



**FOUNDATION INVESTIGATION AND DESIGN REPORT
FOR PROPOSED
NEW BUILDING LOCATED AT THE MINDEMOYA PATROL YARD
AGREEMENT NO.: 5009-E-0062
GEOCRES NO.: 41G-11
WO 2010-11040**

**AUGUST 09, 2010
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PART 1: FACTUAL INFORMATION

1. INTRODUCTION

DST Consulting Engineers Inc. (DST) has been retained by the Ministry of Transportation, Northeastern Region, to conduct a foundation investigation for the proposed new building located at Mindemoya Patrol Yard that is located on Highway 542, on Lot 15, Concession 5, Township of Carnarvon in the Sudbury area, or the local address of 6702 Hwy 542, Mindemoya, Ontario, P0P 1S0. This work was carried out under the Agreement No. 5009-E-0062.

This report, the factual information, addresses the field investigation undertaken, laboratory test program performed and factual report on subsurface conditions encountered.

2. SITE DESCRIPTION

This site is mainly flat at the north end and slightly rises in elevation at the south end. Vegetation exists north and west of sides of the dome consisting of mainly grasses (Figure 2.1). A ditch (Figure 2.2) is located north, east and west of the existing dome and is at a distance of approximately 10 m from the dome.

The proposed structure has dimensions of 24.5 m × 42.5 m (80 ft × 140 ft) and will replace the existing Fitzpatrick Dome (Figure 2.3) that has been in-place for 37 years and has reached its life expectancy. The new structure will have a slightly larger foot print than the old dome and will be constructed in approximately same location as the old dome.

In this location, a geotechnical investigation was performed in 1959 for the construction of existing structure. According to that investigation, the generalized stratigraphy was identified as soil overlying bedrock varying in depth from a minimum of 0.2 m at the north end of the site to about 1.7 m at the south end. In addition, the overlying soil consisted of thick brown fine silty sandy followed by dry lighter brown fine silty sand usually with some gravel and small boulders above the bed rock. During the investigation, the water table was not detected above the bedrock and the bedrock was noted at shallow depth. It was recommended to lay the foundation directly on the bedrock.



Figure 2.1 Mindemoya patrol yard (facing north)



Figure 2.2 Mindemoya patrol yard (facing north east)



Figure 2.3 Mindemoya patrol yard location (facing south)

3. INVESTIGATION PROCEDURES AND LABORATORY TESTING

Site work was carried out in the period between July 10 and July 14, 2010 utilizing a CME 750 drill rig mounted on an all terrain chassis with large floatation tires. Nine (9) boreholes were put down to depths ranging between 0.9 and 4.2 m. Seven (7) of the boreholes were drilled at the strategic locations of the building foundation and another two were drilled at the middle of the proposed building area (Drawing 1). Twenty-two (22) hand auger boreholes were put down at the north side of the proposed building, where the new ditch is expected to be excavated (Drawing 1). Boreholes were advanced with 83 mm inside diameter hollow stem augers. Advancement beyond auger refusal with diamond drilling techniques was performed in BH 2 and BH 4. Soil samples were obtained from the auger flights and from the split spoon sampler used for the standard penetration test (SPT) at intervals of 0.75 m. The rock coring was performed using 'B' size core barrels.

The soil samples were identified in the field, placed in labelled containers and transported to DST's laboratory in Thunder Bay for further analysis. The classification and index tests were subsequently performed in the laboratory on samples collected from the boreholes to aid in the selection of engineering properties. Laboratory tests included natural moisture contents, gradation and Atterberg limits on soil samples and point load tests were performed on rock cores. Laboratory test results are presented in the Borehole Logs (Enclosures 1 to 9) and in the graphical illustrations (Enclosures 32 to 34).

Ground surface elevations of boreholes and hand auger holes were surveyed by DST personnel. The elevations of the boreholes were estimated based on a field level survey based on the Bench Mark (BM) with the elevation of 213.26 m (Drawing 1). The benchmark elevation was provided by MTO.

4. DESCRIPTION OF SUBSURFACE CONDITIONS

The subsurface conditions are presented based on the information obtained during power auger drilling and hand auger drilling. The subsurface conditions are separately discussed for proposed building site and new ditch site.

4.1 Subsurface Conditions – Proposed Building

The subsurface conditions of the proposed building site are discussed based on field and laboratory testing. In this site, slightly varied stratigraphy can be found at different locations of boreholes. The generalized stratigraphy, based on the conditions at the boreholes close to the existing ditch (Boreholes 1, 2 & 6), consists of clay overlying the bedrock. However, the generalized stratigraphy, based on conditions at the other boreholes (Boreholes 3, 4, 5, 7, 8 & 9), consists of mainly sand and gravel, overlying the bedrock. It is indicated that there is a slight change in the overburden between north and south side of the site. The depth of bedrock is about 1 m, slightly uniform over the site ranging from 0.9 to 1.4 m below ground surface at the boreholes due to undulation of its surface. Details of the subsurface conditions of the site are given in the Borehole Logs (Enclosures 1 to 9). Each identified stratigraphy is further discussed below.

4.1.1 Asphalt

A thickness of 80 mm asphalt was encountered in Borehole 3.

4.1.2 Sand

Sand with varying amount of gravel and silt was encountered in Boreholes 3, 4, 5, 7, 8 and 9. This layer varies in thickness between 0.2 and 1.2 m. SPT values are between 3 and 31 blows per 0.3 m indicating a state of variable compactness from very loose to compact. Gradation analyses conducted on samples collected at the boreholes indicate gravel, sand and fines contents of 7 to 37%, 42 to 83% and 10 to 38%, respectively. Grain size distributions are reported on the Borehole Logs (Enclosures 1 to 9) and are plotted in Enclosures 32 and 34. The moisture contents of samples range from 4 to 13%.

4.1.3 Clay

A clay material varying thickness between 0.9 and 1.2 m was encountered in Boreholes 1, 2, and 6. This clay consists of traceable amount of sand and gravel. The Atterberg limit tests were conducted

on samples from Boreholes 1, 2, 6 and 7 and are plotted in Enclosure 35. Laboratory tests on samples indicate that the clay has a liquid limit between 23 and 43% with a plasticity index between 7 and 29%, indicating low to high plasticity. SPT results between 1 and 10 blows over 0.3 m penetration. The moisture contents of samples range from 17 to 37%. Based on the moisture content and SPT results, the clay identified appears to be firm to stiff.

4.1.4 Till

Till was encountered in Boreholes 4, 7, 8 and 9. The till consists of sand, gravel and fine material and it overlies immediately above the bedrock with thickness ranging from 0.2 to 0.6 m. SPT values for this till are between 10 and 31 blows per 0.3 m indicating a state of variable compactness from loose to compact. The moisture contents of the samples range from 7% to 10%.

4.1.5 Bedrock

All boreholes encountered bedrock at depths varying between 0.9 and 1.4 m below existing grade. In Boreholes 2 and 4, rock coring was performed to a depth of 3 m below the rock surface. The depths of the bedrock below ground surface are provided in Table 4.1. It is expected that depth of the bedrock will vary slightly over the site due to undulation. According to the visual identification, the rock may was smooth and many fractures were noted and identified as sedimentary rock.

Table 4.1 Elevation of boreholes and depth of bedrock

Borehole I.D.	Ground elevation (m)	Bedrock depth (m)
BH 1	214.75	1.40
BH 2	214.28	1.00
BH 3	214.42	1.20
BH 4	214.33	1.20
BH 5	214.29	1.20
BH 6	214.25	0.90
BH 7	214.63	1.40
BH 8	214.42	1.30
BH 9	214.26	1.10

The rock cored was qualitatively identified in the laboratory. The Rock Quality Designation (RQD) is a qualitative estimate of rock mass quality from drill core logs. The RQD is expressed as given in Equation 4.1 (Deere et al., 1967) and Table 4.2 shows the ranges of RQD and strength classifications.

$$RQD = \frac{\sum \text{Length of core pieces} > 10 \text{ cm length}}{\text{Total length of core run}} \quad \text{Equation 4.1}$$

Table 4.2 Classification of rock mass using RQD index

RQD (%)	Rock quality
0 - 25	Very Poor
25 - 50	Poor
50 - 75	Fair
75 - 90	Good
90 - 100	Excellent

The measured RQDs of bedrock based on the Boreholes 2 and 4 are in the range between 33 and 45% and these values indicate a “poor” quality of rock quality underneath the proposed building.

In order to classify the bedrock with respect to strength, two point load tests were conducted on selected core samples. Estimated Uniaxial Compressive Strengths (UCS) from point load tests at Boreholes 2 and 4 are given in Table 4.3. In the estimation of UCS, the conversion factor of 16 was taken in the calculation (Smith, 1997). The bedrock is classified as “Medium” strength using strength classification given in Table 4.4.

Table 4.3 UCS of the bedrock predicted based of point load tests

Borehole I.D	Load (kN)	Corrected point load strength index, I_{50} (MPa)	Estimated Uniaxial Compressive Strength, UCS (MPa)
2	11.3	4.5	70
4	8.4	3.4	55

Table 4.4 Strength classification of rock mass using UCS

UCS (MPa)	Strength classification
1-5	Very Low
5-25	Low Strength
25-50	Moderate
50-100	Medium
100-250	High
250-700	Very High

4.1.6 Groundwater

At the time of the field investigation, the groundwater was not encountered in any of the boreholes. However, groundwater levels can be expected to vary with season and precipitation events. It is likely that a water table above the bedrock surface will occur at times, potentially as high as close to ground surface.

4.2 Subsurface Conditions – New Ditch

The general stratigraphy consists of clay, organics or fills overlying variable strata of clay that in turn are underlain by bedrock. The depths to refusal at each hand auger borehole are tabulated in Table 4.5. This may represent cobbles, boulders or bedrock. Enclosures 10 to 31 show the subsurface condition based on hand auger boreholes.

Table 4.5 Elevation of hand auger boreholes and depth of bedrock

Hand borehole I.D.	Ground elevation (m)	Refusal depth (m)
HA 1	214.93	1.40
HA 2	214.70	1.20
HA 3	214.63	1.10
HA 4	214.47	1.20
HA 5	214.84	1.40
HA 6	214.69	1.30
HA 7	214.62	1.20
HA 8	214.50	1.00
HA 9	214.37	1.10
HA 10	214.27	0.70
HA 11	214.87	1.10
HA 12	214.59	1.10
HA 13	214.46	0.90
HA 14	214.38	0.90
HA 15	214.28	1.00
HA 16	214.26	1.00
HA 17	214.91	1.50
HA 18	215.10	1.70
HA 19	214.08	0.90
HA 20	214.15	0.60
HA 21	215.39	1.50
HA 22	214.15	1.00

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PART 2: DISCUSSION AND RECOMMENDATIONS

5. DISCUSSION

DST Consulting Engineers Inc. (DST) has been retained by Ministry of Transportation, Northwestern Region, to conduct a geotechnical investigation for the proposed new building and the new ditch located at the Mindemoya Patrol Yard. This new building would replace the existing dome structure.

The proposed building that has the slightly larger foot print than existing one will accommodate approximately 7000 tonnes of winter sand. It is understood that the building is unheated.

The purpose of the boreholes along the proposed ditch alignment was to check for potential shallow bedrock by recording auger refusal depths. No design recommendations are required.

Unless noted otherwise, foundation design parameters are given for static, vertically and concentrically loaded foundations under compression loading. In addition, the lateral capacities of footings are also provided. The dynamic, eccentric and uplift design parameters can be provided on request, if applicable.

All design recommendations presented in this report are based on the assumption that an adequate level of construction monitoring during excavation and installation will be provided. An adequate level of construction monitoring is considered to be:

- Examination of all excavation to ensure the integrity of the subgrade for shallow foundations; and,
- Full-time monitoring and compaction testing for earthworks.

5.1 Geotechnical Parameters

Based on the in-situ and laboratory tests carried out, the following parameters are adopted as design parameters for each formation of the soils as given in Table 5.1. The internal friction angles

of granular materials were estimated from standard penetration tests applying Wolff, (1989) which provides an empirical correlation between SPT and internal friction angle. The undrained shear strength of the clay was estimated from SPT values applying Stroud (1975) and drained friction angle was estimated from the plastic index applying Kenney (1954). The values bracketed in the table were used for design. The bedrock was assumed as sedimentary rock based on data published by Natural Resources Canada. The design parameters (Table 5. 2) were adopted using Chang et al. (2006), and Lama and Vutukuri (1978). The unit weights should be reduced for a submerged condition below ground surface.

Table 5.1 Geotechnical parameters for soils

Soil Type	Unit weight (kN/m ³)	Undrained shear strength (kPa)	Drained internal friction angle (Deg)
Clay	19	25-50 (30)	27
Sand & Gravel	20	N/A	30-36 (33)
Till	20	N/A	30-36 (33)

Table 5.2 Geotechnical parameters for rock

Rock type	Unit weight (kN/m ³)	Young's modulus (GPa)	Drained internal friction angle (Deg)	Cohesion (MPa)
Sedimentary rock	29	15	32	1.5

5.2 Foundation Assessment

As the proposed building is single storey and not expected to be heavily loaded, shallow foundations are considered suitable for this site. Since the depth of bedrock is less than 1.5 m, the capacities of shallow footing have been estimated considering footings on bedrock. The bearing capacities were estimated for the ultimate limit state (ULS) and serviceability limit state (SLS) for a maximum settlement of 25 mm (Table 5.3). The resistance at ULS was calculated by applying load resistance factor of 0.5 according to the Canadian Foundation Engineering Manual. In general, SLS value does not apply in the case of unyielding foundation due to load of structure to be experienced by this structure. As stated in Canadian Highway Bridge Design Code (CHBDC) CAN/CSA-S6-06 section 6.6.3.6 para (d), resistance at SLS can be considered the same as resistance at ULS for this type of

competent foundation. The recommended capacities below apply to both square and strip footings. The footing widths should not be less than 0.5 m.

Table 5.3 Shallow Footings bearing pressures on bedrock

Width of Footing, B (m)	Resistance at ULS (kPa)
0.5	4500
1.0	1375
1.5	300

The depth and condition of the bedrock were identified and depths may vary unpredictably on the site. All foundations systems should be placed on sound bedrock (rough to very rough surface, unweathered to slightly weathered, moderately close to wide spacing discontinuities and free of loose rock fragments) on a surface that has been suitably prepared with tight joints. All bearing surfaces should be clear of all loose, fractured or highly weathered rock prior to concrete placement.

The bedrock subgrade preparation requires the following procedures under the direction of a Geotechnical Engineer:

- Sub-excavate any zones of unsuitable (as defined above) rock.
- Clear all bearing surfaces of soil and loose rock as identified by excavator equipment.
- Assess any bedrock with open or soil-filled joints. If design allows for frost penetration of the bedrock, treat by cleaning cracks and joints to a minimum depth equal to 3 times the width and filling with cement mortar or slush grout, dependant on crack width. Otherwise remove such bedrock.
- Apply dental concrete to level out rock surface sufficiently for uniform foundation support.

5.3 The Effect of Interior Stockpile

As the proposed structure accommodates approximately 7000 tonnes of winter sand, any winter sand that may be restrained by a foundation wall will exert lateral pressure against the wall. There

will be additional pressure from the interior earth against the wall below the stockpile. The lateral pressure may cause sliding and/or rotation of the foundation. Lateral resistance is available from earth pressure against the wall's exterior as well as from along the concrete/bedrock surface. These resistances are considered relatively small however and should not be relied upon for footings supporting lateral stockpile loads if the footings have been designed based on vertical loads alone and zero lateral movement. Typical options for providing lateral resistance are:

- A wider footing base
- Engineered fill against the wall exterior
- Dowels through the footing into the bedrock

The footings have the following lateral capacity for winter sand. Figure 5.1 show lateral forces that may be exerted on the foundation during its operation. Table 5.4 details the resistance at ULS per meter length of wall. The geotechnical lateral resistance was estimated assuming the lateral forces that are exerted only by the existing soil F_{act} and F_{pas} and the winter sand F_{win} . The depth of the footing was assumed 1.0 m below ground surface. If in any circumstances, the lateral load exerted by the winter sand F_{win} exceeds geotechnical lateral resistance at ULS; wider dimension footing with appropriate supporting should be used to avoid sliding and overturning of the footings.

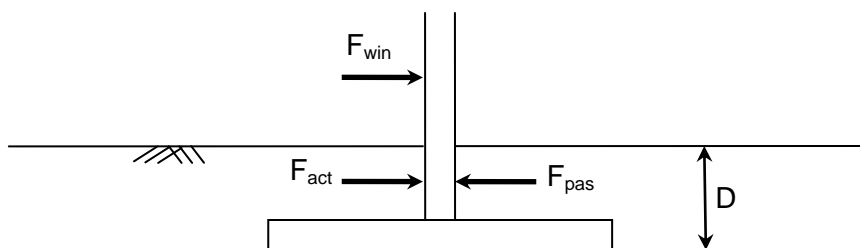


Figure 5.1 Schematic diagram of lateral forces acting on footing

Consolidation of the existing soil over the bedrock will occur under the stockpile load. This is expected to result in uneven settlement, given the variable soil conditions, the presence of variably consolidated areas both inside and outside the previous stockpile, and variations in stockpile height. Soil consolidation is not expected to affect foundations on bedrock. They would, however, damage any buried services above the bedrock under the stockpile. Options are available to control these if required, such as replacement of soil with engineered fill, or preloading. Additional details can be

provided on request, if required.

Table 5.4 Geotechnical lateral resistance of the footings

Width of footing, B (m)	Lateral resistance at ULS (kN/m)
0.5	5.0
1.0	7.0
1.5	9.0

5.4 Excavations

Excavations should be planned and constructed in accordance with the requirements of the Occupational Health and Safety Act of Ontario. No surface surcharges should be placed closer to the edge of the excavation than a distance equal to the twice depth of the excavation, unless an excavation support system is designed and incorporated to accommodate such surcharge.

Even though the water table was not encountered during the geotechnical investigation, dewatering of the excavations may be required, depending on a number of factors including excavation depth, season and weather conditions, and the length of time the excavations are open. Based on the borehole data, it is anticipated that construction areas can be controlled by conventional sump and pump techniques.

Excavations above the groundwater table should be constructed with side slopes no steeper than 1H to 1V for cohesive soils (e.g., clays) and 2H to 1V for cohesionless soils (e.g., sands). In wet material below the groundwater table (if any), excavated side slopes will need to be flattened (4H to 1V, or flatter) to prevent excessive sloughing of the excavation slopes. The stability of the excavation side slopes will be highly dependent on the contractor's methodology and ability to effectively dewater the excavation.

Attention should be paid to any structures or buried service lines close to the excavation. A general guideline is that if a line projected down, at 30° from the horizontal from the base of foundations of adjacent structures intersects the extent of the proposed excavation, underpinning or special shoring techniques may be required to avoid damaging earth movements.

5.5 Frost Protection

Accordance with Canadian Foundation Engineering Manual, the design freezing index for the Mindemoya area has been estimated as 1400 Degree days Celsius. Since clay and sand were identified in the site at different boreholes, the frost depth was estimated assuming the sand. The estimated depth of frost penetration is in the order of 2.3 m.

Much of the soil at this site has high silt content and is considered highly frost susceptible (capable of forming thick ice lenses and heaving). In general, frost protection is not required for competent rock. The bedrock as sampled at 2 locations through vertical coring, however, shows signs of open joints or joints with no soil infill (Figure 5.2). Therefore, frost effects on the bedrock supporting the foundations are considered possible due to highly jointed nature of rocks, when the joints are connected by vertical joints. However, due to the nature the drilling vertical joints were unable to confirm. It is recommended that the bedrock should be inspected for vertical joints during construction and treated to avoid the frost heave.



Figure 5.2 The rock core at Borehole 2

The site soils are considered unsuitable as foundation backfill, given their potential for heaving and associated jacking of foundations as a result of frost. To reduce the potential of frost jacking the foundation excavations should have slopes not steeper than 1:1 and be backfilled with non-frost susceptible granular soil.

6. CONSTRUCTION MONITORING AND INSPECTION

All foundation design recommendations presented in this report are based on the assumption that an adequate level of construction monitoring by qualified geotechnical personnel during construction will be provided. An adequate level of construction monitoring is considered to be: a) for shallow foundations: full-time monitoring and design review during construction; and b) for earthworks: full-time quality control and compaction testing.

An important purpose of providing an adequate level of monitoring is to check that recommendations, based on data obtained at discrete borehole locations are relevant to other areas of the site.

In order to provide an adequate level of construction monitoring, qualified geotechnical personnel should manage and supervise the following tasks during construction.

➤ Shallow foundations

- Confirm that materials and methods meet specifications
- Inspect excavations
- Provide review comments, including any discrepancies found with respect to specifications as well as this report, and the need for any modifications to the design or methods

➤ Earthworks

- Confirm that materials and methods meet specifications
- Inspect subgrade prior to fill placement
- Review compaction testing records

7. REFERENCES

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8. LIMITATIONS OF REPORT

A description of limitations which are inherent in carrying out site investigation studies is given in Appendix 'A', and this forms an integral part of this report.

For DST CONSULTING ENGINEERS INC.

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Principal

8. LIMITATIONS OF REPORT

A description of limitations which are inherent in carrying out site investigation studies is given in Appendix 'A', and this forms an integral part of this report.

For DST CONSULTING ENGINEERS INC.

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Mike Fabius, P. Eng.
Principal

APPENDIX 'A'
LIMITATIONS OF REPORT

LIMITATIONS OF REPORT

GEOTECHNICAL STUDIES

The data, conclusions and recommendations which are presented in this report, and the quality thereof, are based on a scope of work authorized by the Client. Note that no scope of work, no matter how exhaustive, can identify all conditions below ground. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the specific locations tested, and conditions may become apparent during construction which were not detected and could not be anticipated at the time of the site investigation. Conditions can also change with time. It is recommended practice that DST Consulting Engineers be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the testhole locations and should not be used for other purposes, such as grading, excavation, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

Unless otherwise noted, the information contained herein in no way reflects on environmental aspects of either the site or the subsurface conditions.

The comments given in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of testholes may not be sufficient to determine all the factors that may affect construction methods and costs, e.g. the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

Any results from an analytical laboratory or other subcontractor reported herein have been carried out by others, and DST Consulting Engineers Inc. cannot warranty their accuracy. Similarly, DST cannot warranty the accuracy of information supplied by the client.

DRAWINGS

PLATE No
659-542/31-0
DRAWING No.
06590542031
CONT No
5009-0062
WO No
2002-50-008

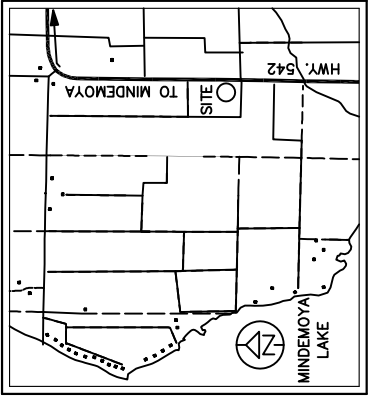
Mindemoya Patrol Yard
STA 23+020 TO STA 23+120
Survey 2002/05 Revised

SHEET

METRIC

DIMENSIONS ARE IN METRES
AND / OR MILLIMETRES
UNLESS OTHERWISE SHOWN

KEY PLAN



LEGEND

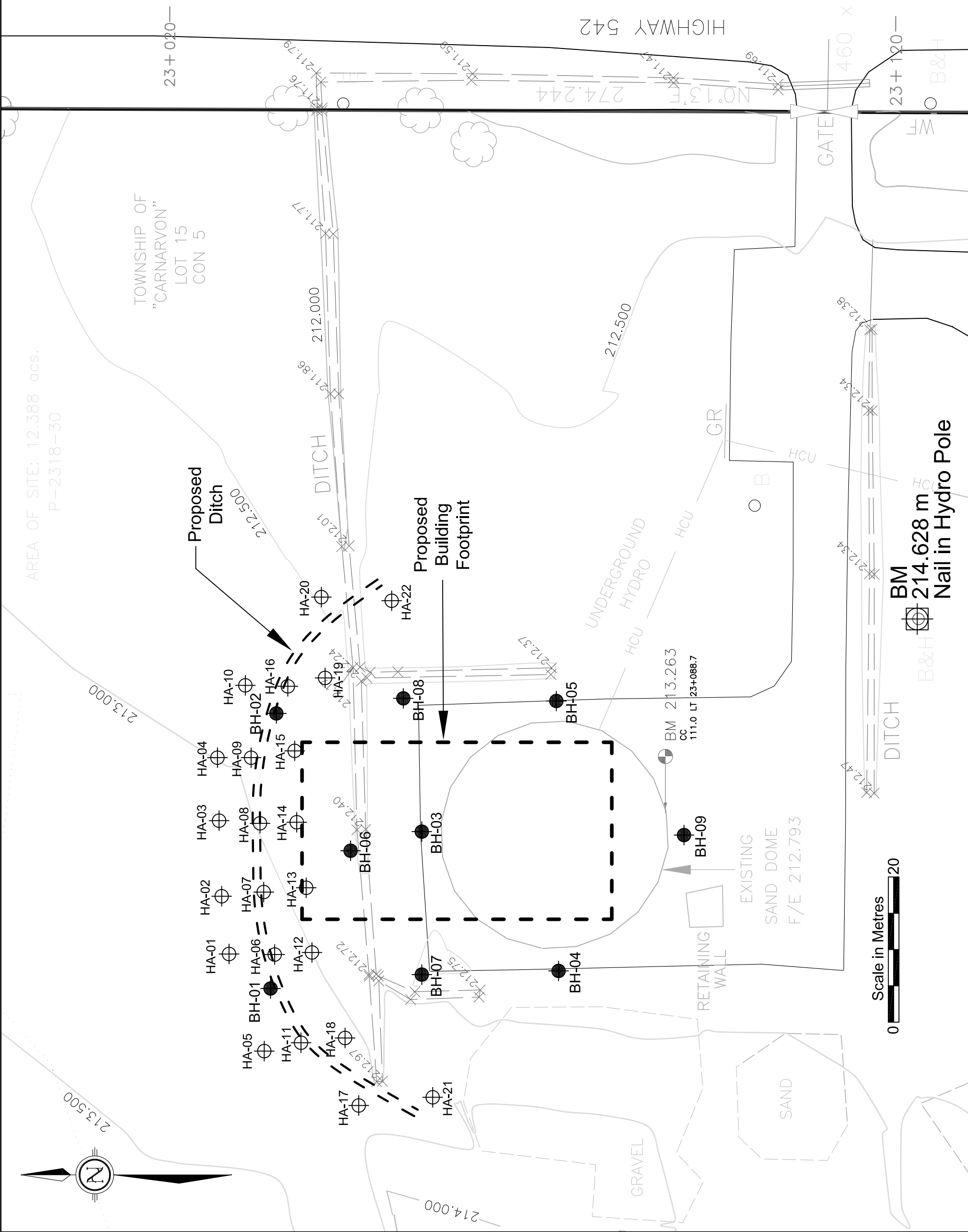
- Borehole - Deep
- Borehole - Shallow
- Borehole with CPT
- Rock Probe
- 'N'
- Blows/0.3m (Std. Pen Test, 475 J/Blow)
- Water level at time of Investigation.

- Fill
- Organics
- Topsoil
- Till
- Bedrock
- Sand
- Silt
- Clay
- Sand & Gravel
- Boulders

No.	Elevation	Northing	Easting
BH-01	214.753	5064100	407003
BH-02	214.233	5064099	407004
BH-03	214.333	5064098	407005
BH-04	214.333	5064060	407005
BH-05	214.293	5064060	407042
BH-06	214.253	5064088	407022
BH-07	214.633	5064079	407005
BH-08	214.633	5064081	407005
BH-09	214.263	5064081	407023
HA-01	214.933	5064106	407008
HA-02	214.698	5064106	407016
HA-03	214.633	5064106	407027
HA-04	214.473	5064107	407035
HA-05	214.633	5064106	407035
HA-06	214.633	5064099	407035
HA-07	214.618	5064100	407017
HA-08	214.503	5064101	407026
HA-09	214.373	5064102	407035
HA-10	214.273	5064103	407040
HA-11	214.586	5064096	407036
HA-12	214.588	5064095	407036
HA-13	214.463	5064095	407018
HA-14	214.378	5064096	407026
HA-15	214.283	5064096	407036
HA-16	214.263	5064097	407045
HA-17	214.586	5064096	407036
HA-18	215.098	5064096	406996
HA-19	214.083	5064092	407046
HA-20	214.053	5064092	407057
HA-21	215.393	5064088	406988
HA-22	214.153	5064082	407056

NOTE:
The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed by interpolation and may not represent actual conditions.

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BM
214.628 m
Nail in Hydro Pole


ENCLOSURES

RECORD OF BOREHOLE No BH-01

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064100 m N, 407003 m E) ORIGINATED BY KS
DIST HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML
DATUM Geodetic DATE 2010 07 10 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
						20 40 60 80 100 ○ UNCONFINED ✕ FIELD VANE □ QUICK TRIAXIAL ★ LAB VANE					WATER CONTENT (%)						
						20 40 60 80 100					20 40 60						
214.8	GROUND SURFACE																
	CLAY - Silty, some organics, brown, firm		SS1	SS	7												
	----- - layered silty clay and clayey silt, brown/grey		SS2	SS	7												
213.4			SS3	SS	28												
1.4	End of Borehole at 1.35 m Auger Refusal																28 blows for 120 mm (Blow counts stopped. Auger Bouncing)

✕³, ★³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ENCLOSURE 1




ON_MOT_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST_MIN.GDT 9/8/10

RECORD OF BOREHOLE No BH-02

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064099 m N, 407041 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)	
								○ UNCONFINED □ QUICK TRIAXIAL	× FIELD VANE ★ LAB VANE							
214.3	GROUND SURFACE							20 40 60 80 100								
	CLAY - Silty, layered, trace sand and gravel, brown, very soft		AS1	AS										Borehole Dry on Completion		
			SS2	SS	1											
213.3																
1.0	BEDROCK															
	RC1 TCR 1.53 m - 100% RQD 1.45 m - 33%		RC1	RC												
	RC1 TCR 1.33 m - 100% RQD 1.33 m - 33%		RC2	RC												
210.5																
3.8	End of Borehole at 3.8 m No Further Progress (Due to damaged core barrel)															

ON_MOT_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST_MIN.GDT 9/8/10

✕³, ★³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



ENCLOSURE 2

RECORD OF BOREHOLE No BH-03

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064077 m N, 407023 m E) ORIGINATED BY KS
DIST HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML
DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
						20 40 60 80 100 ○ UNCONFINED ✕ FIELD VANE □ QUICK TRIAXIAL ★ LAB VANE					WATER CONTENT (%)						
						20 40 60 80 100					20	40	60				
214.4	GROUND SURFACE																
214.3	ASPHALT - 80 mm																
0.1	SAND & GRAVEL - Silty, brown, loose to compact		SS1	SS	8												
	----- - trace clay		SS2	SS	28												
213.2	End of Borehole at 1.24 m Auger Refusal															18 blows for 100 mm (Blow counts stopped. Auger Bouncing)	

✕³, ★³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ENCLOSURE 3

RECORD OF BOREHOLE No BH-04

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064060 m N, 407005 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
								20 40 60 80 100						
214.3	GROUND SURFACE													
	SAND & GRAVEL - Silty, brown, compact		SS1	SS	16		214							
213.7	- Silty Clay, some sand and gravel - 50 mm													
0.6	TILL - Sand, gravelly, silty, trace clay, brown, compact		SS2	SS	31									
213.1	BEDROCK						213							
1.2	RC1 TCR 1.5 m - 100% RQD 1.45 m - 43%		RC1	RC										
							212							
	RC1 TCR 1.53 m - 100% RQD 1.45 m - 43%		RC2	RC			211							
210.1	End of Borehole at 4.2 m													
4.2														

ON_MOT_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST_MIN.GDT 9/8/10

✕³, ★³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No BH-05

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064060 m N, 407042 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	20	40	60			
214.3	GROUND SURFACE																
	SAND- Silty, trace gravel, loose		SS1	SS	10												
	----- - trace clay, occasional cobbles		SS2	SS	10												
213.0			SS3	SS	7												
1.3	End of Borehole at 1.25 m Auger Refusal															7 blows for 50 mm (Blow counts stopped. Auger Bouncing)	

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No BH-06

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064088 m N, 407022 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
						20 40 60 80 100 ○ UNCONFINED ✕ FIELD VANE □ QUICK TRIAXIAL ★ LAB VANE					WATER CONTENT (%)						
						20 40 60 80 100					20	40	60				
214.3	GROUND SURFACE																
	CLAY & SILT - trace sand, layered, varved, brown/grey, stiff		SS1	SS	10												
			SS2	SS	10												
213.4																	
0.9	End of Borehole at 0.85 m Auger Refusal															10 blows for 120 mm (Blow counts stopped. Auger Bouncing)	

✕³, ★³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No BH-07

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064079 m N, 407005 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED ✕ FIELD VANE □ QUICK TRIAXIAL ★ LAB VANE									
214.6	GROUND SURFACE							20	40	60	80	100					GR SA SI CL
214.5	SAND & GRAVEL - Silty, brown																Borehole Dry on Completion
0.2	SAND - some gravel, brown/grey, loose		SS1	SS	8												6 83 (11)
213.9	CLAY & SILT - stiff		SS2	SS	14												
0.8																	
213.4	TILL - Sand, gravelly, silty, trace clay, brown		SS3	SS	30												14 44 (42)
1.2																	
213.2																	
1.4	End of Borehole at 1.4 m Auger Refusal																30 blows for 50 mm (Blow counts stopped. Auger Bouncing)

✕³, ★³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ENCLOSURE 7





ON_MOT_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST_MIN.GDT 9/8/10

RECORD OF BOREHOLE No BH-08

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064081 m N, 407043 m E) ORIGINATED BY KS
DIST HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML
DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
214.4	GROUND SURFACE													
214.3	SAND & GRAVEL - Silty, some organics and asphalt, brown													Borehole Dry on Completion
0.2	SILT & CLAY - layered, brown, stiff		SS1	SS	10		214							
213.8														15 57 (28)
0.6	TILL - Sand, silty, some gravel, trace clay, brown, compact		SS2	SS	12									
213.2														7 45 (48)
1.3	End of Borehole at 1.25 m Auger Refusal		SS3	SS	4									4 blows for 40 mm (Blow counts stopped. Auger Bouncing)

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

ENCLOSURE 8

ON_MOT_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST_MIN.GDT 9/8/10

RECORD OF BOREHOLE No BH-09

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064044 m N, 407023 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hollow Stem Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 12 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								20	40	60	80	100					

✕³, ★³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-01

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064106 m N, 407008 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	20	40	60			
214.9	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, occasional cobbles, brown CLAY - Silty, trace sand and gravel, occasional cobbles, brown																
214.8 0.1																	
213.6 1.4	End of Borehole at 1.35 m Auger Refusal on Bedrock																

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-02

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064106 m N, 407016 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100		
214.7														
214.6	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown													
0.1	CLAY - Silty, trace sand and gravel, brown													
213.5							214							
1.2	End of Borehole at 1.20 m Auger Refusal on Bedrock													

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\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-03

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064106 m N, 407027 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	20	40	60			
214.6																	
214.5	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown																
0.1	CLAY - Silty, trace sand and gravel, brown																
213.5																	
1.1	End of Borehole at 1.10 m Auger Refusal on Bedrock																

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-04

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064107 m N, 407035 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
214.5	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown																
214.4 0.1	CLAY - Silty, trace sand and gravel, brown																
213.3 1.2	End of Borehole at 1.15 m Auger Refusal on Bedrock																


\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-05

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064100 m N, 406995 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT						UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
214.8	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown CLAY - Silty, trace sand and gravel, brown						<div><div>20406080100</div><div>○ UNCONFINED × FIELD VANE</div><div>□ QUICK TRIAXIAL ★ LAB VANE</div></div>						<div><div>PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT</div><div>w_p w w_L</div><div>WATER CONTENT (%)</div></div>			GR SA SI CL	
214.7																	
0.1																	
213.4							214										
1.4	End of Borehole at 1.40 m Auger Refusal on Bedrock																

✕³, ★³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-06

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064099 m N, 407008 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
214.7	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown CLAY - Silty, trace sand and gravel, occasional cobbles, brown																
214.6 0.1																	
213.4 1.3	End of Borehole at 1.30 m Auger Refusal on Bedrock																

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-07

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064100 m N, 407017 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
						20	40	60	80	100							
214.6																	
214.5	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown																
0.1	CLAY - Silty, trace sand and gravel, brown																
213.5																	
1.2	End of Borehole at 1.15 m Auger Refusal on Bedrock																

✕³, ★³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-08

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064101 m N, 407026 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
214.5																	
214.4	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown																
0.1	CLAY - Silty, trace sand and gravel, brown																
213.5																	
1.0	End of Borehole at 1.00 m Auger Refusal on Bedrock																

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-09

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064102 m N, 407035 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
214.4	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown CLAY - Silty, trace sand and gravel, brown																
214.3 0.1																	
213.3 1.1	End of Borehole at 1.05 m Auger Refusal on Bedrock																

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-10

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064103 m N, 407040 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
						20	40	60	80	100	W _p	W	W _L			
214.3	TOPSOIL - CLAY - Silty, with organics, some sand and gravel, brown CLAY - Silty, some sand and gravel, brown					214										
214.2 0.1																
213.6 0.7	End of Borehole at 0.70 m Auger Refusal on Bedrock															

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-11

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064096 m N, 406996 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W _p	W	W _L		
							20	40	60	80	100						
214.9																	
214.8	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown																
0.1	CLAY - Silty, trace sand and gravel, brown																
213.8																	
1.1	End of Borehole at 1.10 m Auger Refusal on Bedrock																

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-12

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064094 m N, 407008 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
214.6																	
214.5	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, brown																
0.1	CLAY - Silty, trace sand and gravel, occasional cobbles, brown																
213.5	End of Borehole at 1.05 m Auger Refusal on Bedrock																
1.1																	


\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-13

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064095 m N, 407018 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
214.5																	
214.4	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, occasional cobbles, brown																
0.1	CLAY - Silty, trace sand and gravel, brown																
213.6																	
0.9	End of Borehole at 0.90 m Auger Refusal on Bedrock																

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-14

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064096 m N, 407026 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	20	40	60			
214.4	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, occasional cobbles, brown CLAY - Silty, trace sand and gravel, brown																
214.3 0.1																	
213.5 0.9	End of Borehole at 0.90 m Auger Refusal on Bedrock																

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-15

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064096 m N, 407036 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
214.3																	
214.2	TOPSOIL - CLAY - Silty, with organics, trace sand and gravel, occasional cobbles, brown																
0.1	CLAY - Silty, trace sand and gravel, brown																
213.3																	
1.0	End of Borehole at 1.00 m Auger Refusal on Bedrock																

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-16

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064097 m N, 407045 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	20	40	60			
214.3																	
214.2	TOPSOIL - CLAY - Silty, with organics, some sand and gravel, occasional cobbles, brown																
0.1	CLAY - Silty, some sand and gravel, brown																
213.3	End of Borehole at 0.95 m Auger Refusal on Bedrock																
1.0																	

✕³, ★³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

METRIC

[illegible]

ENCLOSURE 26

RECORD OF BOREHOLE No HA-18

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064090 m N, 406996 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
215.1	SAND & GRAVEL - Silty, some organics, occasional cobbles, brown						215									Wet at 0.85 m	
214.7	CLAY - Silty, some to trace organics, trace sand and gravel, brown						214										
213.4	End of Borehole at 1.70 m Auger Refusal on Cobbles																

ON_MOT_CS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST_MIN.GDT 3/8/10

✕³, ★³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-19

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064092 m N, 407046 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
						20	40	60	80	100	W _p	W	W _L			
214.1	TOPSOIL - CLAY - Silty, with organics, some sand and gravel, brown CLAY - Silty, brown					214										
214.0 0.1																
213.2 0.9	End of Borehole at 0.85 m Auger Refusal on Bedrock															

✕³, ★³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-20

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064092 m N, 407057 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
						20	40	60	80	100	W _p	W	W _L			
214.1																
214.0	TOPSOIL - CLAY - Silty, with organics, some sand and gravel, brown					214										
0.1	CLAY - Silty, brown															
213.5																
0.6	End of Borehole at 0.6 m Auger Refusal on Bedrock															

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-21

1 OF 1

METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064088 m N, 406988 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
							20	40	60	80	100	W _p	W	W _L			
215.4	SAND & GRAVEL - Silty, with asphalt debris, occasional cobbles and boulders, brown																
214.8	CLAY - Silty, trace sand and gravel, brown																
213.9	End of Borehole at 1.45 m Auger Refusal on Bedrock																

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No HA-22

1 OF 1

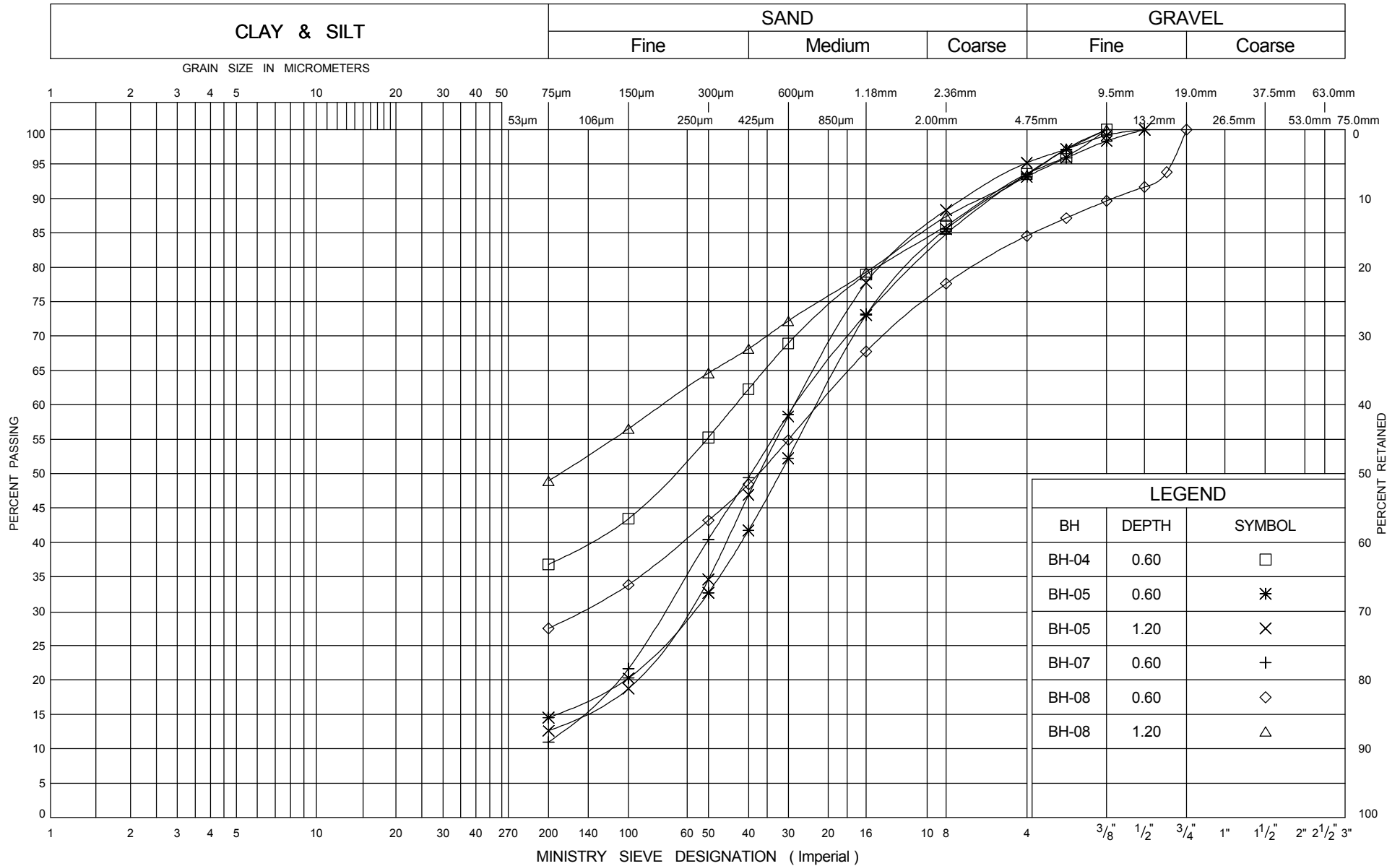
METRIC

W.P. 5009-0062 Assignment #4 LOCATION Mindemoya Patrol Yard (5064082 m N, 407056 m E) ORIGINATED BY KS
 DIST HWY 542 BOREHOLE TYPE Hand Auger COMPILED BY ML
 DATUM Geodetic DATE 2010 07 11 CHECKED BY LP/BV

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa					WATER CONTENT (%)			
						20	40	60	80	100	20	40	60			
214.2	TOPSOIL - CLAY - Silty, with organics, some sand and gravel, brown CLAY - Silty, brown					214										
214.1 0.1																
213.2 1.0	End of Borehole at 0.95 m Auger Refusal on Bedrock															

\times^3, \star^3 : Numbers refer to Sensitivity \bigcirc 3% STRAIN AT FAILURE

UNIFIED SOIL CLASSIFICATION SYSTEM



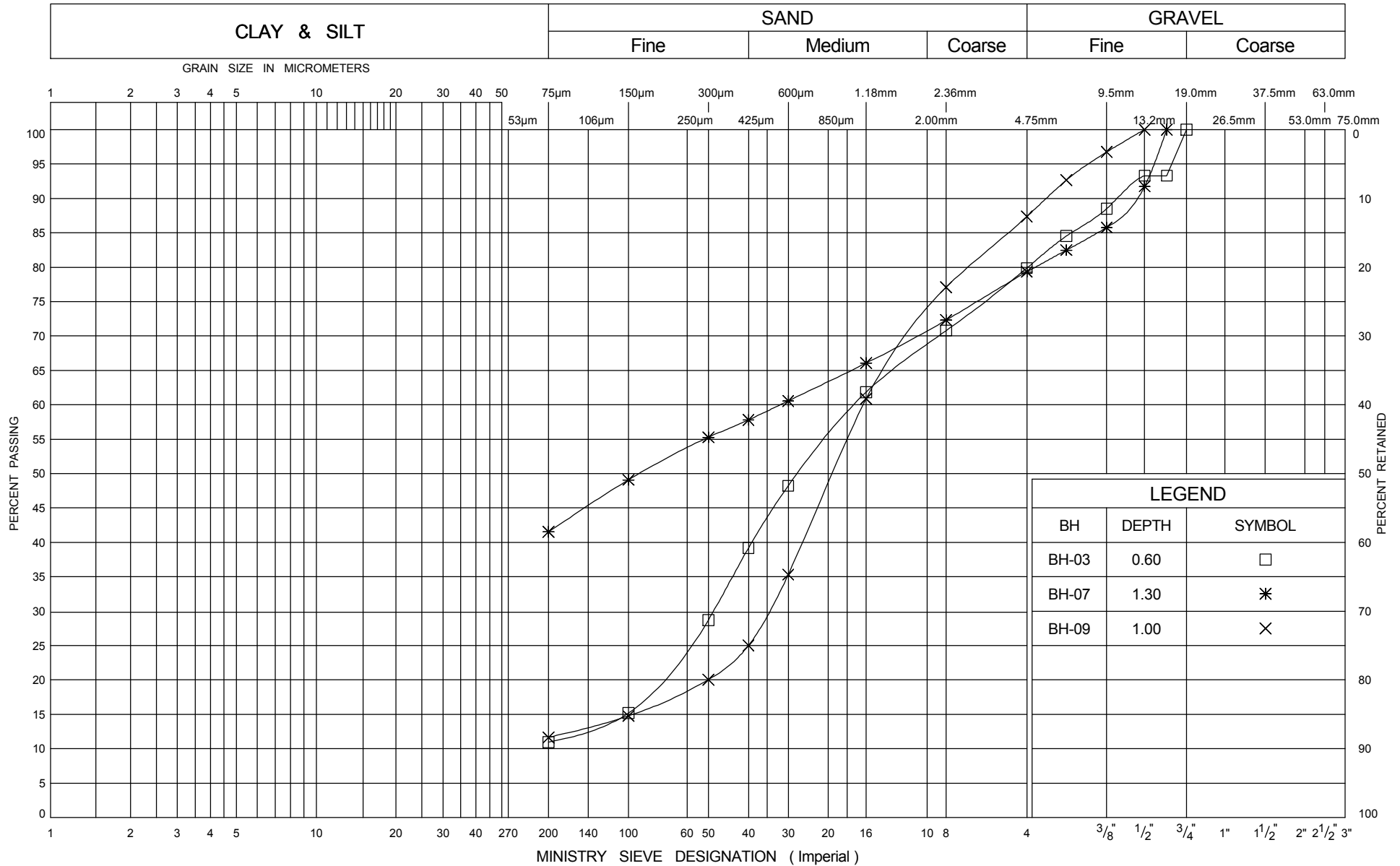
GRAIN SIZE DISTRIBUTION
SAND, TRACE GRAVEL

ENCLOSURE 32

5009-0062 Assignment #4

HIGHWAY 542

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
SAND, SOME GRAVEL

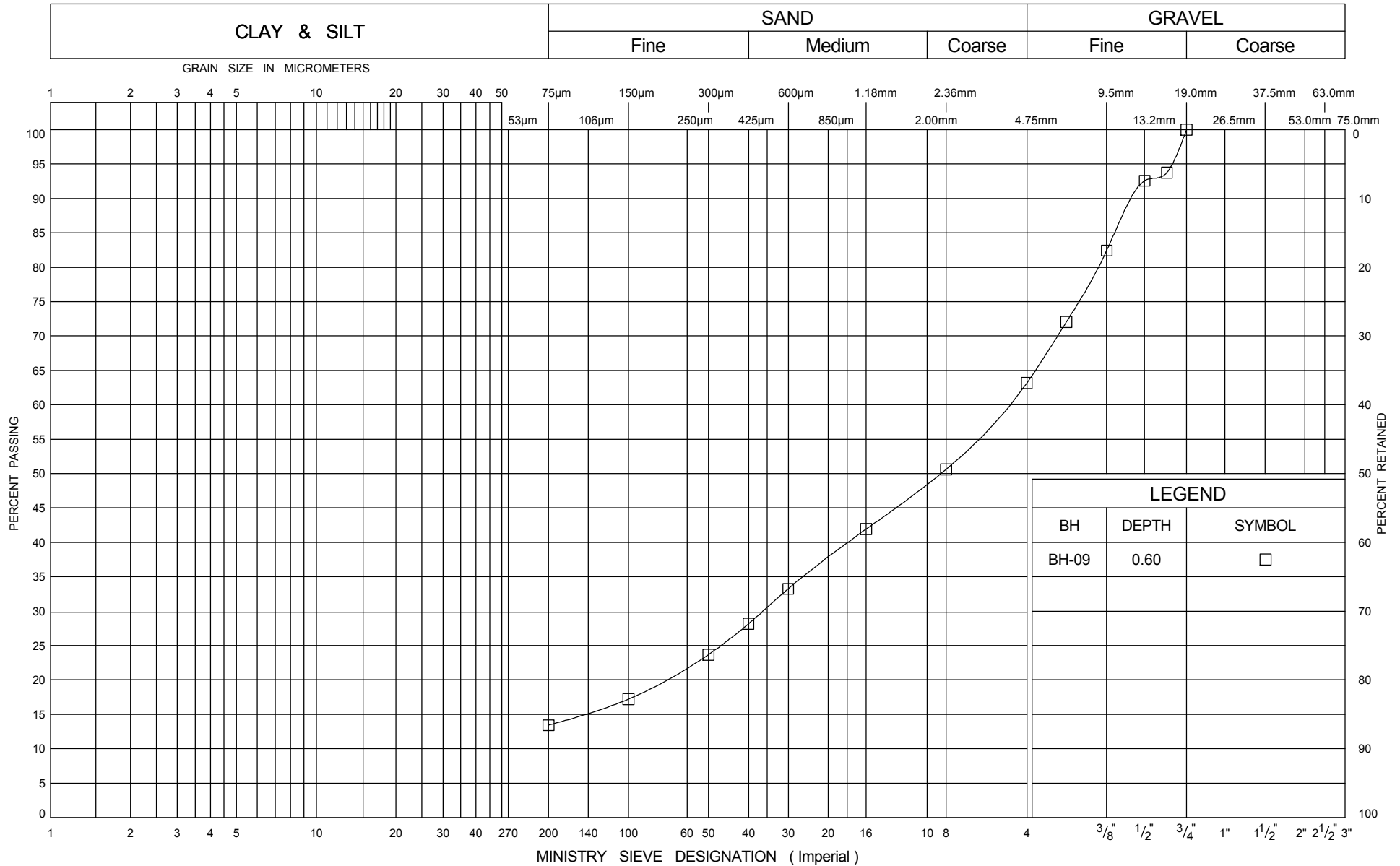
ENCLOSURE 33

5009-0062 Assignment #4

HIGHWAY 542

ONTARIO MOT GRAIN SIZE GS-TB-011970 - MTO COCHRANE - 5009-0062 #4 - MINDEMOYA PATROL YARD.GPJ DST_MIN.GDT 9/8/10

UNIFIED SOIL CLASSIFICATION SYSTEM

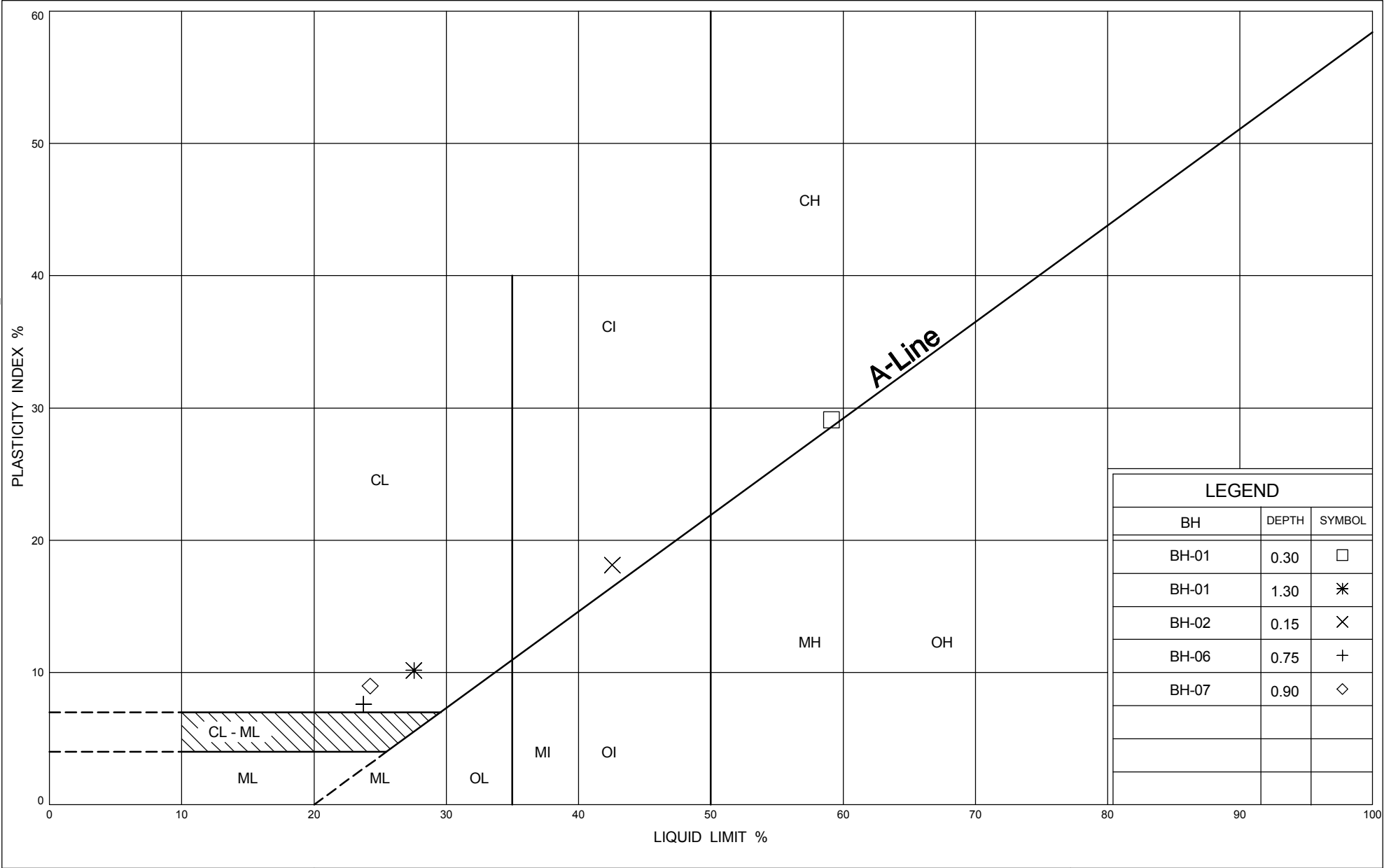


GRAIN SIZE DISTRIBUTION SAND AND GRAVEL

ENCLOSURE 34

5009-0062 Assignment #4

HIGHWAY 542



LEGEND		
BH	DEPTH	SYMBOL
BH-01	0.30	□
BH-01	1.30	*
BH-02	0.15	×
BH-06	0.75	+
BH-07	0.90	◇



PLASTICITY CHART

ENCLOSURE 35
5009-0062 Assignment #4
HIGHWAY 542