY, K, cm/s	**4.48E-09**

NOTES:

Specimen compacted as per client's instruction; dry density of 1.57Mg/m^3 at 24.5% water content.

Consolidation pressure 450kPa.

PERMEANT FLUID Deaired tap water

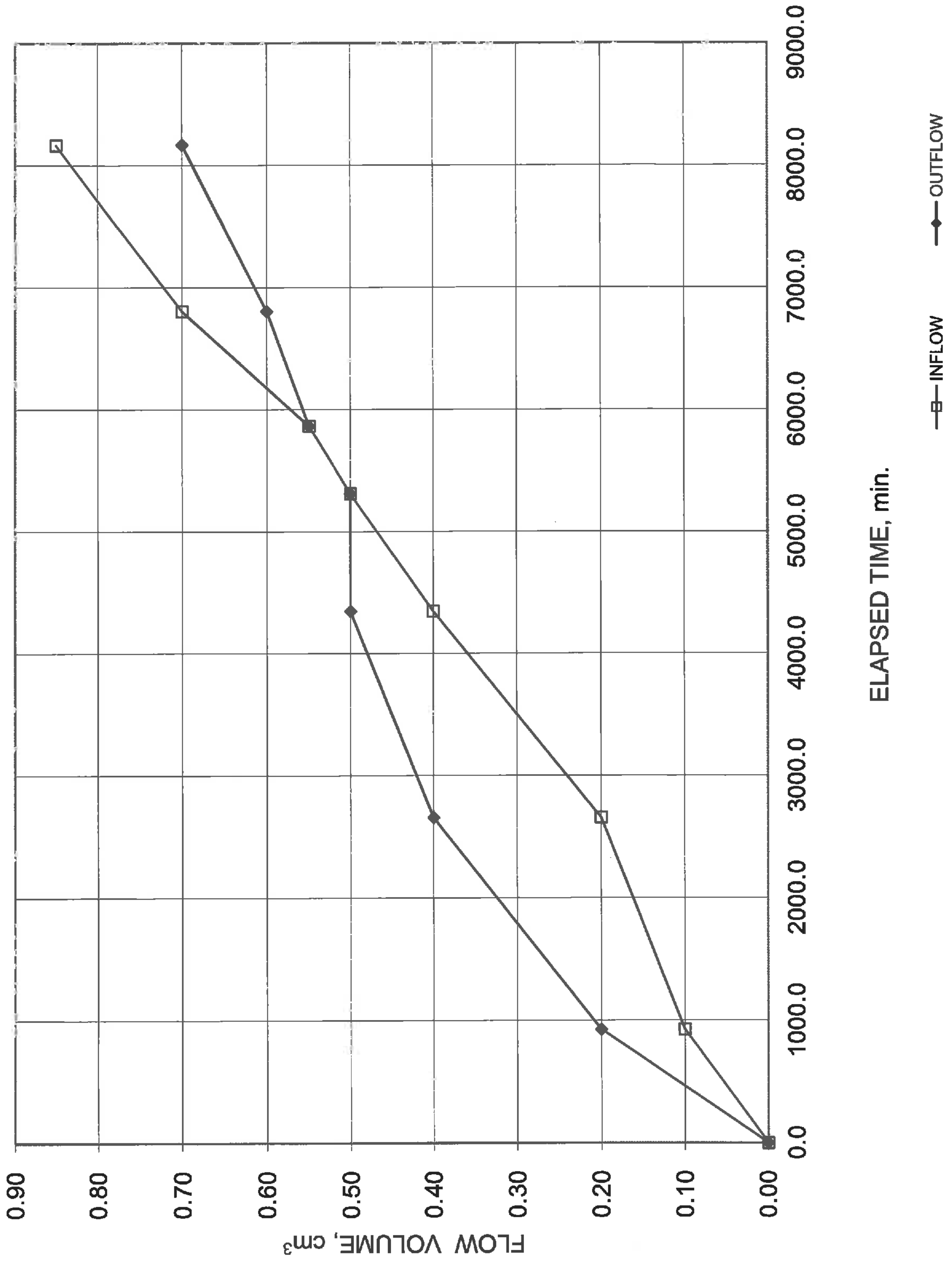
Prepared By: MM

Golder Associates

Checked By:

HYDRAULIC CONDUCTIVITY TEST

Borehole FCD11-BS02 Consolidated at 450kPa



Project No. 12-1183-0015
Prepared By: MM

Golder Associates

Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 1 OF 4

FIGURE

TEST STAGE	A	B	C
BOREHOLE NUMBER	FCD11-BS01	FCD11-BS01	FCD11-BS01
BAG NUMBER	-	-	-
SPECIMEN DIAMETER, cm	4.97	4.99	5.08
SPECIMEN HEIGHT, cm	10.17	10.17	10.12
NATURAL WATER CONTENT, %	23.3	23.6	22.9
DRY DENSITY, Mg/m^3	1.64	1.61	1.62
WATER CONTENT AFTER SATURATION, %	25.3	27.3	26.6
CELL PRESSURE, σ_3, kPa	305.0	505.0	505.0
BACK PRESSURE, kPa	205.0	305.0	205.0
PORE PRESSURE PARAMETER "B"	0.99	0.99	0.96
CONSOLIDATION PRESSURE, σc, kPa	100.0	200.0	300.0
VOLUMETRIC STRAIN DURING CONSOLIDATION, %	5.0	6.7	8.1
WATER CONTENT AFTER CONSOLIDATION, %	22.3	23.2	21.7
AVERAGE RATE OF STRAIN, %/hr	0.5	0.5	0.5
TIME TO FAILURE, HOURS	27.9	37.3	38.4
WATER CONTENT AFTER TEST, %	23.1	21.7	20.5
MAX. DEVIATOR STRESS, (σ_1-σ_3), kPa	127.9	247.5	331.6
AXIAL STRAIN AT (σ_1-σ_3) maximum, %	14.0	18.6	19.2
MAX EFFECTIVE PRINCIPAL STRESS RATIO, (σ'_1/σ'_3) maximum	3.4	4.1	3.0
DEVIATOR STRESS AT (σ'_1/σ'_3) maximum, kPa	113.0	195.1	295.3
AXIAL STRAIN AT (σ'_1/σ'_3) maximum, %	4.7	5.8	9.3
PORE PRESSURE PARAMETER, Af, AT (σ_1-σ_3) maximum	0.306	0.30	0.37
PORE PRESSURE PARAMETER, Af, AT (σ'_1/σ'_3) maximum	0.47	0.54	0.51
FILTER DRAINS USED, y/n	y	y	y

TEST NOTES:

Specimens compacted as per client's instruction, at target dry density of 1.6Mg/m^3 and water content of 22.8%.

FAILURE PLANE NUMBER	1.0	-	-
ANGLE OF FAILURE, DEGREES	60	BULGED	BULGED

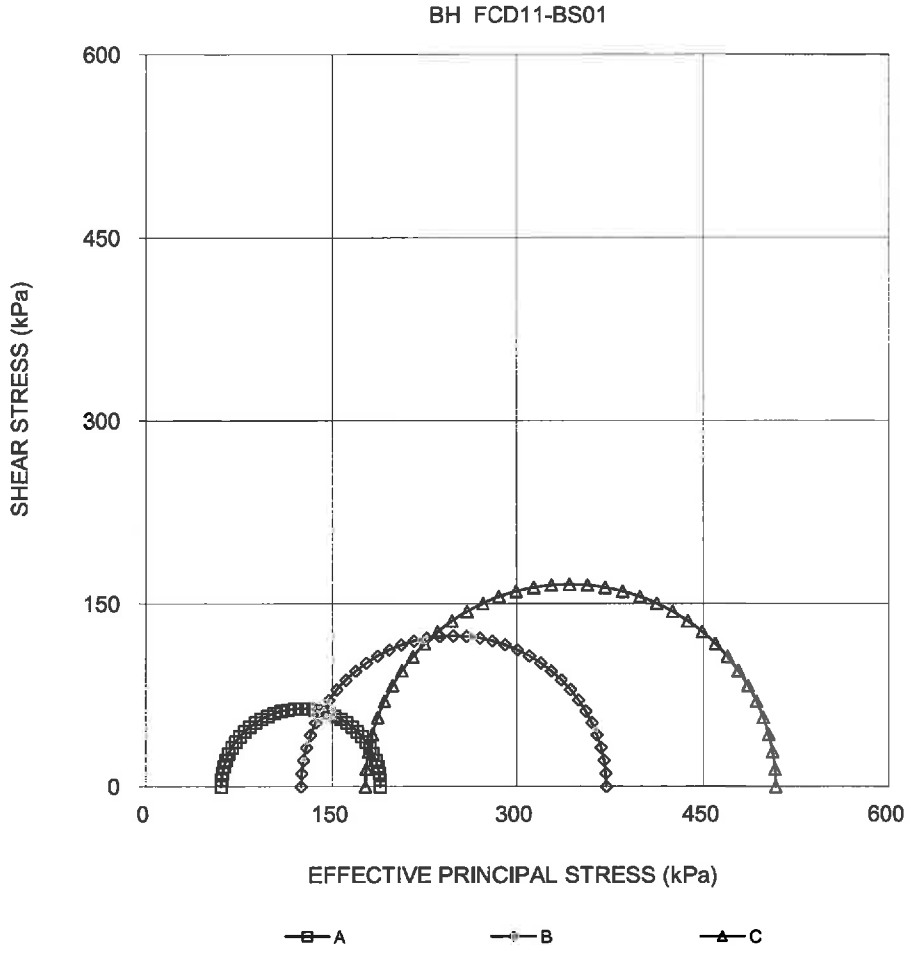
Date: 6/9/2012
Project No. 12-1183-0015

Golder Associates

Prepared By: LH
Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 2 OF 4

FIGURE



Date: 6/9/2012

Project No. 12-1183-0015

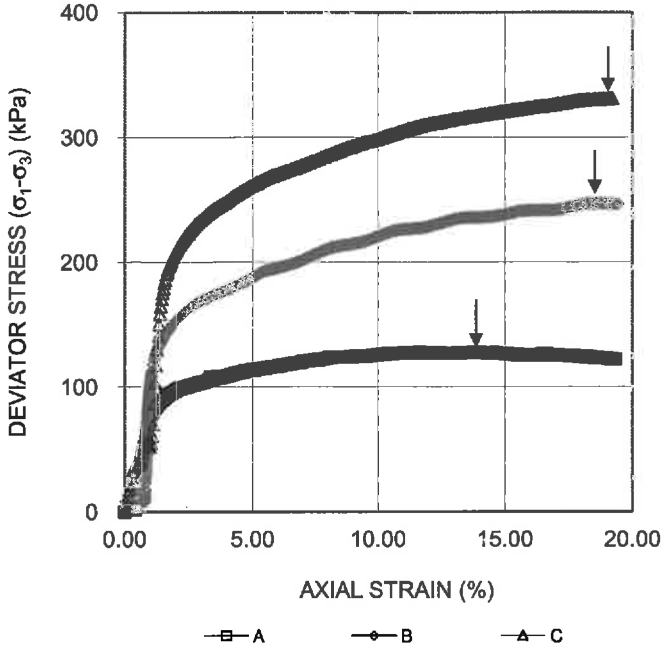
Golder Associates

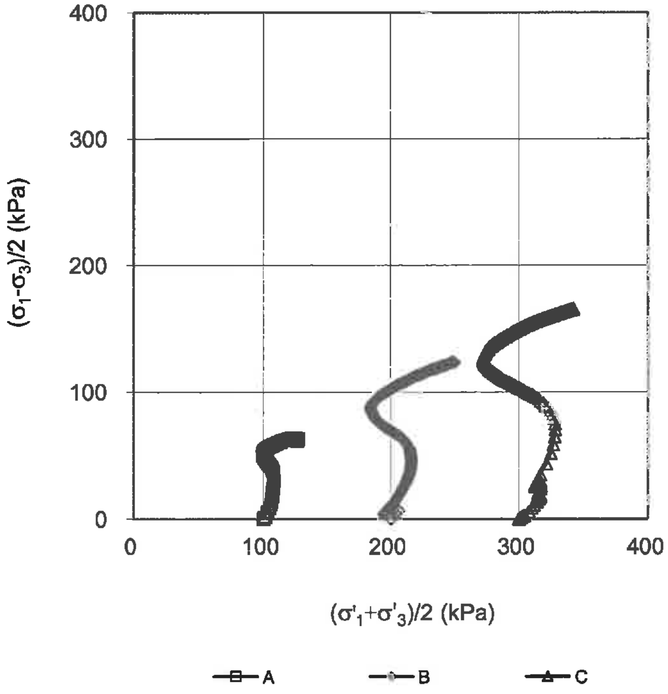
Prepared By: LH

Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS SHEET 3 OF 4	FIGURE

BH FCD11-BS01





Date: 6/9/2012

Project No. 12-1183-0015

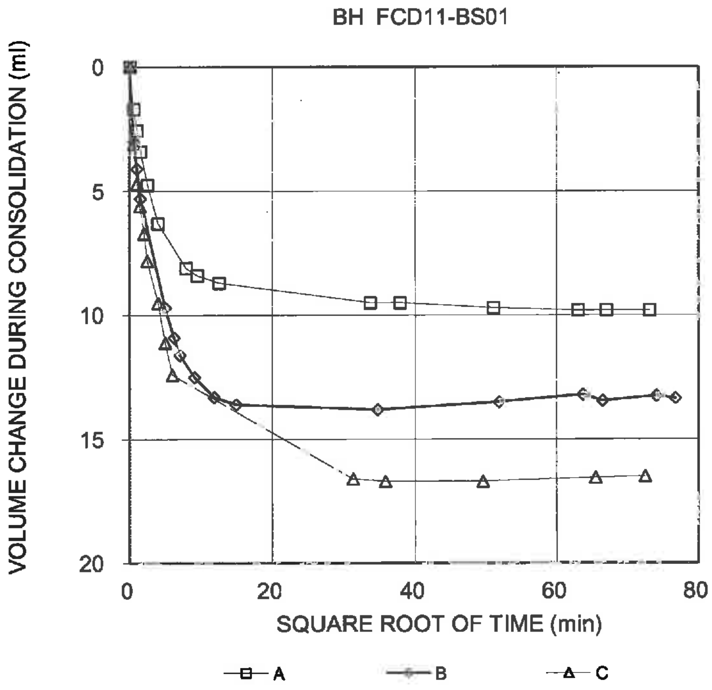
Golder Associates

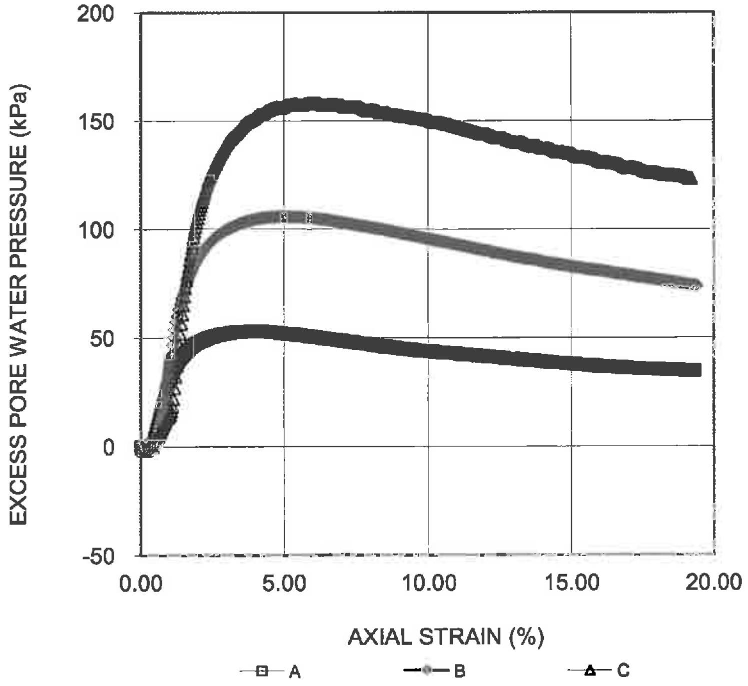
Prepared By LH

Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 4 OF 4

FIGURE





Date: 6/9/2012

Project No. 12-1183-0015

Golder Associates

Prepared By LH

Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 1 OF 4

FIGURE

TEST STAGE	A	B	C
BOREHOLE NUMBER	FCD11-BS02	FCD11-BS02	FCD11-BS02
BAG NUMBER	-	-	-
SPECIMEN DIAMETER, cm	4.96	5.02	5.05
SPECIMEN HEIGHT, cm	10.15	10.13	10.12
NATURAL WATER CONTENT, %	24.2	24.0	24.2
DRY DENSITY, Mg/m^3	1.60	1.61	1.60
WATER CONTENT AFTER SATURATION, %	26.3	25.3	26.3
CELL PRESSURE, σ_3, kPa	305.0	475.0	645.0
BACK PRESSURE, kPa	205.0	275.0	345.0
PORE PRESSURE PARAMETER "B"	0.96	0.97	0.96
CONSOLIDATION PRESSURE, σc, kPa	100.0	200.0	300.0
VOLUMETRIC STRAIN DURING CONSOLIDATION, %	5.2	6.4	9.4
WATER CONTENT AFTER CONSOLIDATION, %	23.0	21.3	23.0
AVERAGE RATE OF STRAIN, %/hr	0.5	0.5	0.5
TIME TO FAILURE, HOURS	23.0	27.6	32.0
WATER CONTENT AFTER TEST, %	23.1	21.7	23.1
MAX. DEVIATOR STRESS, (σ_1-σ_3), kPa	117.5	227.4	309.5
AXIAL STRAIN AT (σ_1-σ_3) maximum, %	11.5	13.8	16.0
MAX EFFECTIVE PRINCIPAL STRESS RATIO, (σ'_1/σ'_3) maximum	3.3	3.1	3.1
DEVIATOR STRESS AT (σ'_1/σ'_3) maximum, kPa	108.6	206.1	286.1
AXIAL STRAIN AT (σ'_1/σ'_3) maximum, %	5.4	8.4	9.8
PORE PRESSURE PARAMETER, Af, AT (σ_1-σ_3) maximum	0.37	0.40	0.47
PORE PRESSURE PARAMETER, Af, AT (σ'_1/σ'_3) maximum	0.48	0.50	0.57
FILTER DRAINS USED, y/n	y	y	y

TEST NOTES:

Specimens compacted as per client's instruction, at target dry density of 1.57Mg/m^3 and water content of 24.5%.

FAILURE PLANE NUMBER	1.0	-	1.0
ANGLE OF FAILURE, DEGREES	70	BULGED	70

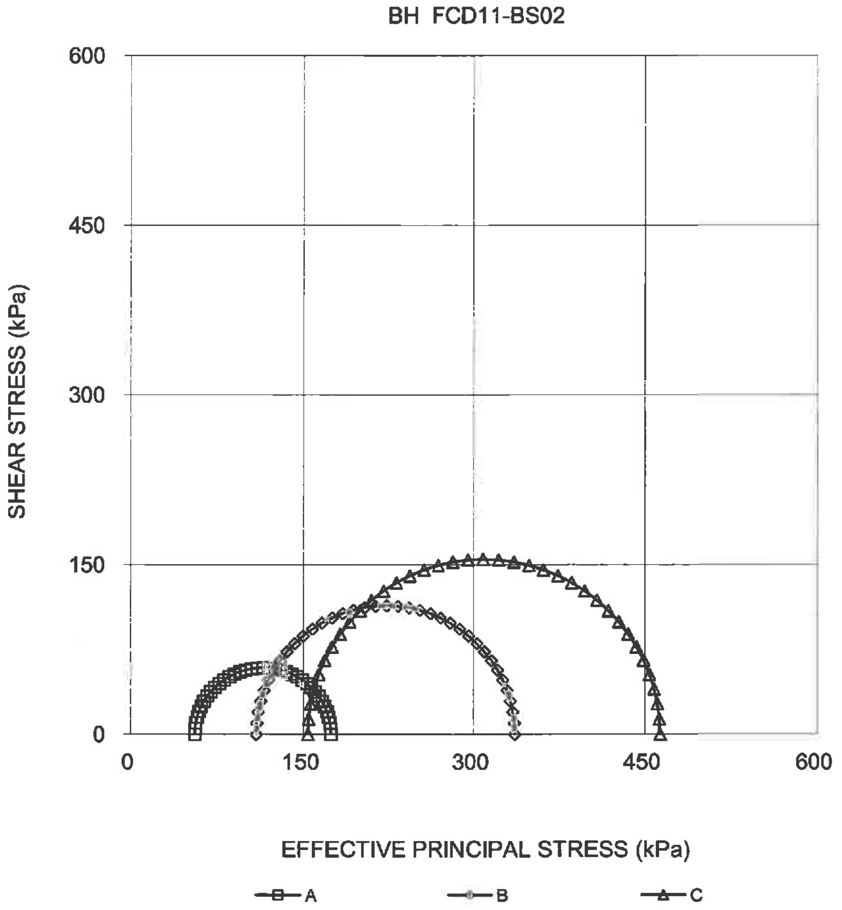
Date: 6/21/2012
Project No. 12-1183-0015

Golder Associates

Prepared By: LH
Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 2 OF 4

FIGURE



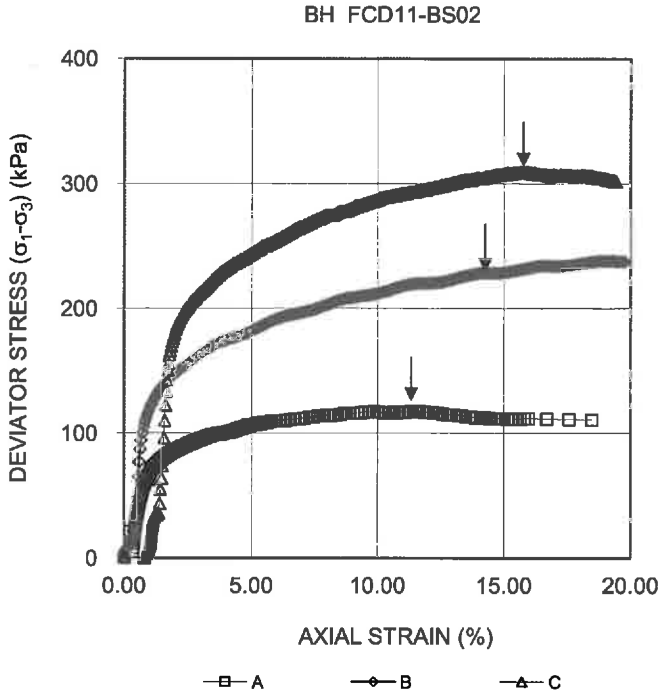
Date: 6/21/2012
Project No. 12-1183-0015

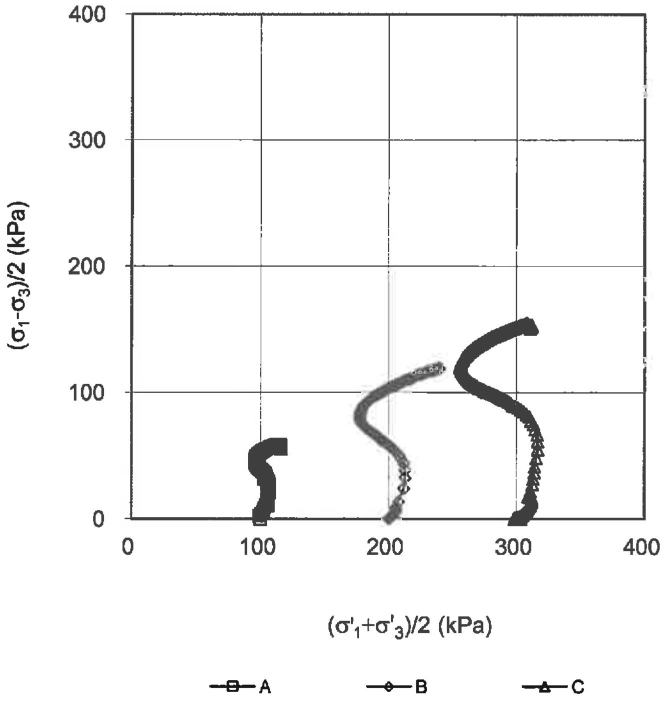
Golder Associates

Prepared By LH
Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL
WITH PORE PRESSURE MEASUREMENTS
SHEET 3 OF 4

FIGURE



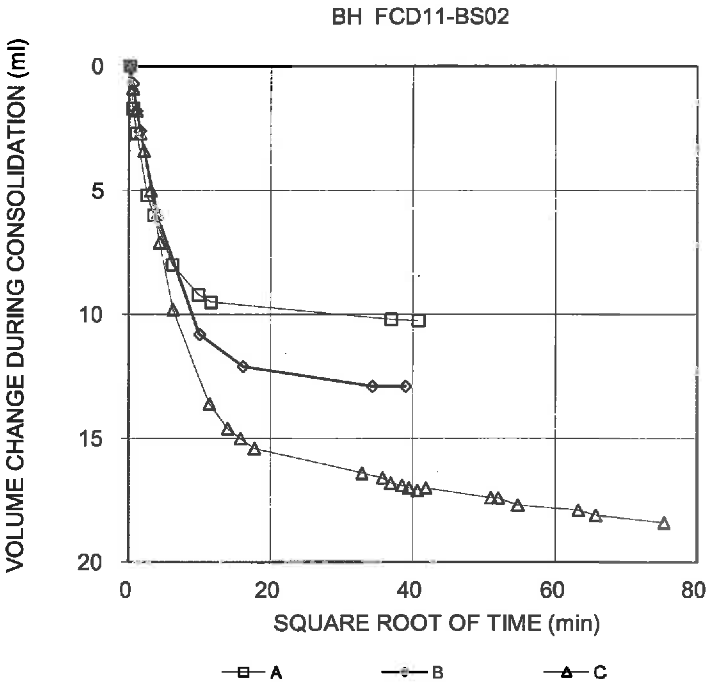


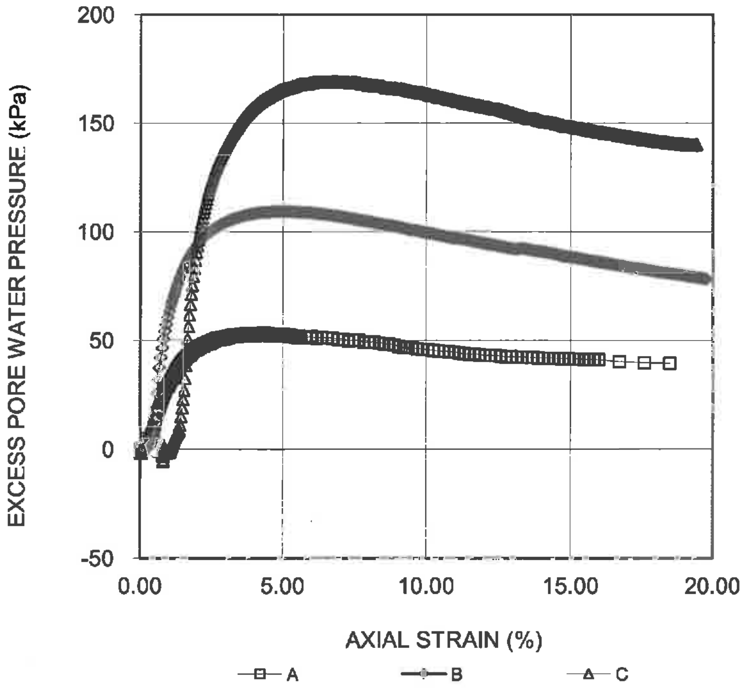
Date: 6/21/2012
Project No. 12-1183-0015

Golder Associates

Prepared By LH
Checked By:

CONSOLIDATED UNDRAINED TRIAXIAL WITH PORE PRESSURE MEASUREMENTS SHEET 4 OF 4	**FIGURE**





Date: 6/21/2012

Project No. 12-1183-0015

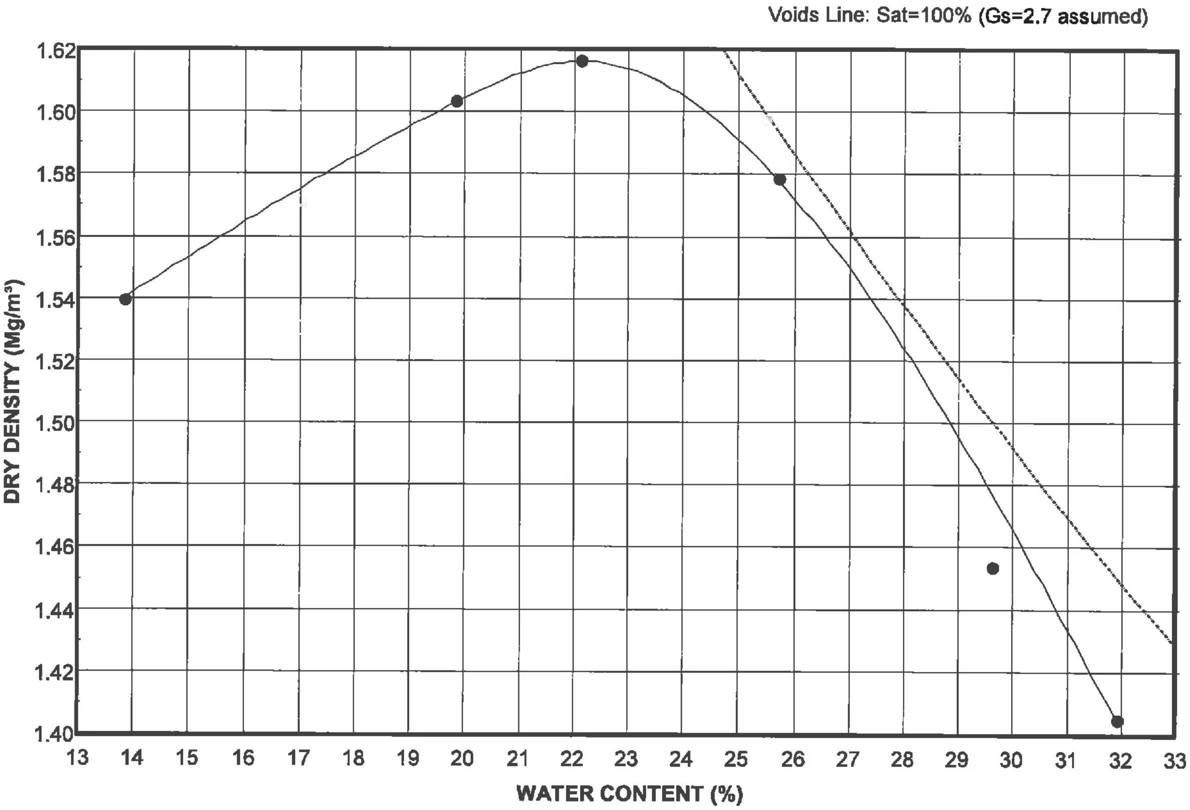
Golder Associates

Prepared By LH

Checked By: LH

LABORATORY COMPACTION TEST

FIGURE



Standard
Proctor Test Results

Sample:
VNWE03-BS01

Source:
Unknown

Max Dry Density:
1.616 Mg/m³

Optimum Water
Content: 22.4%

Natural Water
Content: 28.1%

Project Number: 12-1183-0015
Checked By:

Golder Associates

LABID: 12-941
Date: 18-May-12

DENSITY AND POROSITY DETERMINATIONS OF IRREGULAR SHAPE SAMPLES

ASTM D 7263 Method A

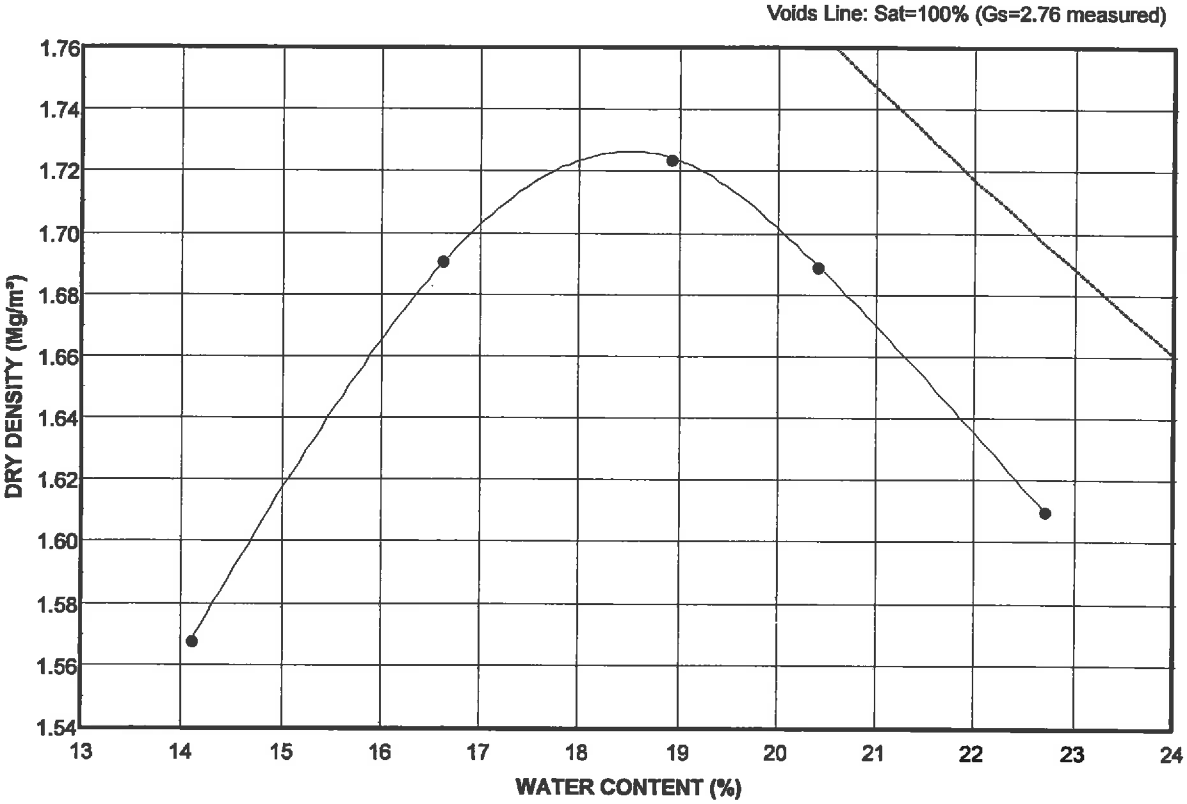
Sample Number	FCD11-BS01	FCD11-BS02	VNEE02-BS01
Bag Number	1	1	1
Depth, m	2.0	6.1	3.5
Wet Mass of Soil in Air, g	278.01	409.89	176.52
Wet Mass of Soil + Wax in Air, g	289.05	423.99	184.02
Wet Mass of Soil + Wax in Water, g	139.29	214.13	96.72
Weight of Wax, g	11.04	14.10	7.50
Displaced Volume, cm^3	149.76	209.86	87.30
Displaced Wax, cm^3	12.16	15.53	8.26
Volume of Soil, cm^3	137.60	194.33	79.04
Specific Gravity, measured	2.76	2.78	2.70
Volume of Solids, cm^3	86.39	127.77	60.09
Volume of Voids, cm^3	51.21	66.56	18.95
Porosity	0.37	0.34	0.24
Water Content, %	16.60	15.40	8.80
Unit Weight, kN/m^3	19.81	20.68	21.90
Dry Unit Weight, kN/m^3	16.99	17.92	20.13

ote: 2.70 specific gravity is assumec

Project Number	12-1183-0015	Tested By	Ian
Date Tested	4/12/2012	Checked By	

LABORATORY COMPACTION TEST

FIGURE



Standard
Proctor Test Results

Sample:
FCD11-BS01 Bag 1

Source:
Unknown

Max Dry Density:
1.726 Mg/m³

Optimum Water
Content: 18.6%

Natural Water
Content: 18.5%

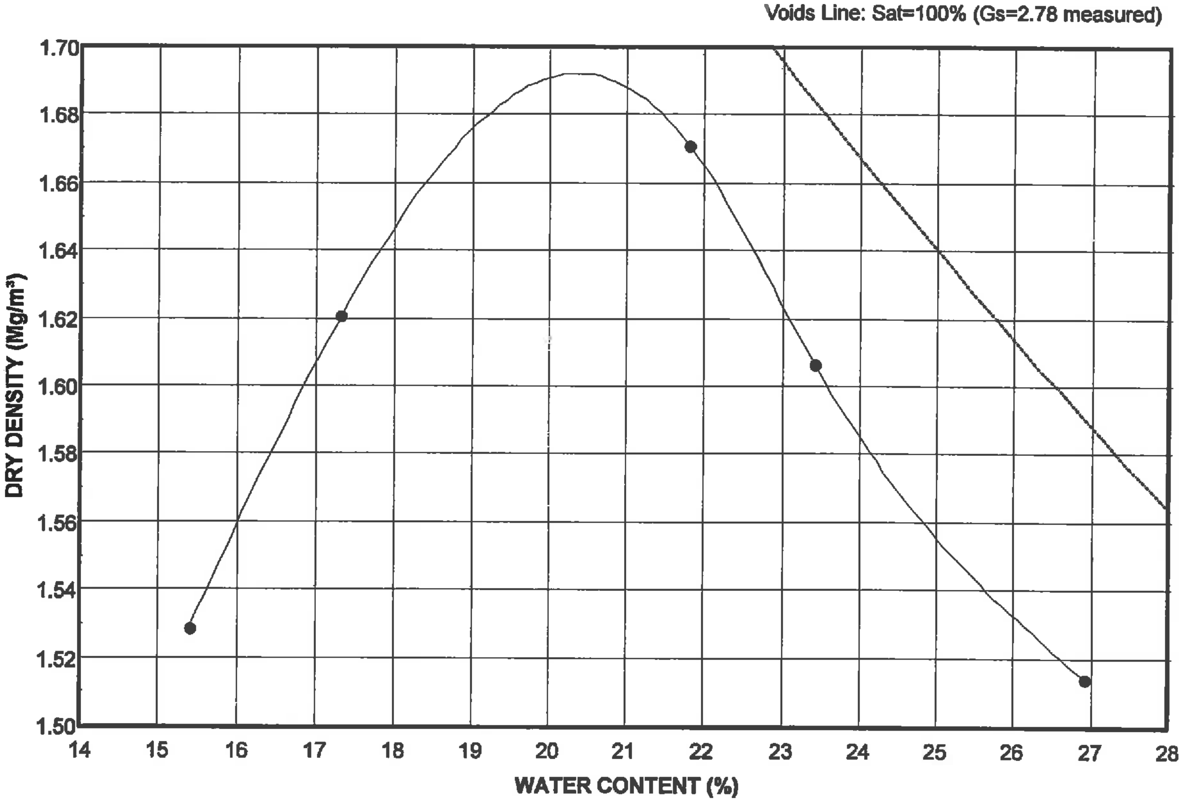
Project Number: 12-1183-0015
Checked By:

Golder Associates

LABID: 12-838
Date: 15-May-12

LABORATORY COMPACTION TEST

FIGURE



Standard Proctor Test Results	Sample: FCD11-BS02 Bag 1	Source: Unknown
Max Dry Density: 1.692 Mg/m³	Optimum Water Content: 20.5%	Natural Water Content: 18.1%

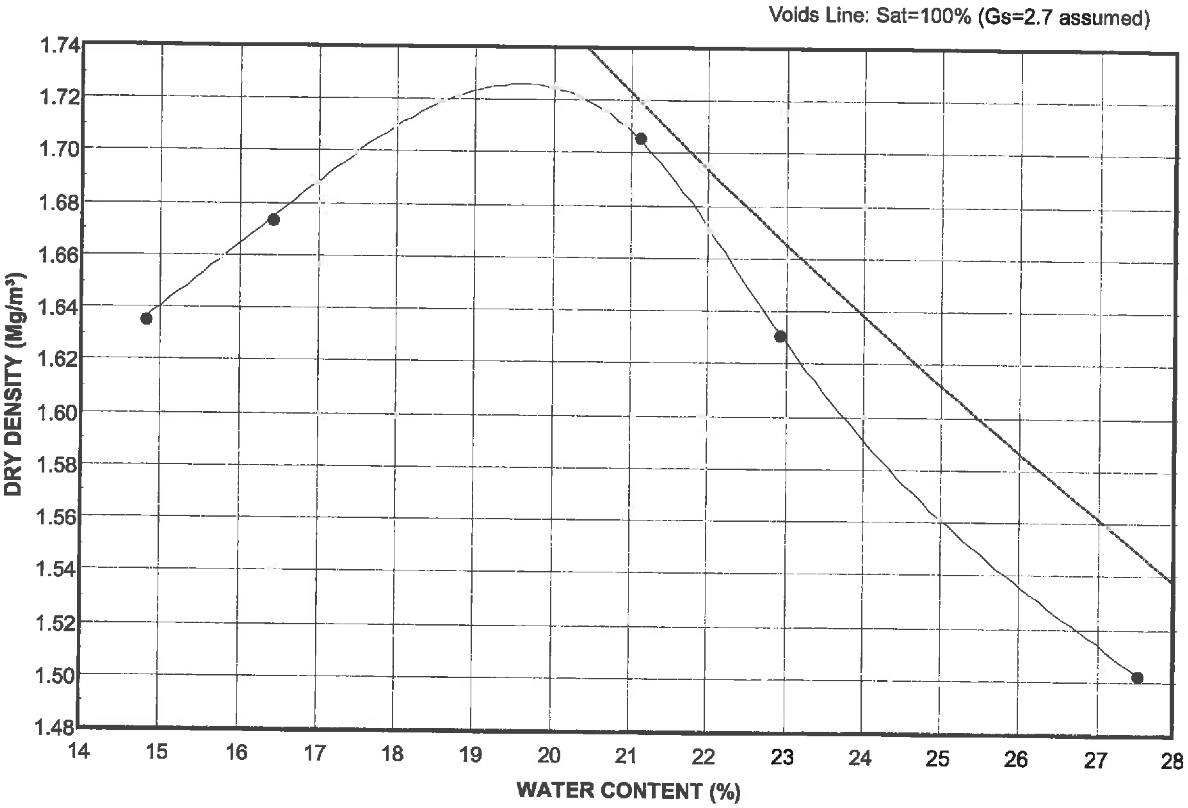
Project Number: 12-1183-0015
Checked By: MM

Golder Associates

LABID: 12-840
Date: 15-May-12

LABORATORY COMPACTION TEST

FIGURE



Standard
Proctor Test Results

Sample:
VNEE02-BS01 Bag 1, 2 & 3

Source:
Unknown

Max Dry Density:
1.726 Mg/m³

Optimum Water
Content: 19.6%

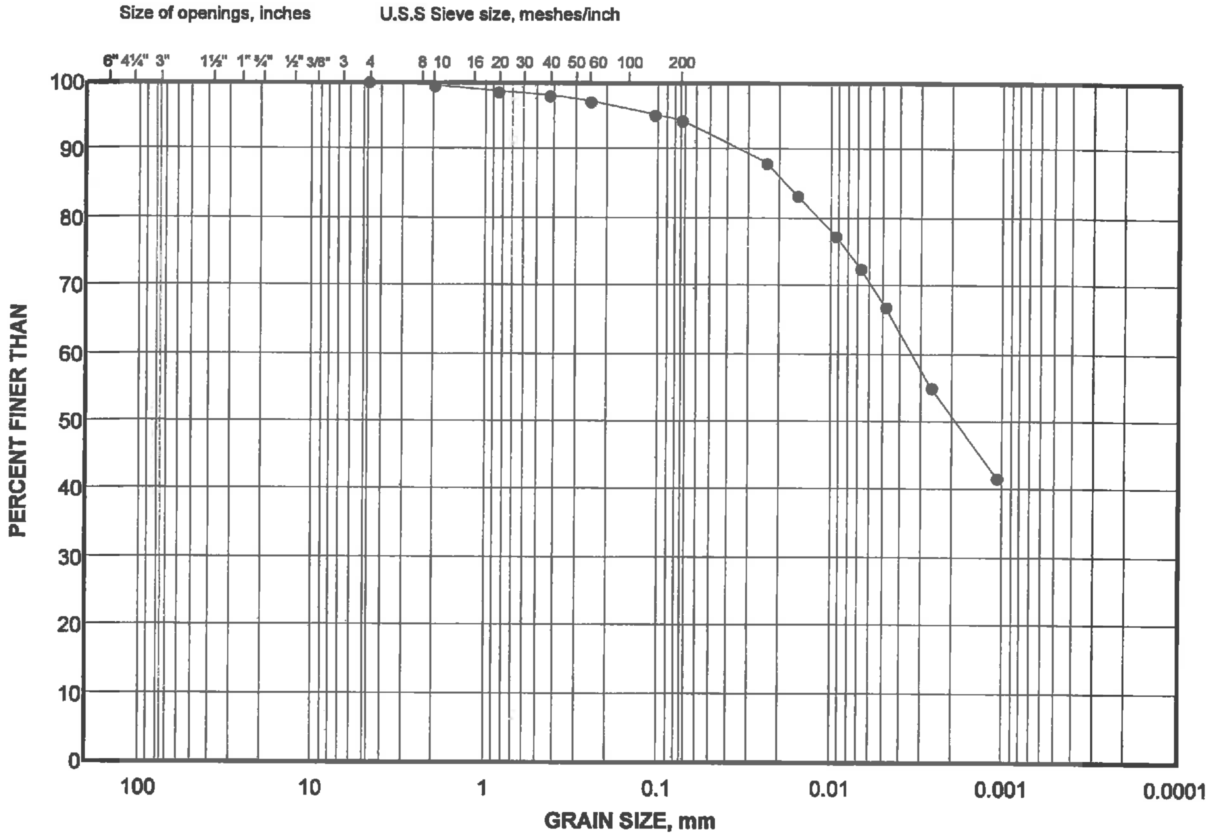
Natural Water
Content: 17.6%

Project Number: 12-1183-0015
Checked By:

Golder Associates

LABID: 12-839
Date: 16-Apr-12

GRAIN SIZE DISTRIBUTION	**FIGURE**



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	SAMPLE	DEPTH(m)
●	FCD11-BS01 Bag 1	2.0

Project Number: 12-1183-0015

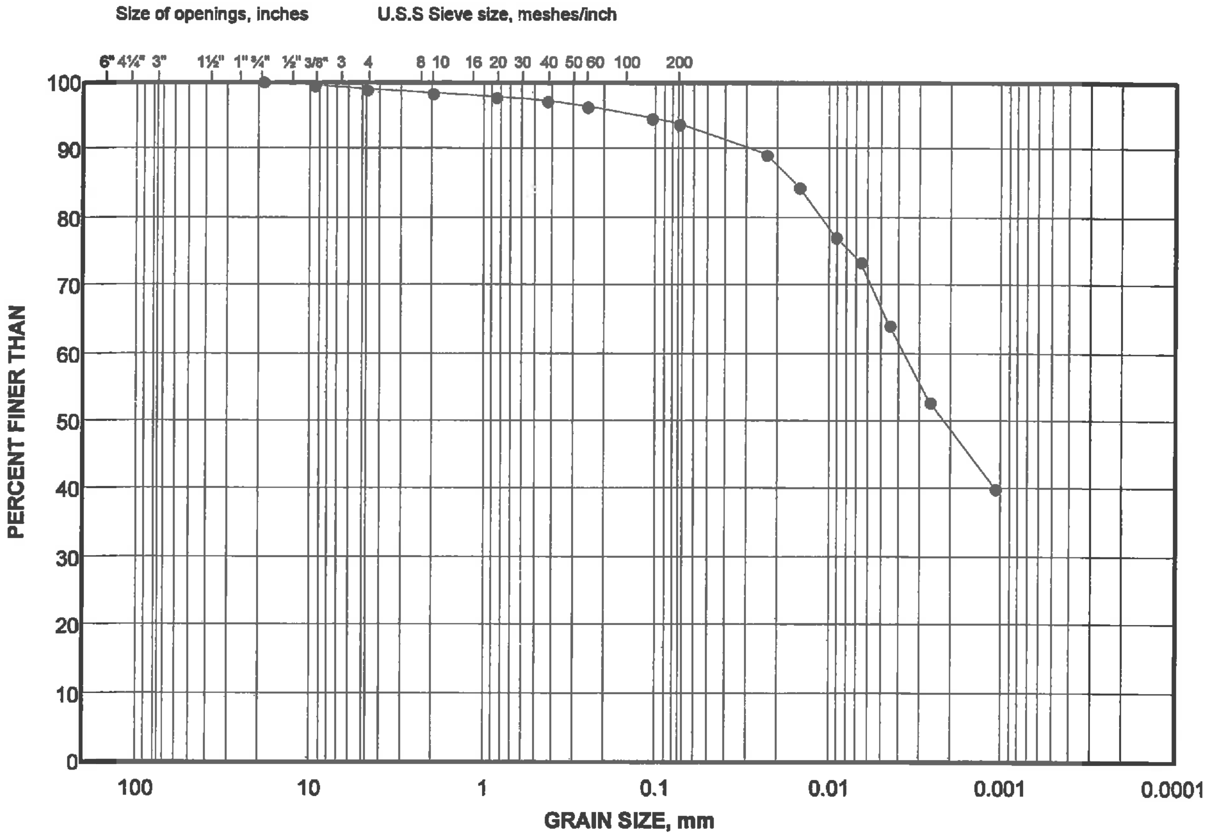
Checked By: ____________________

Golder Associates

Date: 15-May-12

GRAIN SIZE DISTRIBUTION

FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

SYMBOL	SAMPLE	DEPTH(m)
●	FCD11-BS02 Bag 1	6.1

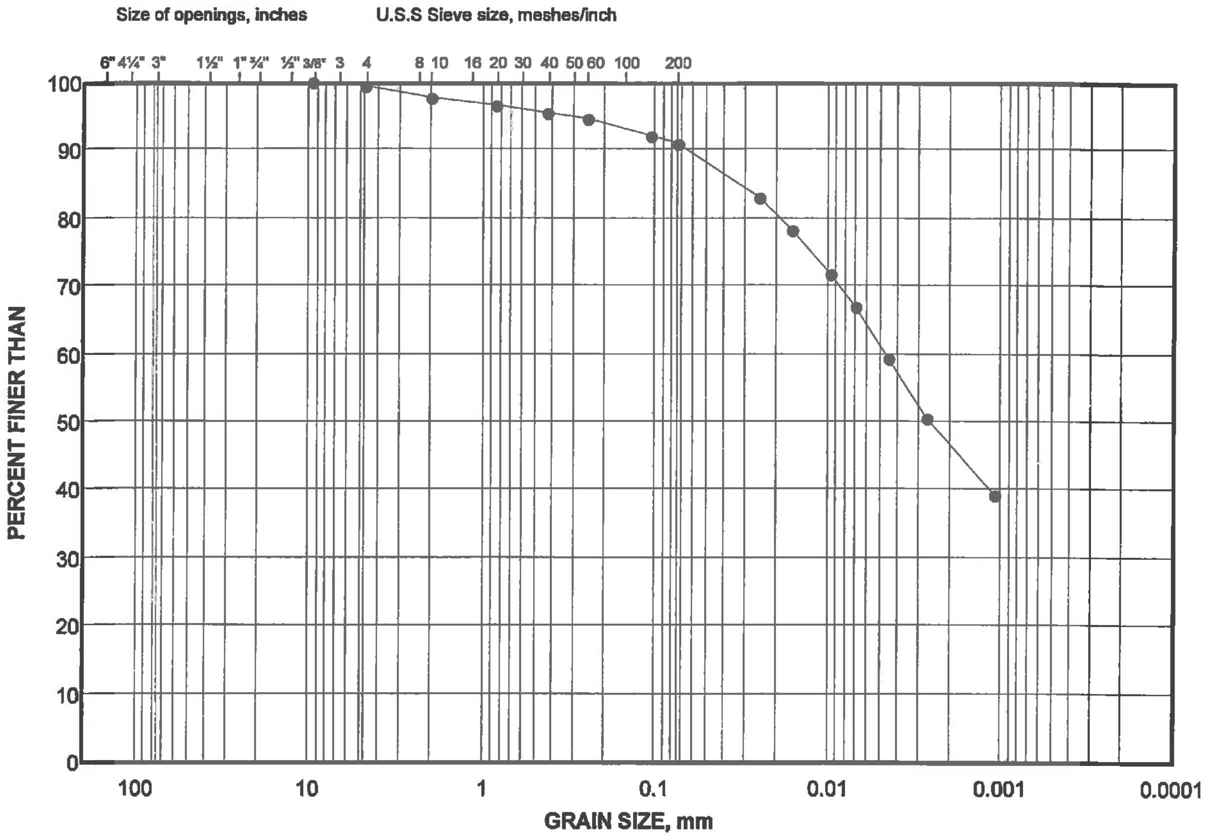
Project Number: 12-1183-0015

Checked By: ______________

Golder Associates

Date: 15-May-12

# GRAIN SIZE DISTRIBUTION	FIGURE



COBBLE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY SIZES
SIZE	GRAVEL SIZE		SAND SIZE			FINE GRAINED

LEGEND

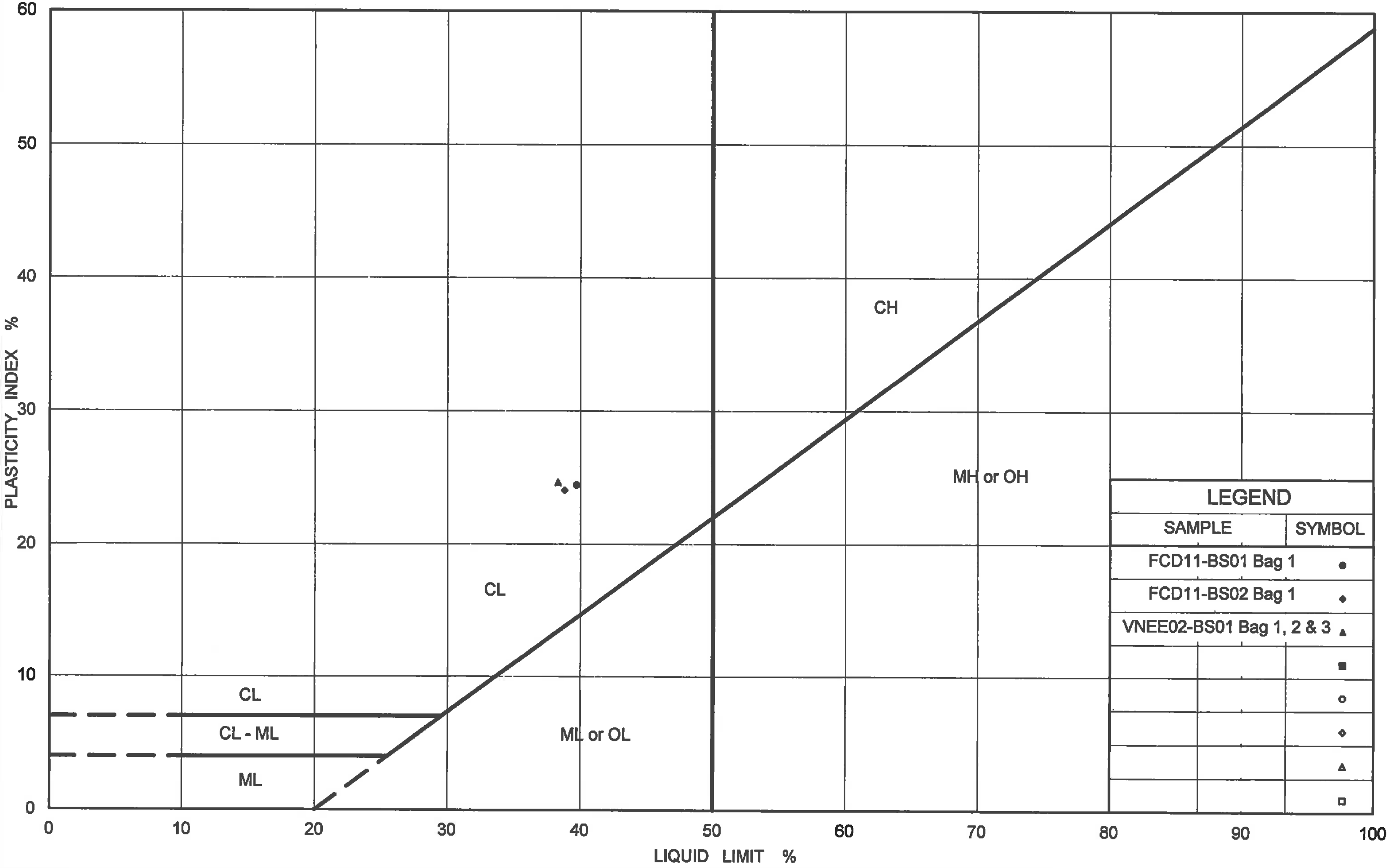
SYMBOL	SAMPLE	DEPTH(m)
●	VNEE02-BS01 Bag 1, 2 & 3	

Project Number: 12-1183-0015

Checked By: ______________

Golder Associates

Date: 18-Apr-12



PLASTICITY CHART

Golder Associates

Figure No.

Project No. 12-1183-0015

Checked By:

SUMMARY OF WATER CONTENT DETERMINATIONS

ASTM D 2216-05

PROJECT NUMBER 12-1183-0015
PROJECT NAME Foth / Testing / Victory Nickel
DATE TESTED April, 2012

Sample No.	Bag No.	Depth (m)	Water Content (%)	Atterberg Limits LL, PL, PI
FCD11-BS01	1	2.0	18.5%	LL=39.7, PL=15.2, PI=24.5
FCD11-BS01	2	2.0	19.9%	
FCD11-BS01	3	2.0	18.8%	
FCD11-BS01	4	2.0	16.9%	
FCD11-BS01	5	2.0	19.0%	
FCD11-BS02	1	6.1	18.1%	LL=38.8, PL=14.7, PI=24.1
FCD11-BS02	2	6.1	19.5%	
FCD11-BS02	3	6.1	20.8%	
FCD11-BS02	4	6.1	18.8%	
FCD11-BS02	5	6.1	22.1%	
VNEE02-BS01	1	3.5	14.4%	
VNEE02-BS01	2	3.5	20.0%	
VNEE02-BS01	3	3.5	18.5%	
VNEE02-BS01	4	3.5	20.1%	
VNEE02-BS01	1, 2 & 3			LL=38.3, PL=13.6, PI=24.7
VNWE03-BS01		4.2	28.1%	

Checked By:

SUMMARY OF WATER CONTENT DETERMINATIONS

ASTM D 2216-05

PROJECT NUMBER	12-1183-0015
PROJECT NAME	Foth / Testing / Victory Nickel
DATE TESTED	April, 2012

Borehole No.	Sample No.	Water Content (%)	Atterberg Limits LL, PL, PI
FTWR11	SS1 & SS2		LL=435.8, PL=347.1, PI=88.7

Checked By:

SPECIFIC GRAVITY TEST RESULTS

ASTM D 854-06 TEST METHOD A

PROJECT NUMBER	12-1183-0015
PROJECT NAME	Foth / Testing / Victory Nickel
DATE TESTED	May, 2012

Sample No.	Bag No.	Specific Gravity
FCD11-BS01	1	2.76
FCD11-BS02	1	2.78

Note: Test carried out on soil particles <2.00mm using distilled water.

Checked By:

Golder Associates

Appendix B

Stability Analyses

Appendix B

Starter Dam / Pre-load and Ultimate Dam Stability Analysis

Overview of Subsurface Conditions

The stratigraphy below the Minago TWRMF is described in Section 2.0 of the main test of this report. A slight simplification of the soil stratigraphy was required to prepare a simplified geological model suitable for performing the slope stability analydid. The following soil units are the dominant soil types at the TWRMF and are included in the model.

- Peat
- Stiff Intermediate Clay (CL)
- Soft Lower Clay (CH)
- Dolomite Bedrock

The weak Lower Clay (CH) is the soil unit that controls the stability of the dam.

Analysis Methodology

The critical dam section for a downstream failure to occur was assumed to be the North Dam at the base of the valley, where the dam height is greatest and the clay foundation is thickest. Three approaches were adopted to analyse the stability of the critical sections of the Starter Dam / Pre-load, Ultimate Dam, and Ulitmate Dam at Closure:

- Starter Dam / Pre-load: A total stress analysis (using undrained shear strength, s_u , for Intermediate and Lower Clay units) was considered to be appropriate for evaluation of the stability of the Starter Dam / Pre-load since it was anticipated that the rate of dyke rise is relatively fast compared to the ability of the foundation soil to dissipate excess porewater pressure (i.e. essentially no dissipation of excess porewater pressure).
- Ulimate Dam: To evaluate the stability of the Ultimate Dam, an effective stress analysis with excess porewater pressure (using effective stress paramters, c' and ϕ', and coefficient of excess porewater pressure, $\bar{B}$ for the clay units) was considered appropriate given the anticipated rate of construction of the Ultimate Dam and that sterngth gain will be required. An effecteive stress undrained approach provides a rationale mathod for assessing stability when excess porewater pressure exists as a function of loading raite (some dissipation of excess porewater pressure, and hence gain in shear strength takes places during loading/construction. The upstream slope of the Ultimate Side Dam was also analyzed against sliding using this approach.
- Ultimate Dam at Closure: To evaluate the stability of the Ultimate Dam at Closure (while providing containment for tailings, waste rock, and water), an effective stress analysis (using effective stress paramters, c' and ϕ', for the clay units) was considered appropriate given the amount of time allowed for filling of the TWRMF and for strength gain/powater pressure dissipation in the foundation soils. An effective stress drained approach provides a rationale method for assessing stability when excess porewater pressure has been allowed to dissipate.

A summary of the soil properties used for each analytical approach is provided in Table 1, and were based on field and laboratory data (Foth, 2013). The commercial software Geostdios SLOPE/W (Version 7.21) that employs the Limit Equilibrium Method was used to perform the stability analyses. Piezometric levels were imported from the Geostudios SEEP/W parent analysis.

Table 1 – Soil Parameters Used in Stability Analyses

Material Type		Unit Weight (kN/m^3)	Starter Dam		Ultimate Dam			Ultimate Dam at Closure	
			Cohesion, s_u (kPa)	Friction Angle, ϕ' (degrees)	Effective Cohesion, c' (kPa)	Effective Friction Angle, ϕ' (degrees)	Excess Porewater Pressure Coefficient, $\overline{B}$	Effective Cohesion, c' (kPa)	Effective Friction Angle, ϕ' (degrees)
Rock Fill[1]		20	0	45	0	45	-	0	45
Compacted Clay		20	0	22	0	22	-	0	22
Intermediate Clay (CL)	Total Stress Analysis	20	52	0	-	-	-	-	-
	Effective Stress Analysis		-	-	14	29	0.5	14	29
Lower Clay (CH)	Total Stress Analysis	18	12	0	-	-	-	-	-
	Effective Stress Analysis		-	-	12	21	0.7	12	21
Peat		12	12	0	12	0	-	12	0
Partially Compressed Peat		13	18	0	18	0	-	18	0
Co-mingled Tailings and Waste Rock		17	-	-	-	-	-	0	25

Notes

1. **The coarse and fine filter zones shown in Figure 5 and 6 were assumed to consist of Rock Fill.**

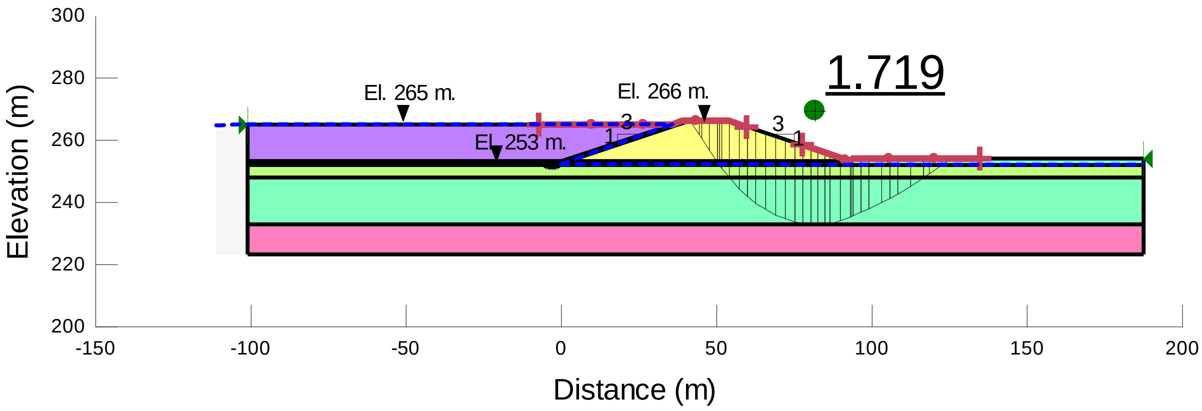
Stability Results

Different failure modes and mechanisms were considered in the analyses including potential shallow or deep-seated slip surfaces and optimized circular or block type slip surfaces, and the minimum calculated factors of safety for each scenario were reported. The results of the slope stability analyses are summarized in Table 2, and graphical results are provided in Figures 1 to 7.

The stability of the critical sections of the Starter Dam / Pre-load, Ultimate Dam, Ultimate Dam at Closure is controlled by the weak Intermediate Clay layer. Factors of Safety ranging from 1.3 to 1.7 were obtained for the different scenarios and failure modes.

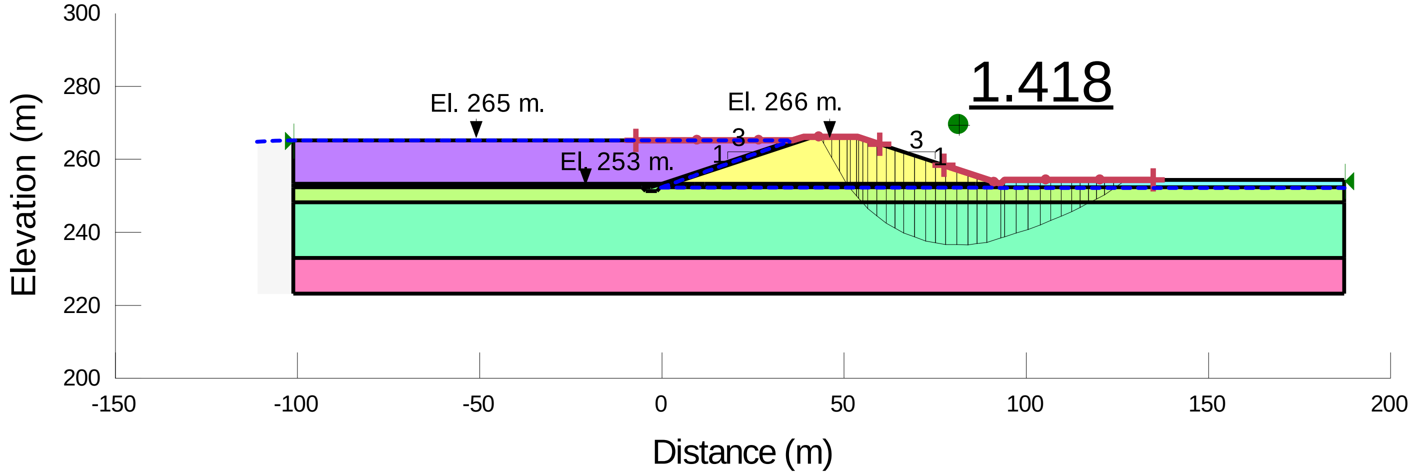
Table 2 - Stability Results

Scenario	Factor of Safety Under Static Conditions / Required	Factor of Safety Under Pseudo-static Conditions / Required
North Starter Dam / Pre-load – Downstream Failure (Total Stress Analysis)	1.31 / 1.3	-
Ultimate North Dam – Downsteam Failure (Effective Stress Analysis with Excess Porewater Pressure)	1.72 / 1.3	1.55 / 1.05
Ultimate Side Dam – Upsteam Failure (Effective Stress Analysis with Excess Porewater Pressure)	1.66 / 1.3	1.53 / 1.05
Ultimate North Dam At Closure - Downsteam Failure (Effective Stress Analysis)	1.72 / 1.5	1.42 / 1.05



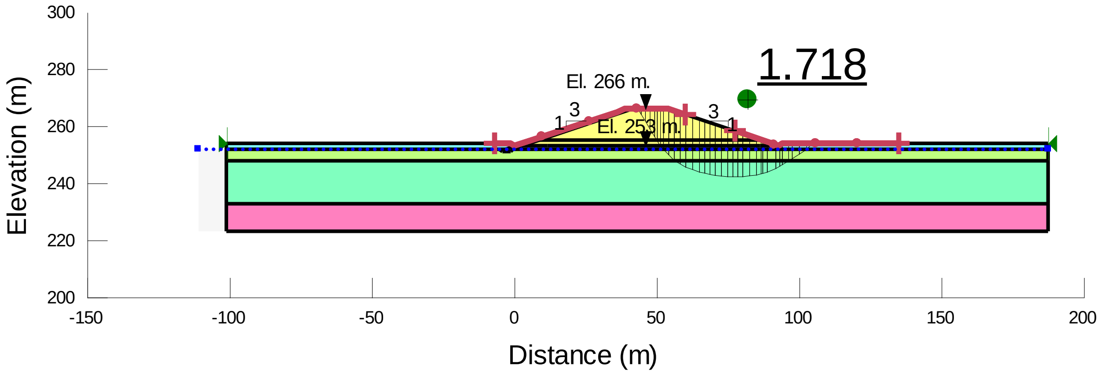
Name: Rock Fill Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 45 °
Name: Intermediate Clay (CL) Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 14 kPa Phi: 29 °
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 22 °
Name: Lower Clay (CH) Model: Mohr-Coulomb Unit Weight: 18 kN/m³ Cohesion: 12 kPa Phi: 21 °
Name: Peat Model: Undrained (Phi=0) Unit Weight: 12 kN/m³ Cohesion: 12 kPa
Name: Partially Compressed Peat Model: Mohr-Coulomb Unit Weight: 13 kN/m³ Cohesion: 18 kPa Phi: 0 °
Name: Co-mingled Tailings and Waste Rock Model: Mohr-Coulomb Unit Weight: 17 kN/m³ Cohesion: 0 kPa Phi: 25 °
Name: Dolomite Model: Bedrock (Impenetrable)

Figure 1 – Ultimate North Dam at Closure Cross Section Under Effective Static Conditions with an Optimized Circular Failure Surface.



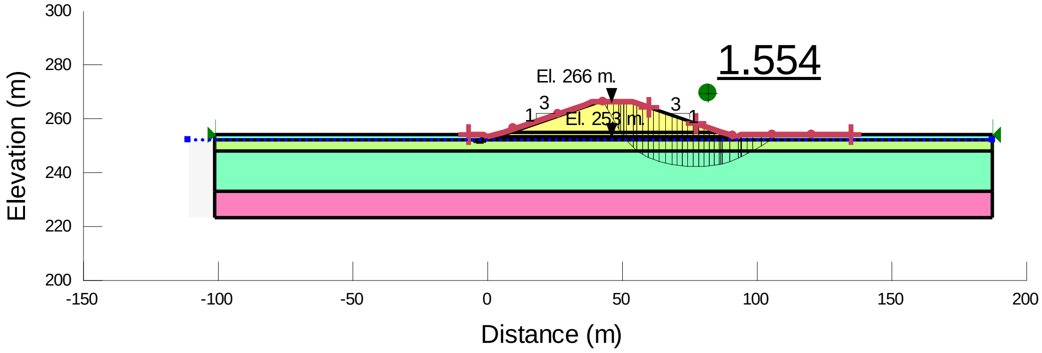
Name: Rock Fill Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 45 °
Name: Intermediate Clay (CL) Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 14 kPa Phi: 29 °
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 22 °
Name: Lower Clay (CH) Model: Mohr-Coulomb Unit Weight: 18 kN/m³ Cohesion: 12 kPa Phi: 21 °
Name: Peat Model: Undrained (Phi=0) Unit Weight: 12 kN/m³ Cohesion: 12 kPa
Name: Partially Compressed Peat Model: Mohr-Coulomb Unit Weight: 13 kN/m³ Cohesion: 18 kPa Phi: 0 °
Name: Co-mingled Tailings and Waste Rock Model: Mohr-Coulomb Unit Weight: 17 kN/m³ Cohesion: 0 kPa Phi: 25
Name: Dolomite Model: Bedrock (Impenetrable)

Figure 2 – Ultimate North Dam at Closure Stability Section Under Effective Pseudo-Static Conditions (PGA = 0.059g) with an Optimized Circular Failure Surface.



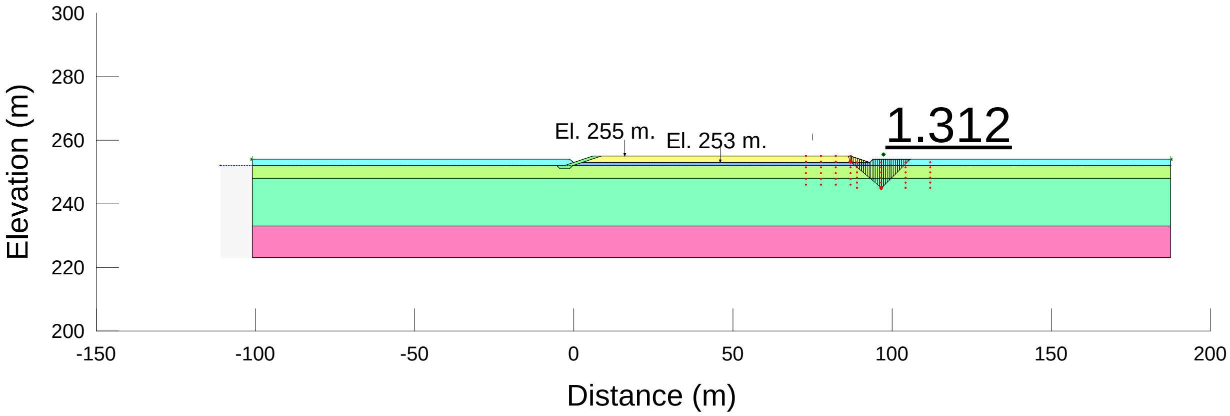
Name: Rock Fill Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 45 ° Piezometric Line: 1 Add Weight: Yes
Name: Intermediate Clay (CL) Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 14 kPa Phi: 29 ° Piezometric Line: 1 B-bar: 0.5 Add Weight: No
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 22 ° Piezometric Line: 1 Add Weight: No
Name: Lower Clay (CH) Model: Mohr-Coulomb Unit Weight: 18 kN/m³ Cohesion: 12 kPa Phi: 21 ° Piezometric Line: 1 B-bar: 0.7 Add Weight: No
Name: Peat Model: Undrained (Phi=0) Unit Weight: 12 kN/m³ Cohesion: 12 kPa Piezometric Line: 1 Add Weight: No
Name: Partially Compressed Peat Model: Mohr-Coulomb Unit Weight: 13 kN/m³ Cohesion: 18 kPa Phi: 0 ° Piezometric Line: 1 Add Weight: No
Name: Dolomite Model: Bedrock (Impenetrable) Piezometric Line: 1 Add Weight: No
Name: Rock Fill (Starter Dam) Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 45 ° Piezometric Line: 1 Add Weight: No

Figure 3 – Ultimate North Dam Stability Section Under Effective Undrained Static Conditions with an Optimized Circular Failure Surface.



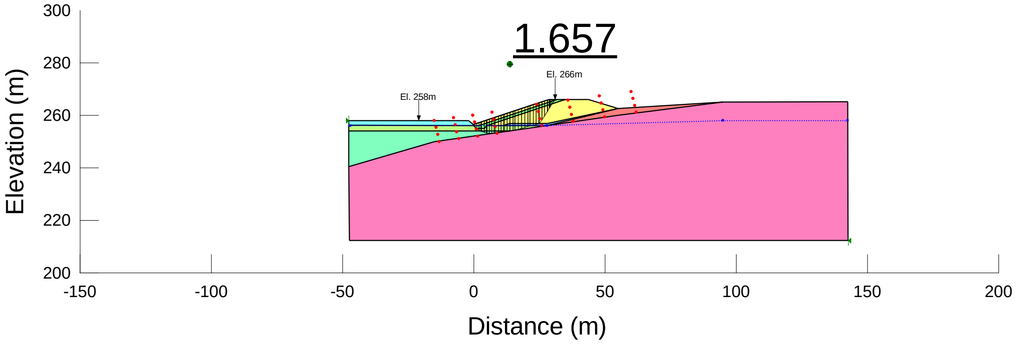
Name: Rock Fill Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 45 ° Piezometric Line: 1 Add Weight: Yes
Name: Intermediate Clay (CL) Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 14 kPa Phi: 29 ° Piezometric Line: 1 B-bar: 0.5 Add Weight: No
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 22 ° Piezometric Line: 1 Add Weight: No
Name: Lower Clay (CH) Model: Mohr-Coulomb Unit Weight: 18 kN/m³ Cohesion: 12 kPa Phi: 21 ° Piezometric Line: 1 B-bar: 0.7 Add Weight: No
Name: Peat Model: Undrained (Phi=0) Unit Weight: 12 kN/m³ Cohesion: 12 kPa Piezometric Line: 1 Add Weight: No
Name: Partially Compressed Peat Model: Mohr-Coulomb Unit Weight: 13 kN/m³ Cohesion: 18 kPa Phi: 0 ° Piezometric Line: 1 Add Weight: No
Name: Dolomite Model: Bedrock (Impenetrable) Piezometric Line: 1 Add Weight: No
Name: Rock Fill (Starter Dam) Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 45 ° Piezometric Line: 1 Add Weight: No

Figure 4 – Ultimate North Dam Stability Cross Section Under Effective Undrained Pseudo-Static Conditions (PGA=0.029g) with an Optimized Circular Failure Surface.



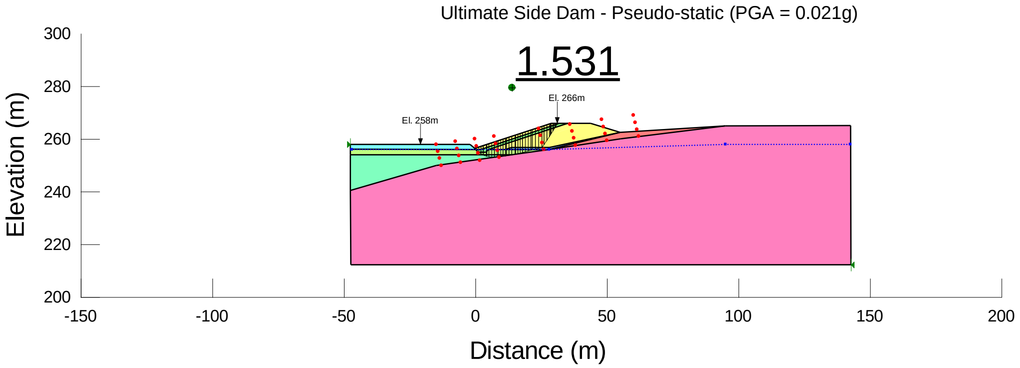
Name: Rock Fill Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 45 ° Piezometric Line: 1
Name: Intermediate Clay (CL) Model: Undrained (Phi=0) Unit Weight: 20 kN/m³ Cohesion: 52 kPa Piezometric Line: 1
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 22 ° Piezometric Line: 1
Name: Lower Clay (CH) Model: Undrained (Phi=0) Unit Weight: 18 kN/m³ Cohesion: 12 kPa Piezometric Line: 1
Name: Peat Model: Undrained (Phi=0) Unit Weight: 12 kN/m³ Cohesion: 12 kPa Piezometric Line: 1
Name: Partially Compressed Peat Model: Mohr-Coulomb Unit Weight: 13 kN/m³ Cohesion: 18 kPa Phi: 0 ° Piezometric Line:
Name: Dolomite Model: Bedrock (Impenetrable) Piezometric Line: 1

Figure 5 – Starter Dam / Pre-load Stability Section Under Undrained Static Conditions with an Optimized Block Failure Surface.



Name: Rock Fill Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 45 ° Piezometric Line: 1 Add Weight: Yes
Name: Intermediate Clay (CL) Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 14 kPa Phi: 29 ° Piezometric Line: 1 B-bar: 0.5 Add Weight: No
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 22 ° Piezometric Line: 1 Add Weight: Yes
Name: Lower Clay (CH) Model: Mohr-Coulomb Unit Weight: 18 kN/m³ Cohesion: 12 kPa Phi: 21 ° Piezometric Line: 1 B-bar: 0.7 Add Weight: No
Name: Peat Model: Undrained (Phi=0) Unit Weight: 12 kN/m³ Cohesion: 12 kPa Piezometric Line: 1 Add Weight: No
Name: Partially Compressed Peat Model: Mohr-Coulomb Unit Weight: 13 kN/m³ Cohesion: 18 kPa Phi: 0 ° Piezometric Line: 1 Add Weight: No
Name: Dolomite Model: Bedrock (Impenetrable) Piezometric Line: 1 Add Weight: No
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 19 kN/m³ Cohesion: 0 kPa Phi: 35 ° Piezometric Line: 1 Add Weight: No

Figure 6 – Ultimate Side Dam Stability Section Under Effective Undrained Static Conditions with an Optimized Block Failure Surface.



Name: Rock Fill Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 45 ° Piezometric Line: 1 Add Weight: Yes
Name: Intermediate Clay (CL) Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 14 kPa Phi: 29 ° Piezometric Line: 1 B-bar: 0.5 Add Weight: No
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 20 kN/m³ Cohesion: 0 kPa Phi: 22 ° Piezometric Line: 1 Add Weight: Yes
Name: Lower Clay (CH) Model: Mohr-Coulomb Unit Weight: 18 kN/m³ Cohesion: 12 kPa Phi: 21 ° Piezometric Line: 1 B-bar: 0.7 Add Weight: No
Name: Peat Model: Undrained (Phi=0) Unit Weight: 12 kN/m³ Cohesion: 12 kPa Piezometric Line: 1 Add Weight: No
Name: Partially Compressed Peat Model: Mohr-Coulomb Unit Weight: 13 kN/m³ Cohesion: 18 kPa Phi: 0 ° Piezometric Line: 1 Add Weight: No
Name: Dolomite Model: Bedrock (Impenetrable) Piezometric Line: 1 Add Weight: No
Name: Sand and Gravel Model: Mohr-Coulomb Unit Weight: 19 kN/m³ Cohesion: 0 kPa Phi: 35 ° Piezometric Line: 1 Add Weight: No

Figure 7 – Ultimate Side Dam Stability Section Under Effective Undrained Static Conditions with an Optimized Block Failure Surface.

Appendix C

Seepage Analyses

Appendix C

Seepage Analysis

Overview

The main focus of the seepage analysis is to assess the adequacy of the seepage control elements within the dam, and to evaluate the seepage through the structure and the foundation soils.

Seepage Control Elements

The seepage control through the perimeter dam and foundation soils is governed by design elements included in the dam and the tailings pond elevation. The following seepage control elements were included in the design of the perimeter dam:

- **Compacted Clay Liner**: An inclined low permeability liner with a 3H:1V slope is to be constructed along the upstream slope of the perimeter dam and tied into a key trench in native clay soils to minimize seepage.
- **Chimney Filter:** An inclined Chimney Filter with a 3H:1V slope is to be constructed along the upstream slope of the perimeter dam, beneath the Compacted Clay Liner to reduce the potential for internal erosion (piping) of the fine grained soil particles in the liner.

Seepage Analysis Methodology

Steady-state seepage analysis was performed along selected sections through North and Side Dams to assess the seepage through the structure and foundation soils and to assess the suitability of various Compacted Clay Liner thicknesses. The analysis was based on the geotechnical conditions of the dam section and foundation soils. The commercial software Geostudios SEEP/W (Version 7.21) that employs the Finite Elemen Method was used to perform the seepage analysis.

Boundary Conditions

For the North Dam analysis the boundary conditions are as follows:

- A constant head boundary (El. 263 m) within the tailings pond in the TWRMF.
- A constant head boundary (El. 252 m) on the downstream side of the dam, to model the water level in the seepage collection ditch.
- Zero flux boundaries along the crest and downstream slope of the dam.
- Zero flux boundaries along the upstream, downstream, and bottom sides of the seepage model.
- Infinite regions along the upstream side of the model, to effectively model the true length of the upsteram side of the TWRMF and maxmize the calculated seepage flux.

For the Side Dam analysis the boundary conditions are as follows:

- A constant head boundary (El. 263 m) within the tailings pond in the TWRMF.
- A constant head boundary (El. 258) along the downstream side of the model, to effectively model the hydraulic head on the downstream side of the Side Dam in the dolomite ridges.
- Zero flux boundaries along the crest and downstream slope of the dam.
- Zero flux boundaries along the upstream, and bottom side of the seepage model.
- Infinite regions along the upstream side of the model, to effectively model the true length of the TWRMF and maxmize the calculated seepage flux.

Hydraulic Conductivity

The saturated hydraulic conductivities that were used in the seepage analysis are summarized in Table 1, and were based on field and laboratory data (Foth, 2013) and on values used in Wardrop, 2010.

In the steady-state seepage analysis, it was assumed that the foundation soils are saturated while dam construction materials and tailings are initially unsaturated. For unsaturated conditions, the water content vs. suction and hydraulic conductivity vs. suction curves were estimated using information provided by the SEEP/W program. Further analysis on these soil water characteristic curves will be required during detailed design.

Table 1 - Saturated Hydraulic Conductivities Used in Seepage Analyses

Material Type	**K_{sat} (m/s)**
Rock Fill	1×10^{-5}
Compacted Clay	1×10^{-10}
Intermediate Clay (CL)	7.5×10^{-11}
Lower Clay (CH)	5×10^{-11}
Peat	1×10^{-5}
Partially Compressed Peat	1×10^{-5}
Dolomite	3.5×10^{-6}
Co-mingled Tailings and Waste Rock[1]	1×10^{-7}

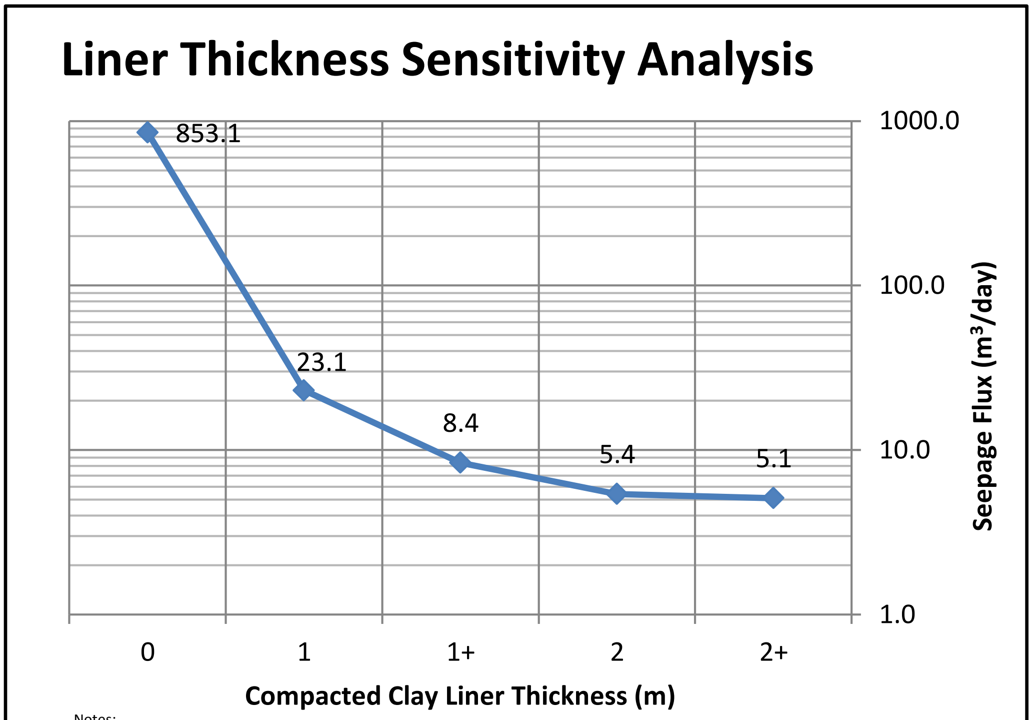
Notes:

1. The effective hydraulic condictvity of the co-mingled tailings and waste rock was assumed to be equal to the hydraulic conductivity of the tailings, since there is typically minimum barrier of 200 m of tailing against the upstream slope of the perimeter dam.

Seepage Results

Different Upstream Compacted Clay Liner thicknesses and configurations were considered in the analyses. Liner thicknesses ranging from 0 m (no liner) to more than 2 m were considered. The effects of varying compacted clay liner thicknesses on the seepage through the TWRMF perimeter dam are shown in Figure 1. Based on the results of the sensitivity seepage analysis, a Compacted Clay Liner thickness of 1 m was selected for TWRMF perimeter dam. The results of the seepage through the North Dam and Side Dam are shown in Figures 2 and 3, respectively, and the calculation of the approximate seepage flux through the entire TWRMF perimeter dam is provided in the following equation:

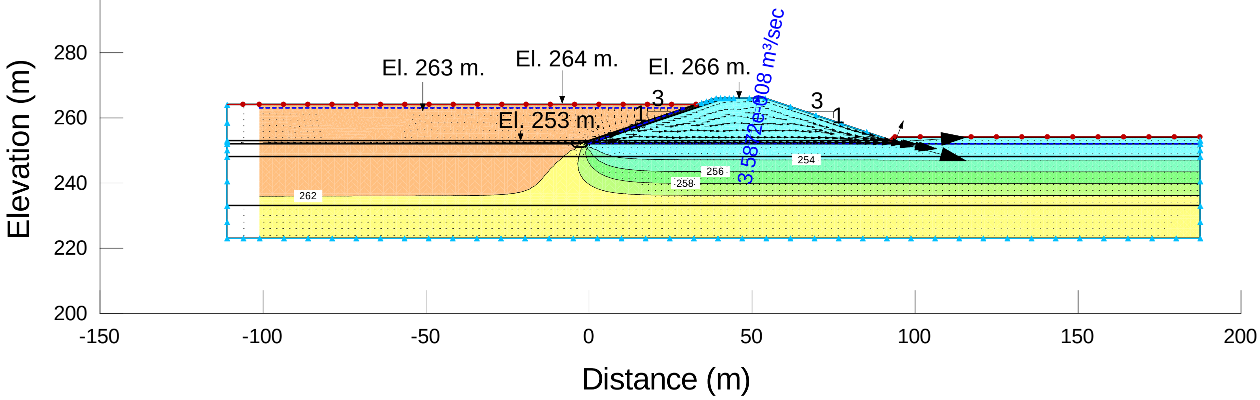
$$Q = 3.59 \times 10^{-8} \frac{m^3}{s} \times \frac{3600s}{hr} \times \frac{24hr}{d} \times 6100m + 1.16 \times 10^{-8} \frac{m^3}{s} \times \frac{3600s}{hr} \times \frac{24hr}{d} \times 4179m = 18.92 + 4.19 = \mathbf{23.1} \frac{\boldsymbol{m^3}}{\boldsymbol{d}}$$



Notes:

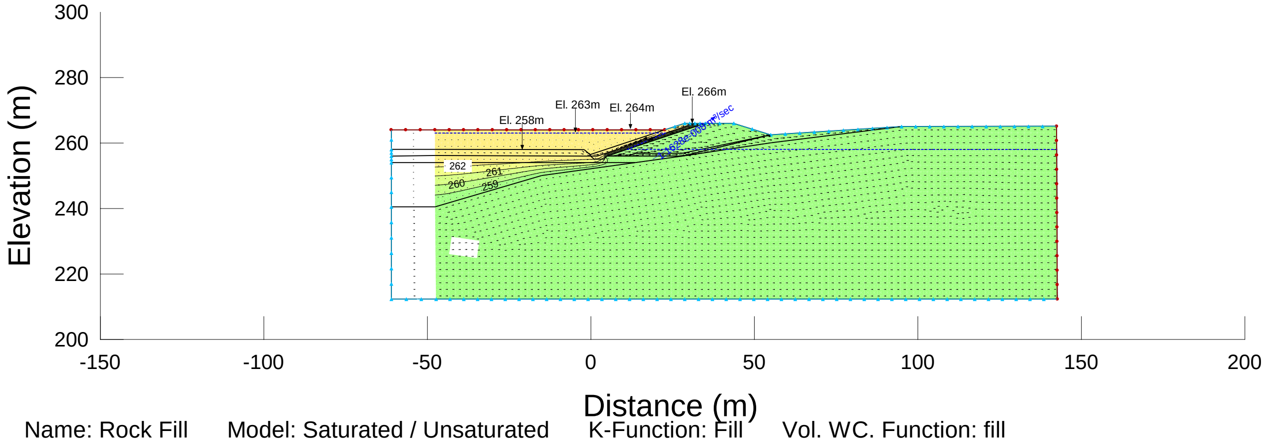
1. A thickness of 1+ m refers to an inclined liner with a thickness of 1 m at the dam crest that increases in thickness along the upstream slope of the dam, to provide additional seepage protection at the upstream toe.

Figure 1 – Evaluation of Seepage Fluxes Through the TWRMF Perimeter Dam With Varying Compacted Clay Liner Thicknesses



Name: Rock Fill Model: Saturated / Unsaturated K-Function: Fill Vol. WC. Function: fill
Name: Intermediate Clay (CL) Model: Saturated Only K-Sat: 7.5e-011 m/sec Volumetric Water Content: 0.35 m³/m³
Name: Compacted Clay Model: Saturated / Unsaturated K-Function: Core 100x (2) Vol. WC. Function: core
Name: Lower Clay (CH) Model: Saturated Only K-Sat: 5e-011 m/sec Volumetric Water Content: 0.35 m³/m³
Name: Peat Model: Saturated / Unsaturated K-Function: Fill Vol. WC. Function: fill
Name: Partially Compressed Peat Model: Saturated / Unsaturated K-Function: Fill Vol. WC. Function: fill
Name: Co-mingled Tailings and Waste Rock Model: Saturated Only K-Sat: 1e-007 m/sec Volumetric Water Content: 0.35 m³/m³
Name: Dolomite Model: Saturated Only K-Sat: 3.5e-006 m/sec Volumetric Water Content: 0.3 m³/m³

Figure 2 – Ultimate North Dam at Closure Seepage Analysis



Name: Rock Fill Model: Saturated / Unsaturated K-Function: Fill Vol. WC. Function: fill
Name: Intermediate Clay (CL) Model: Saturated Only K-Sat: 7.5e-011 m/sec Volumetric Water Content: 0.35 m³/m³
Name: Compacted Clay Model: Saturated / Unsaturated K-Function: Core 100x (2) Vol. WC. Function: core
Name: Lower Clay (CH) Model: Saturated Only K-Sat: 5e-011 m/sec Volumetric Water Content: 0.35 m³/m³
Name: Peat Model: Saturated / Unsa ted K-Function: Fill Vol. WC. Function: fill
Name: Partially Compressed Peat N turated / Unsaturated K-Function: Fill Vol. WC. Function: fill
Name: Co-mingled Tailings and Waste Ro Model: Saturated Only K-Sat: 1e-007 m/sec Volumetric Water Content: 0.35 m³/m
Name: Dolomite Model: Saturated Only K-Sat: 3.5e-006 m/sec Volumetric Water Content: 0.3 m³/m³
Name: Sand and Gravel Model: Saturated / Unsaturated K-Function: Fill Vol. WC. Function: fill

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Figure 3 – Ultimate Side Dam at Closure Seepage Analysis