

## Geotechnical Data Report, Core Area Wastewater Treatment Program

## **Report Context**

The CRD has been planning wastewater treatment for the Core Area for over 30 years. During this time a significant number of reports have been prepared and/or reviewed to assess options and provide information to further planning.

In May 2016 a Project Board was established to define and implement wastewater treatment for the Core Area. The Project Board heard delegations and presentations from the public, industry professionals, and a CRD Director. The Project Board Chair and Vice Chair also met with staff from the CRD, all of the Core Area municipalities, and with Esquimalt and Songhees Nations representatives. The Project Board reviewed the previous technical work and extensive public commentary and developed a methodology to review and evaluate all options. This methodology included evaluation of a large number of options to identify a short list that best addressed the Project goals.

In September 2016 the Project Board presented its recommendation for wastewater treatment and on September 14, 2016 the CRD Board approved the Wastewater Treatment Project (the Project).

A significant number of the reports that have been prepared and/or reviewed still serve as useful background information, but not all of the reports are applicable to the Project. To respond to several recent public inquiries regarding topics of interest, the CRD has prepared a synopsis of reports along with a summary of the applicability of the report to the Project. The document summary is available here:

https://www.crd.bc.ca/docs/default-source/wastewater-planning-2014/2017-05-30summary-of-documents-related-to-topics-of-interest.pdf. The document summary does not provide a comprehensive list of reports completed as part of wastewater treatment planning for the Core Area, it is a compilation of a number of reports related to key topics of interest: odour; seabed pipeline; bluffs and shoreline; geotechnical; and noise. Purpose of this Report

This report was a Geotechnical Data Report that was provided to all bidders for the McLoughlin Point Wastewater Treatment Plant. The report provided the results of test drilling at a number of boreholes drilled on the McLoughlin site and in Victoria Harbour. The report included a compilation of borehole data completed by Stantec and by Golder Associates as part of the McLoughlin site remediation. The report identified issues that would have to be addressed by the successful proponent for the McLoughlin Point Wastewater Treatment Plant.



## Applicability to Project

This report is applicable to the Project. The report provides relevant information with respect to the current geotechnical conditions for the McLoughlin Site and the Victoria Harbour Crossing. The design-build contractor, Harbour Resource Partners (HRP) will consider the findings in this report as they finalize the design of the McLoughlin Point Wastewater Treatment Plant and the Victoria Harbour Crossing. HRP has engaged a geotechnical engineer to provide further geotechnical design information for the design of the McLoughlin plant foundations and the Victoria Harbour Crossing.

## GEOTECHNICAL DATA REPORT

Core Area Wastewater Treatment Program

### **FINAL**



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## **1 INTRODUCTION**

Stantec Consulting Ltd. (Stantec) has prepared this geotechnical report to present the subsurface conditions at McLoughlin Point, Ogden Point and the Victoria Harbour Crossing as part of the Capital Regional District (CRD) Core Area Wastewater Treatment Program. A wastewater treatment plant and marine outfall are proposed at the McLoughlin Point site. An approximately 880 m long submarine forcemain is also proposed for the Victoria Harbour Crossing, extending from McLoughlin Point to Ogden Point. The McLoughlin Point site is located at the south end of Victoria View Road in Esquimalt, BC. The Ogden Point site is located off Dallas Road, northwest of the intersection between St. Lawrence Street and Niagra Street in Victoria, BC.

The purpose of this report is to provide subsurface information about the soil, bedrock and groundwater conditions at the sites to support procurement of this design-build project. The scope of work for this geotechnical assessment consisted of a review of existing documentation for the sites, a subsurface investigation, laboratory testing (soil and rock) and preparation of this report. This report is issued pursuant to the draft Geotechnical Data Report and incorporates the findings of a bedrock laboratory testing program that were not available at the time of the draft report. The scope of this report is limited to the geotechnical aspects of the proposed development, and does not address soil and groundwater contamination at the sites or the remedial work previously conducted at the McLoughlin Point Site.

## 2 **PROJECT DESCRIPTION**

The proposed McLoughlin Wastewater Treatment Plant, Marine Outfall and Victoria Harbour Submarine Crossing will comprise a portion of the CRD's Core Area Wastewater Treatment Program, which will service the Greater Victoria Core Area. The treatment plant will provide secondary-level treatment for wastewater, which will be discharged through a new marine outfall at McLoughlin Point. The Victoria Harbour Crossing will involve the installation of a sub-marine forcemain from McLoughlin Point to Ogden Point using a trenchless construction technology such as horizontal directional drilling (HDD).

Based on the indicative design, and as shown on Drawing 1 in **Appendix A**, the wastewater treatment facility at McLoughlin Point includes a chemical building, high-rate primary clarifiers, biological aerated filters, a sludge storage tank, an odour control room, a mechanical room, a dirty wash water tank, a heat recovery room, a blower and pump station, a clean wash water tank and an electrical room. An operations and maintenance building is situated to the east of the main facility, and a standby generator and transformer occupies the southern end of the site. The marine outfall discharges treated wastewater at the southeast corner of the site. Based on preliminary section drawings for the facility, the high-rate primary clarifiers, biological aerated filters, sludge storage tank and wash water storage tanks extend below the existing site grades, with some portions of the structure being as deep as Elev. -4.15 m Geodetic.

In addition to the wastewater treatment plant and associated structures, the development at McLoughlin point includes an access road encircling the wastewater treatment facility with parking stalls being situated alongside the roadway. A new retaining wall will be constructed around the shoreline of the site, connecting to an existing retaining wall along the east side of the property, to accommodate the eastern portions of the access road and parking areas. The remaining site areas aredesigned as green areas.

The entry point for the sub-marine forcemain Crossing will be located at the McLoughlin Point site and will exit at the Ogden Point site. Based on the preliminary design, the alignment of this forcemain will require an 8 m diameter entry pit of approximately 3 m depth and a 5 m diameter exit pit of approximately 3 m depth.

Based on preliminary design, the sub-marine forcemain may be installed up to 40 m below the sea floor and founded within the underlying bedrock. The sub-marine forcemain will be approximately 880 m long.

## 3 SITE DESCRIPTION

As shown on Drawing 1 in **Appendix A**, the site of the proposed wastewater treatment plant and marine outfall is located at the south end of Victoria View Road in Esquimalt, BC. The site is irregular in shape and is bounded by Victoria Harbour to the south and east, by Victoria View Road to the west and by a recreational boating facility to the north. The dimensions of the site are approximately 180 m in the north-south direction and 100 m in the east-west direction at the widest point. The site was formerly occupied by a bulk fuel storage and distribution terminal (operated by Imperial Oil), which has since been demolished. Access to the site is through one of two fences along Victoria View Road.

The terrain at McLoughlin Point is generally flat, except along the shoreline and at the bedrock outcrops present in the eastern portion of the property. The elevation of the site typically ranges from approximately Elev. 6.5 m Geodetic in the northwest corner of the property to Elev. 3.5 m Geodetic in the southeast corner, with an elevation rise to approximately Elev. 9 m occurring at the bedrock outcrops. The site is mostly gravel-covered, although asphalt pavement is present along the western side of the property and a grass-covered area is situated in the northwest corner. The gravel cover was observed to be thin within the central portion of the site, and the underlying silty material was found to be soft. Occasional concrete walls (remnants of old buildings) remain across some portions of the site, and an existing concrete retaining wall up to approximately 4 m in height is present on the eastern side of the property.

As shown on Drawing 2 in **Appendix A**, the Ogden Point site is rectangular in shape and is approximately 50 m wide in the east-west direction and 70 m long in the north-south direction. The site is undeveloped except for a small, one-storey structure located at the east end of the site near Dallas Road. There is a boat launch with a concrete ramp at the northwest corner of the property. The site is asphalt paved along the east end, and the remaining areas are gravel covered. The site gently slopes from east to west, and the grades range from approximately Elev. 3.6 m Geodetic at the east end down to Elev. -1.5 m Geodetic at the west end of the boat launch.

## 4 EXISTING INFORMATION

In preparation of this factual report, Stantec has reviewed documentation of past site investigation and environmental remediation works completed at the McLoughlin Point site. Relevant documentation of these past works includes the following:

- "Limited Stage 2 Preliminary Site Investigation: Former Imperial Oil Limited Agency and Terminal Facility, 337-343 Victoria View Road, Esquimalt, BC (SAP No. 88002302)", dated May 19, 2011, by Golder Associates.
- "Confirmation of Soil Excavation Report: 337 343 Victoria View Road, Esquimalt, BC (SAP No. 88002302)", dated December 20, 2011, by Golder Associates.
- "Confirmation of Remedial Soil Excavation: Former Distribution Terminal and Agency Site, 337-343 Victoria View Road, Esquimalt, BC (SAP 88002302 / Site ID 300544)", dated January 16, 2013, by Golder Associates.
- "Submarine Pipeline Crossing CRD Wastewater Treatment Program Alignment Evaluation", dated November 15, 2010, by Stantec Consulting Ltd.

The Stage 2 Preliminary Site Investigation (PSI) by Golder Associates included a subsurface investigation consisting of 40 mechanically excavated test pits and 38 auger holes across the site. The test pits were advanced to a maximum depth of 5 m or until refusal on bedrock, and the auger holes were advanced to a maximum depth of 16.5 m or until refusal on bedrock. Of the 38 auger holes, 35 were equipped with monitoring well installations. The test hole location plan and test hole logs from the Stage 2 PSI report by Golder Associates are provided in **Appendix F**. Based on the findings of the Stage 2 PSI by Golder Associates, remedial work was carried out in 2011 and 2012, and included excavation and replacement of contaminated soils in the identified areas of environmental concern.

The remedial work in 2011 involved excavation of contaminated soils from an approximately 60 m east-west by 25 m north-south area in the southern portion of the site. The depth of excavation was typically in the range of 1 to 4 m. The western half of the excavation extended into the native silt and clay soils, while the eastern half extended to the depth of bedrock. The excavation was backfilled mostly with imported fill materials, although excavated sand and gravel material was also used as backfill at lower elevations in the eastern portion of the excavation. Imported silt material was used as backfill at lower elevations in some portions of the excavation. Seventy five (75) millimeter minus crushed gravel was used as backfill for the remainder of the excavation and as surficial cover overtop the imported silt and excavated sand and gravel backfill materials

The remedial work in 2012 involved excavation of contaminated soils from three additional areas: a 25 m east-west by 30 m north-south area to the southwest of the bedrock outcrops, a 25 m eastwest by 43 m north-south area in the central portion of the site to the west of the bedrock outcrops, and a 20 m east-west by 36 m north-south area in the northeast corner of the site. The excavation depths in these areas typically ranged from 1 to 2.5 m below the ground surface. Excavation in the area to the southeast of the bedrock outcrops exposed the underlying bedrock. The eastern side of



the excavation in the central portion of the site exposed the underlying bedrock, while the remainder of the excavation extended into the native silt and clay soils. The excavation in the northeast corner of the site extended mostly into the native silt and clay soils, although bedrock was exposed at the southeast corner of the excavation. The excavations were backfilled with an assortment of fill materials, including blast-rock, excavated sand and gravel material and 75 to 150 mm clear stone, in addition to imported silty material, fine sand, 75 mm minus crushed gravel and 19 mm minus crushed gravel.

As a result of the remedial work completed at the site, the existing soil conditions at the site differ from those described on the test hole logs in the Stage 2 PSI report by Golder Associates (included in **Appendix F**). Drawings by Golder Associates showing the extents of the remedial work and describing the nature of backfill materials are provided in **Appendix G**.

An Alignment Evaluation report completed by Stantec for the sub-marine crossing included a geophysical survey of Victoria Harbour, which was completed by Frontier Geoscience. The survey data was used to determine the depth to the sea floor and the depth to bedrock. Details of the geophysical survey are presented in Frontier's report enclosed in **Appendix H**.

## 5 STANTEC SUBSURFACE INVESTIGATION

### 5.1 General

The Stantec subsurface investigations were completed in three (3) stages and were continuously monitored by a Stantec field representative, who positioned the test holes, selected the sample locations, classified the soil and rock encountered, kept a detailed record of each borehole, and observed and recorded pertinent site features. Representative soil samples and rock core were returned to the Stantec laboratory in Burnaby. Laboratory soil testing consisted of detailed visual classification of the soil, moisture content measurement and Atterberg Limits testing. Laboratory examination of the rock cores included detailed characterization of the rock and fracture properties.

## 5.2 McLoughlin Point

Stantec completed a site investigation for the proposed wastewater treatment plant from December 13 to 18, 2012 to characterize the soil, bedrock and groundwater conditions at the site, and to record pertinent site features. The subsurface investigation consisted of three (3) Cone Penetration Tests (CPTs), ten (10) mud rotary boreholes with Standard Penetration Tests (SPTs) and diamond-bit rock coring, and six (6) mechanically excavated test pits. The test hole locations were selected to provide adequate coverage of the site area and to supplement the test hole information previously acquired by Golder Associates in their Stage 2 PSI. The test hole locations from the Stantec investigation are shown on Drawing 1 in **Appendix A**.

The CPTs were advanced to depths ranging from 10.3 to 13.7 m below the ground surface with a track-mounted rig. The CPT involves hydraulically pushing a stainless steel cone into the ground at a constant rate of penetration. The cone device consists of transducers and sensors mounted on the cone tip and friction sleeve (shaft of the cone) to measure end-bearing resistance at the tip, frictional resistance along the sleeve and pore water pressure. The electronic readings from the transducers and sensors were recorded at 25 mm depth intervals. The CPT results can be used to obtain a detailed stratigraphic log, information about groundwater conditions and indication of soil properties/parameters. The full depths of the CPT holes were grouted in accordance with the *Groundwater Protection Regulation* of the BC *Water Act*.

The mud rotary boreholes with rock coring were advanced to depths of 7.0 to 19.8 m below the existing site grades with the same track-mounted drill rig. The total length of mud rotary drilling ranged from 1.6 to 14.6 m, while the total length of rock coring ranged from 1.5 to 18.2 m. SPTs were typically conducted at 1.5 m intervals within the overburden soils in order to obtain representative samples and evaluate the consistency and compactness condition of the these soils. Upon completion of each borehole, the full depths of the holes were grouted in accordance with the *Groundwater Protection Regulation* of the BC *Water Act*.

Select rock cores from the McLoughlin Point investigation were logged by a geological engineer to establish Rock Mass Rating (RMR) characterization in support of proposed bedrock excavations in the following areas: proposed structures with below grade storage tanks and the proposed entry pit



for the sub-marine forcemain (Boreholes BH12-05, BH12-06 and BH12-09). RMR is a geomechanical classification system widely used to quantify rock mass quality and can be empirically correlated to excavation performance and support requirements. It is based on the following parameters: intact rock strength, rock quality designation (RQD), joint spacing, joint condition and groundwater conditions. The RMR classification system applied to the McLoughlin Point cores was RMR (1974)<sup>1</sup>.

The mechanically excavated test pits extended to depths in the range of 0.1 to 3.4 m below the ground surface. The shallower test pits are indicative of areas in which refusal was encountered on near-surface bedrock.

#### **High Resolution Core Photography**

Detailed photographs of the McLoughlin Point core were taken with a Nikon D5100 digital SLR (single lens reflex) 10.2 megapixel camera. Core logging and photography were completed at Stantec's Sidney, BC warehouse facilities. Core photograph summaries are provided in **Appendix E**.

## 5.3 Ogden Point

The site investigation at the Ogden Point site was completed from February 5 to 6, 2013 to characterize the soil, bedrock and groundwater conditions at the site, and to record pertinent site features. The site investigation consisted of 2 mud rotary boreholes (BH13-1 and BH13-2) with Standard Penetration Tests (SPTs) and diamond-bit rock coring. The approximate locations of the boreholes are shown on Drawing 2 in **Appendix A**. The locations of the boreholes were selected based on the preliminary alignment of the proposed sub-marine forcemain in order to obtain subsurface information in the vicinity of the forcemain and receiving pit.

Boreholes BH13-1 and BH13-2 were advanced to depths of 17.8 and 20.4 m below the existing site grades, respectively. The total length of mud rotary drilling was 15 m for borehole BH13-1 and 19.4 m for borehole BH13-2. The total length of rock coring was 2.8 m for borehole BH13-1 and 1.0 m for borehole BH13-2. SPTs were typically conducted at 1.5 m intervals within the overburden soils in order to obtain representative samples and evaluate the consistency and compactness condition of the these soils. Upon completion of each borehole, the full depths of the holes were grouted in accordance with the *Groundwater Protection Regulation* of the BC *Water Act*.

## 5.4 Victoria Harbour Crossing

A marine geotechnical investigation of the Victoria Harbour Crossing was carried out by Stantec between January 25 to February 2, 2013. The geotechnical investigation consisted of four (4) mud-rotary boreholes (MBH13-1 to MBH13-4) with SPT's and diamond-bit rock coring. The approximate locations of the marine boreholes are shown on Drawings 3-1 to 3-3 in **Appendix A**.



<sup>&</sup>lt;sup>1</sup> Barton N., Lien R. and Lunde J. (1974): Engineering classification of rock masses for the design of rock support. Rock Mechanics 6, 1974, pp. 189-236.

The marine geotechnical investigation was carried out from a spud barge subcontracted from Spectrum Marine Services. The spud barge was approximately 30 m in length and 10 m wide and was equipped with two steel vertical spuds of approximately 22 m length, located on the starboard side. Maneuvering of the barge was achieved using a self-propelled tug boat. The boreholes were located using a hand held GPS unit. Once in position, the barge location was fixed using the two vertical spuds. Stantec site supervision was provided by three geotechnical staff across two twelve hour shift patterns to allow 24 hour fieldwork to be carried out.

All four (4) of the marine boreholes were advanced to 50 m below the seafloor and terminated within the underlying bedrock. SPTs were typically conducted at 3 m intervals within the overburden soils in order to get a general description of the soil strata. The primary focus of the marine boreholes was to obtain information of the bedrock zones within proximity of the proposed submarine pipeline alignment. It should be noted that two (2) attempts were required to complete borehole MBH13-3. During the first attempt, the borehole was advanced to a depth of 22 m, but was terminated early due to mechanical problems with the drill-rig. Following repairs to the drill-rig, the barge and drill-rig were repositioned near the original MBH13-3 location (shown as MBH13-3A on Drawing 3-2) and was successfully completed on the second attempt.

Upon completion of each borehole, the full depths of the holes were grouted in accordance with the *Groundwater Protection Regulation* of the BC *Water Act*.

### 5.4.1 Detailed Geotechnical Logging with Q-Method

The rock cores of the Victoria Harbour Crossing were logged by a geological engineer according to the Q-method.

The Q–Method is a rock mass classification system that can be related to stability in underground openings. It was originally developed at the Norwegian Geotechnical Institute (NGI) between 1971-1974 (Barton et. al. 1974)<sup>1</sup> and has been further refined using thousands of case studies from existing excavations. Based on six rock mass parameters, a Q-value for any rock mass may be calculated.

Q = RQD/Jn X Jr/Ja X Jw/SRF

Where: Jw/SRF = 1

Guidelines for the determination of each parameter are given within the system methodology. To summarize:

- RQD/Jn: Defines the block size within the rockmass. RQD is calculated for each geotechnical interval. Joint set number (Jn) is a value that represents the number of natural joint sets present within the interval.
- Jr/Ja: Defines the strength of joints within the rockmass. Joint roughness (Jr) is assigned a value per interval based on the degree of asperities along the joint planes. Joint alteration (Ja) is assigned a value per interval based on the degree of joint wall mineralization or coating.



Jw/SRF: Defines the state of stress in a rockmass. For preliminary assessment of Q, a value of unity (1) was assigned to the last term of the formula where Jw represents the Joint Water Reduction Factor and SRF represents the Stress Reduction Factor. This is a common practice for preparation of the factual investigation report, as the tunnel designer selects Jw and SRF based on other considerations, such as tunnel alignment and geological stress history of the area, for example.

#### **High Resolution Core Photography**

Detailed photographs of the Victoria Harbour Crossing cores were taken with a Nikon D5100 digital SLR (single lens reflex) 10.2 megapixel camera. Core logging and photography were completed at Stantec's Sidney, BC warehouse facilities. Core photograph summaries are provided in **Appendix E**.



## 6 LABORATORY SOIL AND ROCK TESTING

The primary objectives of the laboratory testing program were to aid in the visual classification of the soil and rock core samples and to measure pertinent engineering properties of soil/rock to facilitate design of the proposed facilities. In general, geotechnical laboratory testing was performed in accordance with applicable American Society for Testing Materials (ASTM) test procedures. Details of the laboratory test results are enclosed in **Appendix D**.

It should be noted that bedrock samples from the McLoughlin Point and Victoria Harbour Crossing subsurface investigations were subjected to further field and laboratory strength testing as described below.

## 6.1 Water Content Determination (Soil)

Water (or moisture) contents (w) were determined from measured total and dry weights of both undisturbed and disturbed specimens cut from the recovered soil samples. Measurements were performed in accordance with the procedures described in ASTM D 2216.

## 6.2 Atterberg Limits (Soil)

An index soil test called Atterberg Limits is used to describe the plastic limit and liquid limit of a soil. As water is added to a dry soil, the soil changes from a solid to a semi-solid, then to a plastic, and finally to a liquid. The moisture content in the soil at the threshold between semi-solid and plastic state is called the plastic limit. The moisture content in the soil at the threshold between plastic and liquid state is called the liquid limit. Subtracting the plastic limit from the liquid limit yields the plasticity index.

The Atterberg Limits tests were performed on selected soil samples using the multipoint test method. The liquid (*LL*) and plastic (*PL*) limits are determined using the test procedures described in ASTM D4318. The plasticity index, PI, is defined as:

PI% = LL% - PL%

The liquidity index, LI, is defined as:

LI = (w% - PL%)/ PI%

In general, Atterberg Limits were performed on samples that were tested for strength or deformation characteristics.

## 6.3 Field Point Load Testing (Rock)

Concurrently with detailed core logging, representative core samples were subjected to field point load strength testing. A RocTest Point Load Tester (Model PIL-7) was used to measure the point load strength index for rock samples. The samples were selected from the McLoughlin Point and Victoria Harbour Crossing borehole locations. The tests were performed diametrically in accordance with ASTM D5731.



## 6.4 Laboratory Strength and Density Testing

Representative samples of rock core were selected to measure the uniaxial compressive strength (UCS) of the intact rock core specimens. UCS Samples were prepared and tested in accordance with ASTM D 2938-95 (2002) and D 4543-04. On each UCS samples, bulk density was determined. Indirect (Brazilian) strength testing was conducted on select rock core samples in accordance with ASTM D 3967.

## 7 SUBSURFACE CONDITIONS

## 7.1 Surficial Geology

Based on *Quaternary Geological Map of Greater Victoria* (Monohan and Levson, 2000)<sup>2</sup>, the McLoughlin Point site is situated in a region consisting primarily of shallow soils over bedrock. Overburden soils typically include less than 5 metres of Victoria Clay overlying thin, older Pleistocene deposits or bedrock. Scattered outcrops occur throughout the unit, and bedrock is commonly found within a few metres of the ground surface. The thickness of the older Pleistocene deposits is less than a few metres in most areas, but locally up to approximately 10 m.

The Ogden Point site is situated in an area of thick anthropogenic fills overlying the grey facies of Victoria Clay, which typically exceeds 3 m in thickness. The thickness of the grey clay facies is commonly greater than 10 m and locally exceeds 20 m. The grey clay facies is typically overlain by the brown clay facies, which is generally 2 to 5 m thick. The thickness of older Pleistocene deposits underlying the Victoria clay is generally less than a few metres.

The results of the geotechnical investigations at McLoughlin Point and Ogden Point are in general agreement with the surficial geology for the region.

## 7.2 McLoughlin Point Soil and Bedrock Conditions

Based on the results of the Stantec site investigation and our review of the documentation produced by Golder Associates for the past site investigation and remedial work, the majority of the site is covered by existing fill materials. The fill materials are directly underlain by bedrock at shallow depth throughout much of the eastern portion of the property, in which some bedrock outcrops are also present. In the western and northern parts of the property, the fill materials are underlain by native silt and clay soils of variable thickness. In some areas, the native silt and clay soils were found to be directly underlain by granodiorite bedrock; whereas in others, they were underlain by granular soils which were, in turn, underlain by bedrock.

Additional details regarding the soil, bedrock and groundwater conditions at the site are provided below. The detailed borehole and test pit logs are presented in **Appendix B**, CPT results are presented in **Appendix C**, and field strength and laboratory testing results are presented in **Appendix D**.

### 7.2.1 Fill

The majority of the site is covered by surficial fill materials with the exception being the area of the bedrock outcrops in the eastern portion of the property. Based on the test hole information acquired by Stantec and Golder Associates and documentation of the environmental remediation work

<sup>&</sup>lt;sup>2</sup> Quaternary Geological Map of Greater Victoria, Trim Sheets (92B.043, 044, 053 & 054)



completed at the site, the fill extends to a depth of up to 4 m below the ground surface. The composition of fill material is variable across the site. The fill encountered in the investigation by Golder Associates consisted predominantly of granular material ranging from sand with a trace of gravel to sand and gravel. Occasional zones of silty material were also encountered within the fill, and other areas contained cobble and debris inclusions.

Much of the existing fill materials were excavated from the site as part of the environmental remediation work completed in 2011 and 2012. The excavations were backfilled with an assortment of fill materials, including imported silty material, fine sand, 75 mm minus crushed gravel and 19 mm minus crushed gravel. Where placed, the imported silt fill was typically covered with a surficial layer of gravel. Existing on-site blast-rock, excavated sand and gravel, and 75 to 150 mm clear stone were also used as backfill in portions of the 2012 excavations. Records of the nature and variability of the fill materials used to backfill the excavations completed during the site remediation are generally consistent with the findings of the Stantec site investigation.

### 7.2.2 Silt and Clay

In the western and northern portions of the site, the fill materials are underlain by a deposit of silt and clay with a trace of sand and occasional gravel inclusions. Based on the test holes completed during the site investigations by Stantec and Golder Associates, the deposit of silt and clay extends to a maximum depth of approximately 14.6 m below the ground surface. In some areas, the lower portions of the deposit are described as sandy silt with some clay and a trace to some gravel. The silt and clay soils are generally light brown in colour near the ground surface, becoming grey with depth. The results of Atterberg Limit testing conducted on selected samples from the silt and clay deposit generally categorizes the soil as high plasticity clay under the Unified Soil Classification System. The CPT results indicate that the silt and clay soils are very stiff to hard (i.e., overconsolidated) within 4 to 5 m of the ground surface, becoming stiff below. Measured moisture contents of the deposit where measured moisture contents were in the range of 13% to 16%. A summary of the Atterberg Limits tests for the silt and clay samples are shown in Table 1. The graphic results are presented in **Appendix D**.

			-	
Borehole No. (Sample Depth)	Liquid Limit %	Plastic Limit %	Plasticity Index %	Natural Water Content %
BH12-1 (3.3 m)	50	21	29	29
BH12-2 (4.8 m)	48	25	23	33
BH12-3 (4.8 m)	57	18	39	41
BH12-4 (4.8 m)	54	19	35	36
BH12-7 (4.8 m)	59	18	41	36

Table 1: Summary of Atterberg Limits Tests for Si	It and Clay, ASTM D 4318
---	--------------------------



### 7.2.3 Silty Sand to Sand

The silt and clay soils are underlain in some areas by a deposit of granular soil. The maximum thickness of granular soil encountered in the Stantec investigation was 1.7 m, although up to 6.1 m of granular soil was encountered in boreholes completed by Golder Associates. The granular deposits consist primarily of sand, with some zones containing a trace to some silt and others being described as silty. The deposit typically contains a trace to some gravel, although some portions are described as gravelly. The thickest regions of granular soil beneath the silt and clay deposit occur within the northwest portion of the property.

### 7.2.4 Bedrock

The overburden soils across the site are underlain by bedrock consisting predominantly of granodiorite intruded by occasional andesite dykes. In proximity to the andesite intrusions, alteration of the granodiorite was observed and is noted herein as "altered granodiorite". The bedrock is described as moderately jointed to intact in some areas, but very severely fractured to severely fractured in zones, as illustrated on the attached borehole records (see **Appendix B**). The rock is typically medium strong to strong and slightly weathered. Discrete zones of moderate weathering were observed and correspond to zones of low RQD.

Each of the boreholes in the Stantec investigation was terminated within the bedrock formation. The test pits were each terminated upon refusal at the bedrock surface, except TP12-1 which was terminated within the deposit of silt and clay.

Further bedrock characterization was completed on BH12-5, BH12-6 and BH12-9 in support of proposed site infrastructure that may require significant bedrock excavation. The details are provided below in Sections 7.2.4.1 and 7.2.4.2.

### 7.2.4.1 Intact Rock Properties

The intact strength of the bedrock has been determined using unconfined compression tests, indirect (Brazilian) tensile strength tests and field point load tests. The laboratory bedrock testing report and a summary of point load strength data are provided in **Appendix D**.

Four (4) unconfined compression tests were carried out on samples of the bedrock core and two (2) indirect (Brazilian) tensile strength test were conducted. Point load tests were performed diametrically on samples of the bedrock core and are reported as values of the Point Load Index corrected to a standard 50 mm diameter specimen,  $I_{s(50)}$  in Table D-1, **Appendix D.** To summarize, the following mean parameters are provided in Table 2:



Intact Strength Parameter	Granodiorite	Altered Granodiorite <sup>2</sup>
Point Load Is(50) (MPa)	6.9	5.0
Dry Density(kg/m <sup>3</sup> )	2,630	2,663
UCS (MPa) <sup>1</sup>	110	153
Indirect Tensile Strength (MPa)	8.4	13.2

#### Table 2: Summary of Intact Strength and Density Parameters, McLoughlin Point

Note: 1. Average of valid test results: i.e., excludes tests that failed along foliation.

2. Lithology in attached laboratory reports incorrect: specimens noted as gneiss are equivalent to altered granodiorite.

Average point load strength indices ( $Is_{50}$ ) range from 6.9 to 5.0 for the granodiorite and altered granodiorite, respectively. Estimated uniaxial compressive strength can be obtained from these data by utilizing a conversion factor, K. K is an index to strength conversion factor that depends on site-specific correlation between UCS and  $I_S$  for a particular specimen size. To accurately determine K, a robust site-specific database is required and is not available for the McLoughlin Point bedrock. In lieu of a site-specific factor, ASTM D5731 dictates generalized K values for specific core diameter. For NQ sized core, a conversion factor, K, of 21 is provided.

Average laboratory UCS values range from 110 MPa to 153 MPa in the granodiorite and altered granodiorite, respectively. Based on the field and laboratory testing results, both the granodiorite and altered graniodiorite in the McLoughlin Point area may be classified as very strong (100 - 250 MPa).

#### 7.2.4.2 Rock Mass Characteristics

An explanation of the rock mass quality descriptors is presented in the Borehole Symbols and Terms in **Appendix B**.

#### **Rock Quality Designation (RQD)**

RQD values were obtained for all drill holes, and are plotted on the Borehole Records in **Appendix B**. RQD values for each lithological unit in drill holes BH12-5, BH12-6 and BH12-9, based on the recovered core, are summarized in Table 3.

#### Table 3:Summary of RQD Values, McLoughlin Point

Rock Type	Average RQD (%)	Standard Deviation (%)
Granodiorite	67	26
Altered Granodiorite	68	32
All Rock Types	68	28



Based on the average RQD values from these three boreholes, the rock mass at McLoughlin Point may be described as fair quality, fractured, or blocky. It should be noted, however, that low RQD values (< 50%) representing severely fractured rock mass were observed at discrete intervals.

#### Rock Mass Rating (RMR)

RMR values were obtained for all core runs in boreholes BH12-5, BH12-6 and BH12-9 and are plotted on the Borehole Records in **Appendix B**.

Table 4: Summary of RMR Values, McLoughlin Point

Rock Type	Average RMR	Standard Deviation
Granodiorite	61	15
Altered Granodiorite	62	14
All Rock Types	61	14

Based on an RMR rating of 61, the overall rock mass may be classified as good quality rockmass. No significant variation in the two lithologies was noted with respect to RMR.

#### Surface Characteristics of Structural Discontinuities

Based on the detailed core logging, discontinuities of all sets have general surficial characteristics that range from rough and undulating to smooth and undulating. In general, joint surfaces were partially stained or partially coated. Local occurrences of silty joint infill < 5mm were observed more frequently near the bedrock surface and in discrete zones of higher weathering, as noted on the Borehole Records.

### 7.2.5 Groundwater Conditions

The monitoring well records from the Stage 2 PSI by Golder Associates indicate that, where encountered, the groundwater table was in the range of 0.95 to 5.06 m below the existing ground surface at the site (i.e., between Elev. 0.35 m and Elev. 4.76 m Geodetic). Due to the proximity of the site to the ocean, it is anticipated that the groundwater table elevation will be strongly influenced by tidal fluctuations. Due to the granular nature of the fill throughout much of the site, it is expected that perched groundwater zones will be present within the fill materials overtop the relatively impermeable silt, clay and bedrock surfaces. Evidence of the perched groundwater was observed during the excavation of test pit TP12-6. Heavy seepage was encountered within the fill at a depth of approximately 1.5 m below grade.

## 7.3 Ogden Point Soil and Bedrock Conditions

In general, the soil conditions at the Ogden Point site consist of existing fill underlain by a deposit of silt and clay, which is in turn underlain by sand. The overburden soils are underlain by granodiorite bedrock. A summary of the soil conditions encountered in the Stantec subsurface investigation is provided below, and details are presented on the borehole logs enclosed in **Appendix B**.



### 7.3.1 Fill

The fills encountered at the site consisted primarily of granular soils, varying from gravelly sand or sand and gravel to silty sand. The thicknesses of fill encountered in boreholes BH13-1 and BH13-2 were 5.2 m and 4.4 m, respectively. Traces of asphalt, concrete and organics were encountered throughout the fill layer. A 450 mm thick concrete slab was encountered in borehole BH13-2 at approximately 4 m depth. Based on the recorded SPT blow counts, the compactness condition of the fill is variable, but generally loose to compact.

### 7.3.2 Silt and Clay

The deposit of silt and clay extended to depths of approximately 13 m and 17 m in boreholes BH13-1 and BH13-2, respectively. The silt and clay soil is stiff to very stiff in the upper portions of the deposit, and transitions to a soft to firm consistency with depth. This deposit is typically light brown in colour within its upper portions, becoming grey with depth. Measured moisture contents of the silt and clay soil samples ranged from 27% to 56%.

### 7.3.3 Sand

The silt and clay soils were underlain by a deposit of sand, which extended to depths of 15 and 19.4 m at boreholes BH13-1 and BH13-2, respectively. The sand contains variable amounts of silt and some gravel. Based on the recorded SPT blow counts, the sand is compact to very dense.

### 7.3.4 Bedrock

The bedrock encountered in the boreholes at Ogden Point consists mostly of fractured to moderately jointed, medium strong, slightly weathered, grey granodiorite with occasional andesite dykes. Both of the boreholes in the Stantec investigation were terminated within the bedrock formation.

As the currently proposed site works in the Ogden Point area do not include significant bedrock excavation, detailed rock core logging was not conducted for these boreholes.

### 7.3.5 Groundwater Conditions

Due to the proximity of the site to the ocean, it is anticipated that the groundwater table elevation will be strongly influenced by tidal fluctuations. Standpipe piezometers were not installed at the Ogden Point site.

## 7.4 Victoria Harbour Crossing Soil and Bedrock Conditions

In general, the soil conditions below the sea floor within the Victoria Harbour Crossing consists primarily of very loose sediments consisting of silty sand underlain by compact sand, firm to stiff silt and clay and bedrock.

Results of the geophysical survey indicate the bedrock surface is approximately 15 to 30 m below the seafloor through the central portion of the channel, which is in general agreement with bedrock depths encountered the marine drilling investigation.



### 7.4.1 Silty Sand/Sand

The loose sediments along the seafloor consisted of silty sand and ranged from approximately 1.5 to 1.8 m thick. A thicker deposit of compact sand 7.1 to 13.7 m thick was encountered below the looser silty sand.

### 7.4.2 Silt and Clay

Below the sand unit is a layer of silt and clay. The silt and clay encountered in the boreholes ranged from approximately 6.6 to 18.8 m thick. The silt and clay is generally firm to stiff.

### 7.4.3 Bedrock

Bedrock was encountered underlying seabed sediments at elevations ranging from -18.8 m (MHB13-4) to -41.8 m (MBH13-1). The bedrock encountered in the four (4) boreholes consisted primarily of grey granodiorite occasionally intruded by dark grey andesite dykes that ranged in apparent thickness from approximately 0.2 m to 3.0 m. In proximity to the andesite intrusions, alteration of the granodiorite to was observed and is noted herein as "altered granodiorite". In these zones of alteration, micro-veins and disseminated sulphides were more frequent.

Weathering was noted at the surface of the bedrock extending several metres below the bedrock soil interface. In this zone, the rock is described as slightly weathered (W2) to moderately weathered (W3). Further discrete zones of moderately (W3) to highly weathered (W4) bedrock were observed to depths up to 50 m below the bedrock surface (MBH13-4).

#### 7.4.3.1 Intact Rock Properties

The intact strength of the bedrock has been determined using unconfined compression tests, indirect (Brazilian) tensile strength tests and field point load tests. The laboratory bedrock testing report and a summary of point load strength data are provided in Appendix D.

Eight (8) unconfined compression tests were carried out on samples of the bedrock core and four (4) indirect (Brazilian) tensile strength tests were conducted. Point load tests were performed diametrically on samples of the bedrock core and are reported as values of the Point Load Index corrected to a standard 50 mm diameter specimen, I<sub>s(50)</sub>, in Table D-2, **Appendix D.** To summarize, the following mean parameters are provided:

5	• •	
Intact Strength Parameter	Granodiorite	Altered Granodiorite <sup>2</sup>
Point Load Is <sub>(50)</sub> (MPa)	3.7	4.2
Total Unit Weight (kN/m <sup>3</sup> )	2,630	2,589
UCS (MPa) <sup>1</sup>	91	57
Indirect Tensile Strength (MPa)	9.5	3.3

 Table 5:
 Summary of Intact Strength and Density Parameters, Victoria Harbour Crossing

Note: 1. Average of valid test results: i.e., excludes tests that failed along foliation, excludes outliers.



2. Lithology in attached laboratory reports incorrect: specimens noted as gneiss are equivalent to altered granodiorite

Average point load strength indices ( $Is_{50}$ ) range from 3.7 to 4.2 for the granodiorite and altered granodiorite, respectively. Estimated uniaxial compressive strength can be obtained from these data by utilizing a conversion factor, K. K is an index to strength conversion factor that depends on site-specific correlation between UCS and  $I_S$  for a particular specimen size. To accurately determine K, a robust site-specific database is required and is not available for the Victoria Harbour bedrock. In lieu of a site-specific factor, ASTM D5731 dictates generalized K values for specific core diameter. For NQ sized core, a conversion factor, K, of 24.5 is provided.

Average laboratory UCS values range from 91 MPa to 57 MPa in the granodiorite and altered granodiorite, respectively. Based on the laboratory testing results, both the granodiorite and altered graniodiorite in the area of the Victoria Harbour Crossing may be classified as strong (50 – 100 MPa).

#### 7.4.3.2 Rock Mass Characteristics

An explanation of the rock mass quality descriptors is presented in the Borehole Symbols and Terms in **Appendix B**.

#### **Rock Quality Designation (RQD)**

RQD values were determined for all boreholes, and are plotted on the Borehole Records provided in Appendix B. RQD values for each borehole are summarized in Table 5, below.

Rock Type	Average RQD (%)	Standard Deviation (%)
Granodiorite	69	26
Altered Granodiorite	58	30
Andesite	12	20
All Rock Types	62	30

 Table 6:
 Summary of RQD Values, Victoria Harbour Crossing

Based on the average RQD values from these three boreholes, the granodiorite and altered granodiorite rock mass at the Victoria Harbour Crossing may be described as fair quality, fractured, or blocky. It should be noted, however, that low RQD values (< 50%) representing severely fractured rock mass were observed at discrete intervals as indicated on the attached Borehole Records.

Andesite dykes were observed in the Victoria Harbour Crossing core in sufficient thickness to estimate an average RQD of 12%. Based on this value, the andesite may be described as very severely fractured.



#### Rock Mass Quality (Q-Value)

The Victoria Harbour Crossing rock core was logged according to the Q-Method. For preliminary assessment of Q, and as noted previously, a value of unity (1) was assigned to the last term of the formula, where Jw represents the Joint Water Reduction Factor and SRF, Stress Reduction Factor.

The rock mass quality is classified across all boreholes as 'very poor' to 'very good' with Q-values ranging from 0.4 to 100.0, with an average of 30.5 ('very good'). By rock type, the Q values can be summarized as follows:



Rock Type	Average Q-Value	Standard Deviation
Granodiorite	35.0	27.6
Altered Granodiorite	27.5	25.8
Andesite	3.0	4.6
All Rock Types	30.5	27.2

#### Table 7: Summary of Q-Values, Victoria Harbour Crossing

#### Surface Characteristics of Structural Discontinuities

Based on the detailed core logging, discontinuities of all sets in have general surficial characteristics that range from rough and undulating to smooth and undulating. In general, joint surfaces were partially stained or partially coated. Local occurrences of silty joint infill < 5mm were observed more frequently near the bedrock surface and in discrete zones of higher weathering, as noted on the Borehole Records.

## 8 DISCUSSION

Based on our review of existing documentation for past site works, and on the results of the Stantec subsurface investigations and laboratory testing, Stantec considers that the following geotechnical issues are relevant to the design and construction of the wastewater treatment plant and sub-marine forcemain.

- A variety of predominantly granular fill materials are present across the McLoughlin Point site, including existing fills from the previous site development and imported fills placed during the environmental remediation work completed in 2011 and 2012. It is expected that the majority of the existing fill material was placed and compacted as engineered fill; however, as Stantec was not on-site at the time that these fills were placed, we cannot comment on their compaction.
- It is anticipated that most excavations on the McLoughlin Point site will encounter fill materials. The nature and variability of fill materials at the site suggests that steep cuts within these materials are unlikely to remain stable, particularly in areas containing perched groundwater. Accordingly, it is expected that sloping or shoring measures will be required for excavation through the existing fill materials.
- Construction of below-grade facilities at the McLoughlin Point site is anticipated to require excavation into bedrock within some areas. As the bedrock at the site consists predominantly of strong granodiorite, it is expected that drill and blast techniques will be required for excavation into the bedrock. Further geotechnical characterization of the rockmass and, in particular, geological structure is recommended prior to the design of these excavations. Rockmass support may be required.
- Based on the design foundation depths for some of the proposed structures, it is anticipated that excavation will extend below the depth of the water table. Accordingly, ingress of water from granular soil zones and open fracture networks within the bedrock should be expected. Ingress of water is also likely to occur through zones of granular fill materials containing perched groundwater.
- Although the silt and clay soils at the site are overconsolidated, construction of heavily loaded structures above these soils could result in settlement, particularly due to compression/consolidation in the more lightly overconsolidated zones at depth.
- The potential for earthquake-induced liquefaction of the granular soil deposits underlying the silt and clay soils should be addressed. Structures founded in these areas may experience post-liquefaction differential settlements in the event of the design earthquake.
- For the exit pit at Ogden Point, consideration should be given to the thickness of the existing fill and the depth of bedrock. Similarly to McLoughlin Point, deep excavations in the variable fills are unlikely to remain stable. Based on the anticipated depths of excavation and the close proximity to the ocean, groundwater seepage will likely be a construction issue.



- Advancement of the sub-marine forcemain along the Victoria Harbour Crossing will require further understanding of the bedrock geotechnical conditions along its alignment. Zones of very poor quality (Q-method classification) and very severely to severely fractured rock (RQD classification) were encountered at varying depths. It is likely that the forcemain bore may encounter these zones and may warrant stabilizing measures such as grouting or the advancement of a supporting liner.
- Particular attention to the subsurface quality in zones where the Victoria Harbour Crossing alignment nears the bedrock surface will be warranted. Generally, the rockmass within several metres of this interface is more highly fractured and weathered than bedrock at depth. Stabilization measures for the forecemain bore may be required.
- The occurrence of sulphide mineralization was noted in the bedrock at all areas of the site and more frequently in the altered granodiorite rock mass. The mineralization was noted on fracture surfaces and disseminated through the rockmass in areas. As a result, consideration must be given to waste rock management during site development as acid rock drainage may be a concern.

## 9 CLOSURE

This report was prepared for the exclusive use of the CRD and their agents for specific application to the development of the subject site. Any use of this report or the material contained herein by third parties, or for other than the intended purpose, should be first approved in writing by Stantec. The report and any interpretations or conclusions contained herein are based on the site conditions encountered by Stantec at the time of our site investigation and at the specific testing and sampling locations. Any interpretation or extrapolation thereof by others is done so at the risk of the user.

This report was prepared by Chris Longley, EIT, Maureen Matthew, M.Sc., P.Geo., Ben Huynh, P.Eng. and reviewed by Henrik Kristiansen, M.A.Sc., P.Eng. We trust that this report meets your present requirements. If you have any questions or require additional information, please contact the undersigned.

Respectfully submitted,

Stantec Consulting Ltd.

Reviewed by:

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#### Original signed by:

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Geotechnical Data Report

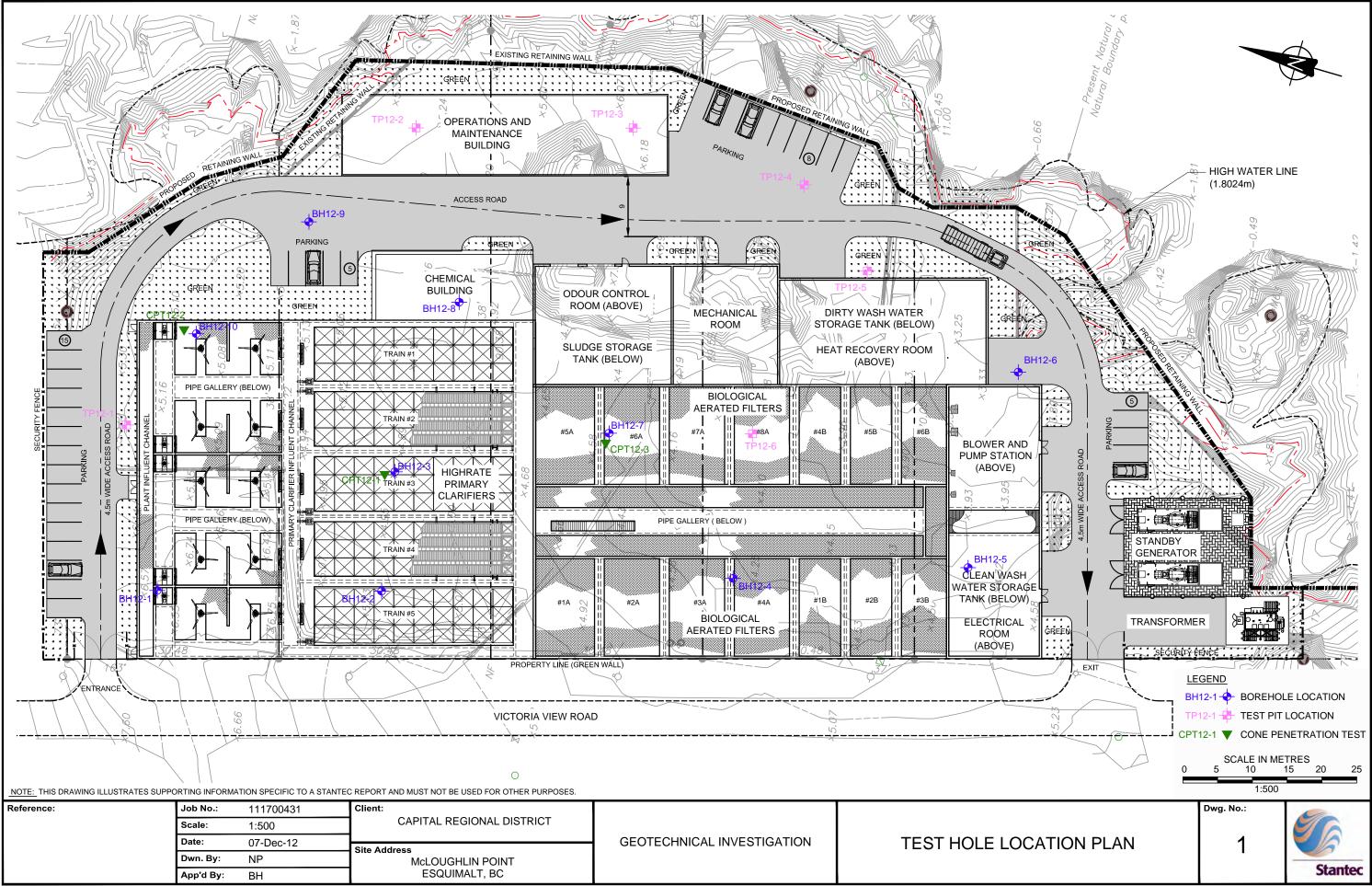
Core Area Wastewater Treatment Program Final

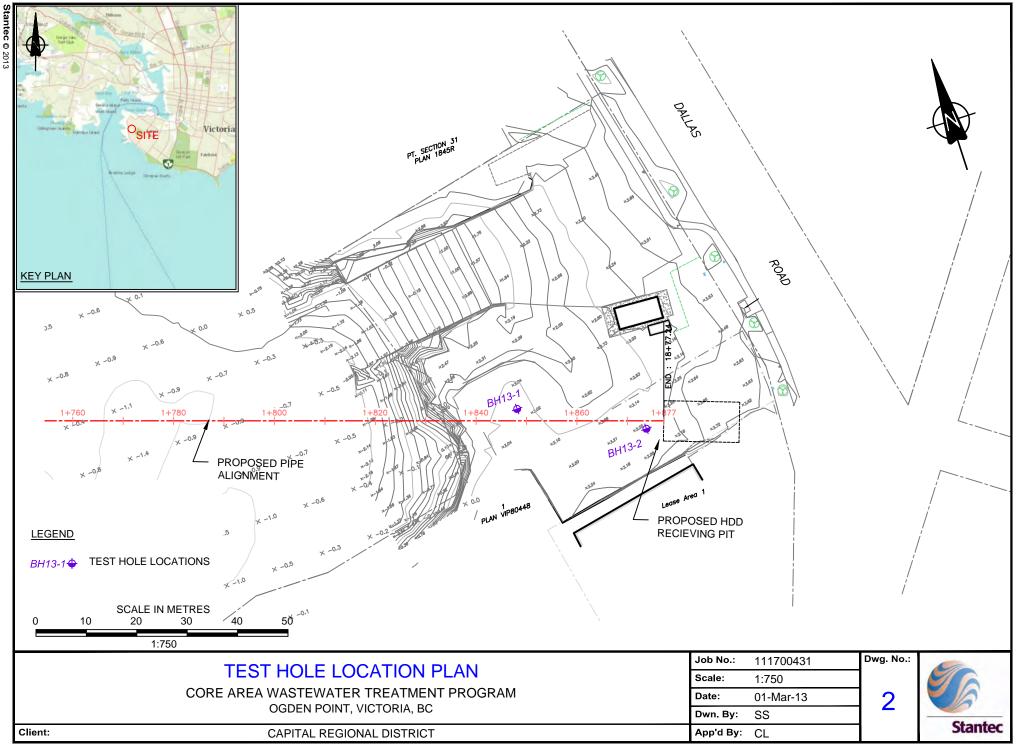
# **APPENDIX A**

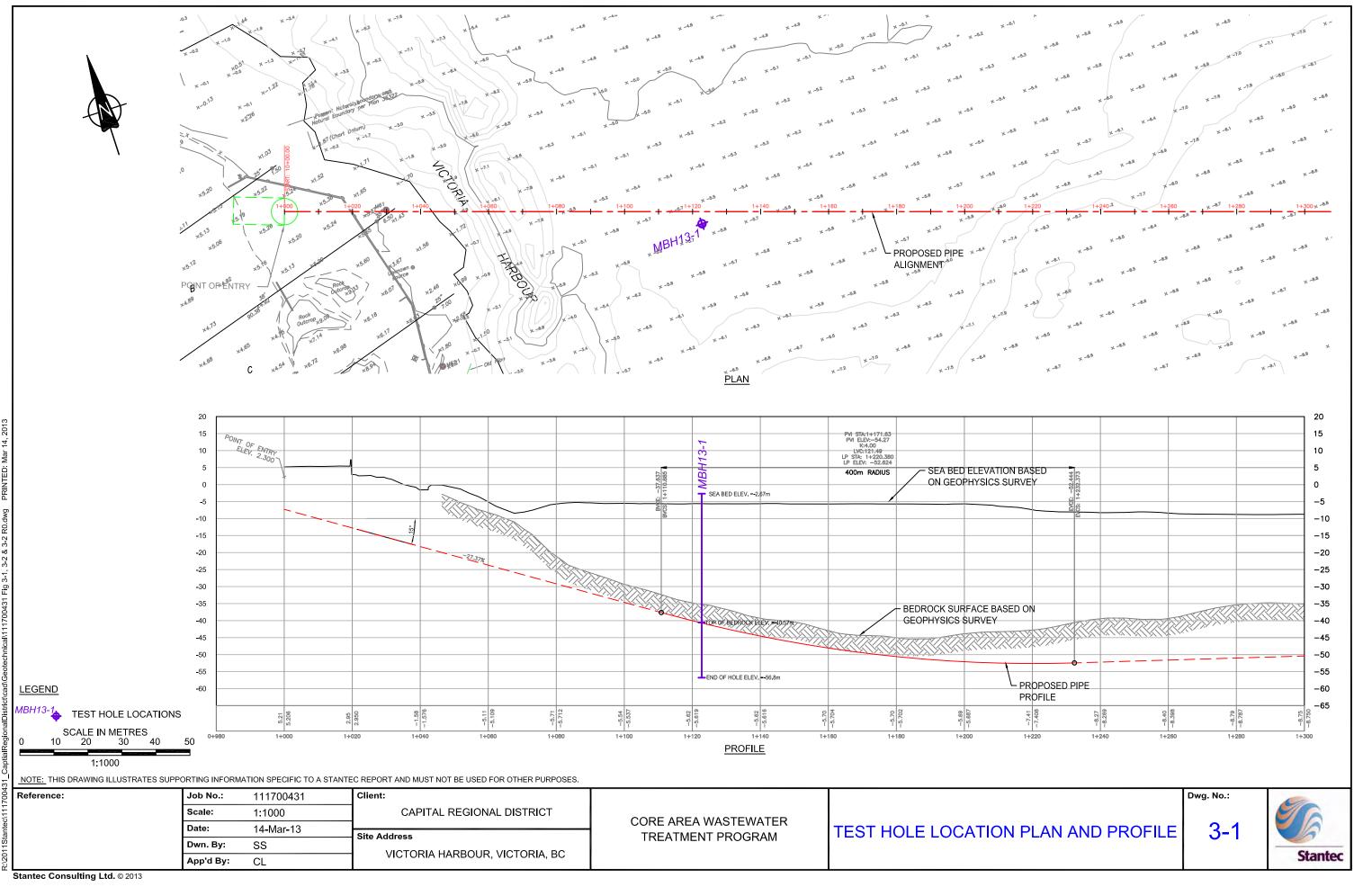
Drawings

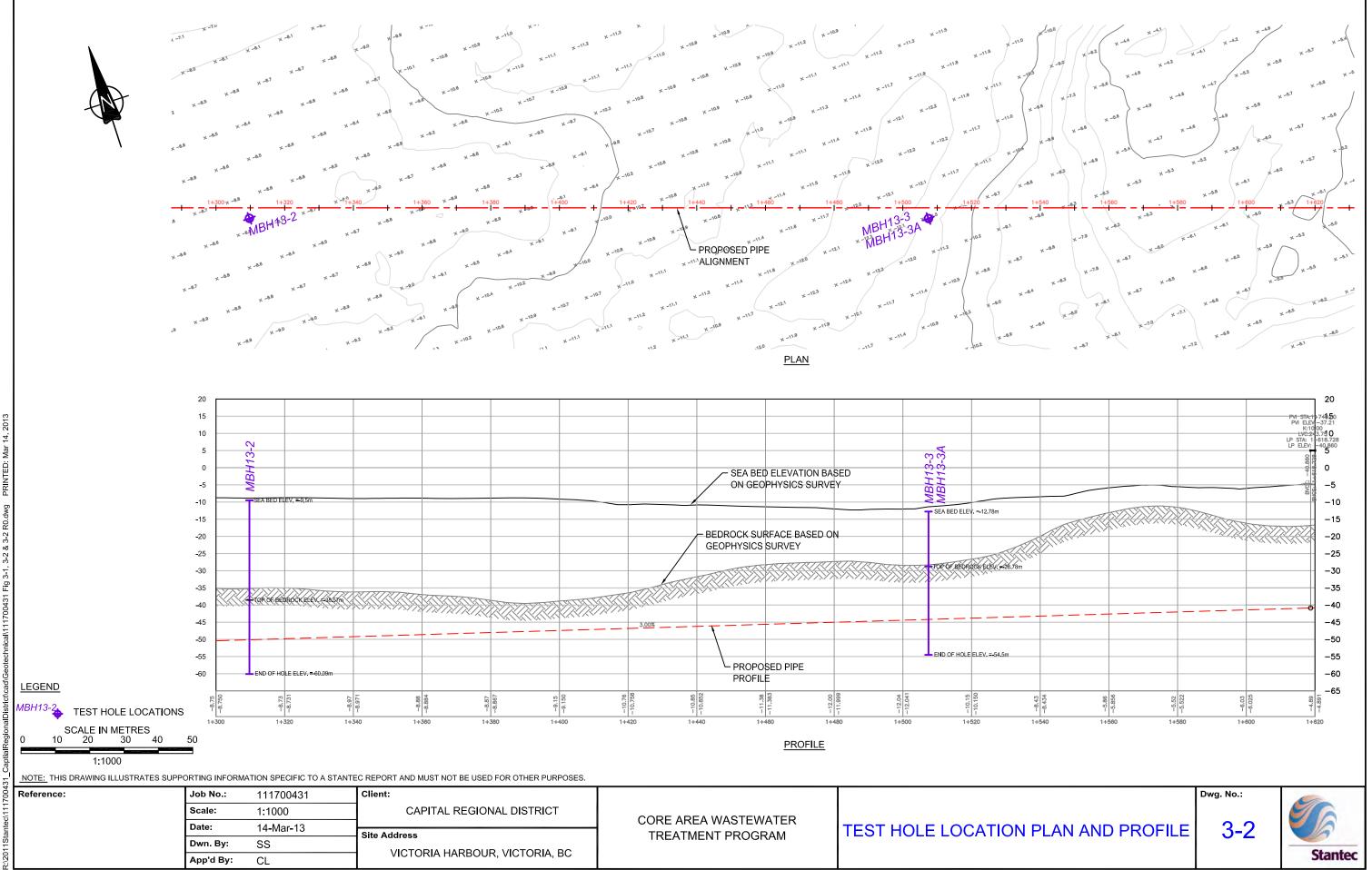


One Team. Infinite Solutions.

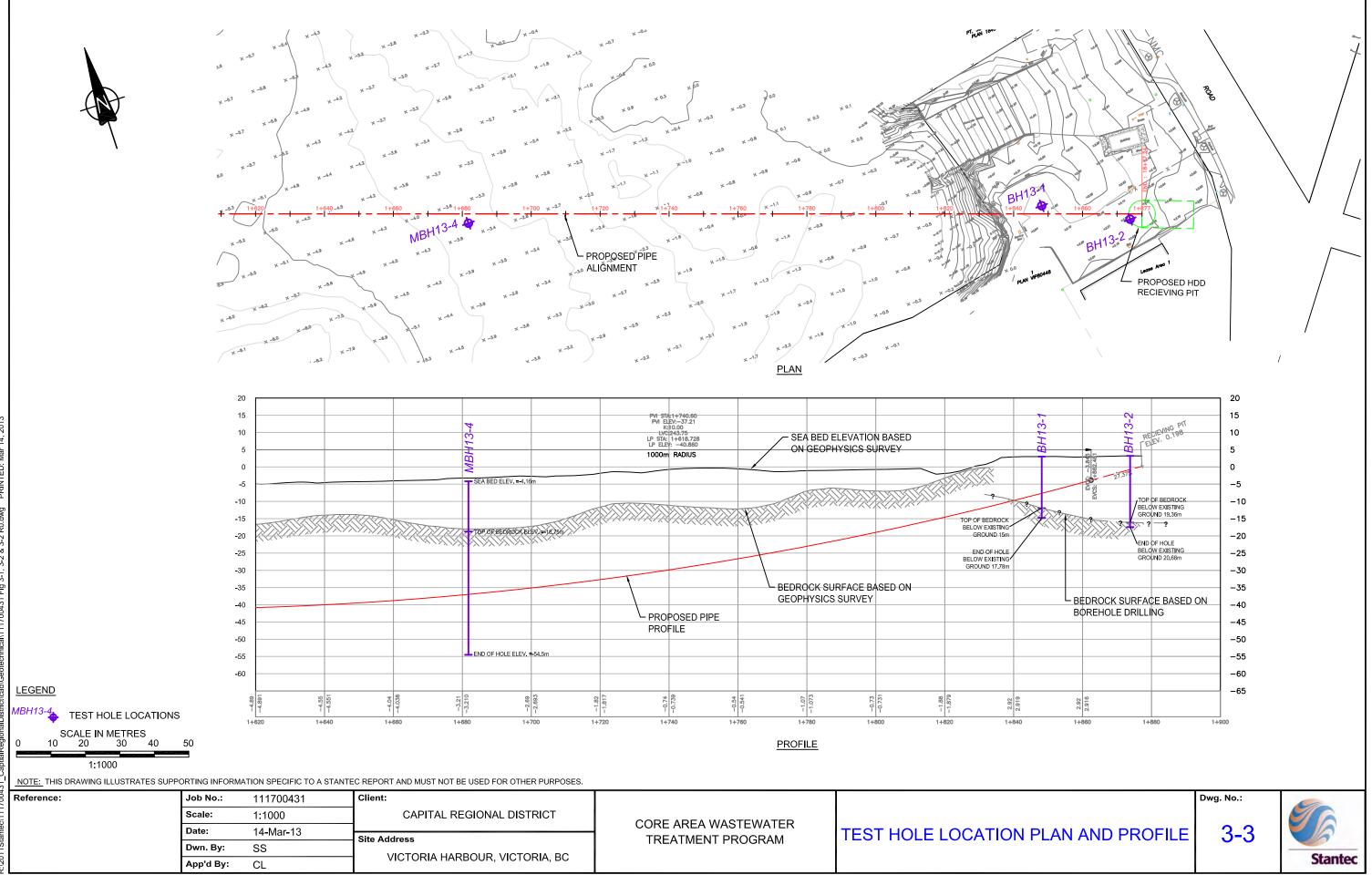








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Geotechnical Data Report

Core Area Wastewater Treatment Program Final

# **APPENDIX B**

**Borehole and Test Pit Logs** 



One Team. Infinite Solutions.

## SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

## SOIL DESCRIPTION

#### Terminology describing common soil genesis:

Rootmat	- Vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil - mixture of soil and humus capable of supporting vegetative growth	
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

#### Terminology describing soil structure:

Homogeneous	- same color and consistency throughout
Desiccated	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	- having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

### Terminology describing soil types:

The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488). The classification excludes particles larger than 76 mm (3 inches). The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

#### Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):

Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%		
Some	10-20%		
Frequent	> 20%		

## Terminology describing compactness of cohesionless soils:

The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test N-Value (also known as N-Index) in accordance with ASTM D1586. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

#### Terminology describing consistency of cohesive soils:

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests.

Consistensy	Undrained Sh	near Strength	Approximate	
Consistency	kips/sq.ft.	kPa	SPT N-Value           <2           2-4	
Very Soft	<0.25	<12.5		
Soft	0.25 - 0.5	12.5 - 25		
Firm	Firm 0.5 - 1.0 25 - 50	4-8		
Stiff	1.0 - 2.0	50 – 100	8-15 15-30	
Very Stiff	ry Stiff 2.0 - 4.0	100 - 200		
Hard	>4.0	>200	>30	

## **ROCK DESCRIPTION**

## Terminology describing rock quality:

RQD	Rock Mass Quality						
0-25	Very Poor Quality	Very Severely Fractured	Crushed				
25-50	Poor Quality	Severely Fractured	Shattered or Very Blocky				
50-75	Fair Quality	Fractured	Blocky				
75-90	Good Quality	Moderately Jointed	Sound				
90-100	Excellent Quality	Intact	Very Sound				

The RQD denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD determined in accordance with ASTM D6032.

#### Terminology describing rock with respect to discontinuity spacing:

Spacing (mm)	Discontinuity	Bedding, Laminations, Bands
> 6000	Extremely Wide	-
2000-6000	Very Wide	Very Thick
600-2000	Wide	Thick
200-600	Moderate	Medium
60-200	Close	Thin
20-60	Very Close	Very Thin
<20	Extremely Close	Laminated
<6	-	Thinly Laminated

#### Terminology describing rock strength:

Strength Classification	Grade	Unconfined Compressive Strength (MPa)		
Extremely Weak	R0	< 1		
Very Weak	R1	1 – 5		
Weak	R2	5 – 25		
Medium Strong	R3	25 – 50		
Strong	R4	50 – 100		
Very Strong	R5	100 – 250		
Extremely Strong	R6	> 250		

#### Terminology describing rock weathering:

Term	Symbol	Description				
Fresh	W1	No visible signs of rock weathering. Slight discolouration along major discontinuities				
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock naterial may be discoloured.				
Moderately	W3	ess than half the rock is decomposed and/or disintegrated into soil.				
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.				
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.				
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.				

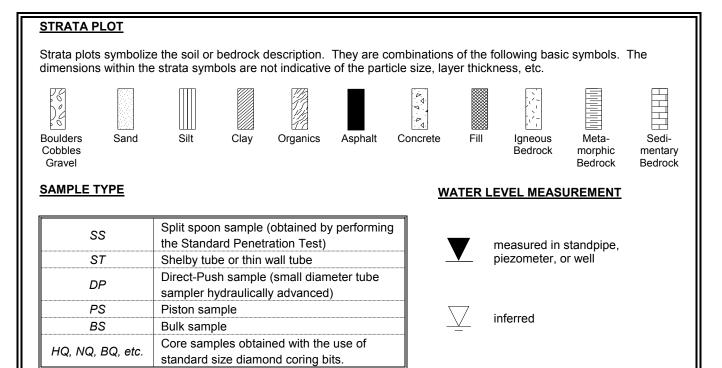
#### Solid Core Recovery (SCR):

Solid core recovery is defined as the cumulative length of all solid core in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis (i.e. length of core run excluding broken, crushed or rubble zones)

#### Fracture Index (FI):

Fracture Index is defined as the number of naturally occurring fractures occurring per given length of core. The Fracture Index is reported as a simple count of fractures.





## RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery (or total core recovery - TCR) is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

## N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (64 kg) hammer falling 30 inches (762 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (305 mm) into the soil. In accordance with ASTM D1586, the N-value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (152 to 457 mm). However, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (305 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-values cannot be presented, the total number of blows are reported over sampler penetration in millimeters (e.g., 50/75).

## **DYNAMIC CONE PENETRATION TEST (DCPT)**

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to A size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (305 mm) into the soil. The DCPT is used as a probe to assess soil variability.

## OTHER TESTS

S	Sieve analysis
Н	Hydrometer analysis
k	Laboratory permeability
Ŷ	Unit weight
Gs	Specific gravity of soil particles
CD	Consolidated drained triaxial
си	Consolidated undrained triaxial with pore pressure
	measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
С	Consolidation
Qu	Unconfined compression
Ι <sub>ρ</sub>	Point Load Index ( $I_p$ on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

Ţ	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
Ŷ	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer



	BOREHOLE RECORD BH12-01										
	CLIENT       CAPITAL REGIONAL DISTRICT       PROJECT No.       111700431         PROJECT       Core Area Wastewater Treatment Program       DATUM       Geodetic       NORTHING       5363184							1			
	PROJECT <u>Core Area Wastewater Treatment Program</u> DATUM <u>Geodetic</u> NORTHING <u>5363184</u> LOCATION <u>McLoughlin Point, Esquimalt, B.C.</u> ELEVATION <u>~6.5m</u> EASTING <u>470559</u>							—			
DRILLING DATE Dec 18, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Corir											
SAMPLES Insitu Shear Vane (kPa) Remoulded Shear Vane (kPa)											
Ê		Ĩ				1	$\triangle$ Pocket I	Penetrometer (kPa)	X Disturbed Torv	vane (kPa)	E
TH (r	USC	SYMBOL	SOIL DESCRIPTION	TYPE	3ER	1 11 (%		50kPa 100	kPa 150kPa	a 200kPa	DEPTH (ft)
DEP.	(III)     OBWAS     SOIL DESCRIPTION       OBWAS     TIOS     SOIL DESCRIPTION				NUMBER	MOISTURE CONTENT (%)	W <sub>P</sub> W ⊢ O	M <sub>L</sub> → Moisture C	content & Atterberg	Limits	DEP.
		Ň				ZQZ	10	<ul> <li>Standard F</li> <li>20 30 44</li> </ul>	Penetration Test, blo 0 50 60	ows/0.3m 70 80 90	
-0	╞	$\boxtimes$	FILL - 150mm brown silty Sand, some organics over								0
		$\bigotimes$	brown silty gravelly Sand, loose								Ē 2
- 1 -	FL	$\bigotimes$		XG	5 1-1				· · · · · · · · · · · · · · · · · · ·		
		$\bigotimes$									
		$\bigotimes$		SP	T 1-2		8	·····			
- 2 -	┣	$\not$	Light brown SILT and CLAY, trace sand partings,	-							
	1		very stiff								8
- 3 -				M				18			E 10
	СН			XSP	T 1-3	29		• <u>                                     </u>			
- 4 -	ł										= 12
	L										<b>E</b> 14
	SM	.1.1.	Light brown silty gravelly SAND, compact	- SP	T 1-4	13	o	· · · · · · · · · · · · · · · · · · ·	<b>50</b>		16
- 5 -		((()	SPT refusal at 4.8m; 50 blows for 125mm Moderately jointed, medium strong to strong, slightly						•••••••••••••••••••••••••••••••••••••••		
	ł		weathered, grey GRANODIORITE								<b>E</b> 18
- 6 -	BR	$\left( \left( \right) \right)$	TCR = 100% SCR = 97% RQD = 90%								Ē 20
	1	(((		C	C 1						
- 7 -		(((									22
,			End of Borehole at 7.0m								24
- 8 -	1										<b>26</b>
	1										28
- 9 -											
											<b>30</b>
10											<b>32</b>
-10-											34
-11-	1										<b>36</b>
: 	1										38
-12-	1										
	Ⅰ—	nple T	ype: GS - Grab Sample SPT - Standard Penetration Test	 ~		l .ogged by	/: CG/RI			· · · · · · · · · · · · · · · · · · ·	- 40
		zomet		_		eviewed		<u></u>	Stant	tec	
	Backfill Type: Bentonite a Sloughed Drill Cuttings Sand Date: Jan 4, 2013										

			BOREH	OL	E ]	REC	COF	RD							BE	[12-	-02	
	LIEN		CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program					I -					ROJE				70043	<u>31</u>
		ECT TION	McLoughlin Point, Esquimalt, B.C.			DATUM LEVAT							ORTH ASTIN		j	<u> </u>	<u>3159</u> 573	
			DATE Dec 13, 2012 DRILLING CO. Mud												lud R			<u>c Co</u> rir
				s	SAMP	LES	🗆 Ins	itu She	ear \	/ane (l	kPa)		Remo	oulder	d Shea	r Vane	(kPa)	
Ê		BOL				ш 🖗	△Po		eneti 50kP			a) 🗙 10 <u>k</u> Pa	Distur		Torvan )kPa		)0¦kPa	(j)
DEPTH (m)	nsc	SYMBOL	SOIL DESCRIPTION	ТҮРЕ	NUMBER	TURI NT (9			-		10	ОКГа		150	кга	20		DEPTH (ft)
BE	[	SOIL		≿	NUN	MOISTURE ONTENT (%)	W <sub>P</sub> ⊢	W 0		Мо					erg Lim			DEF
						20		10	20	Sta 3(		Pene 40	50	n Test 60	t, blows 0 7		80	90
- 0 :	FL	$\boldsymbol{\nearrow}$		AGS	5 2-1	24				0								
			Light brown mottled SILT and CLAY, trace sand, very stiff									-						2
- 1 -																		
	1			Maria					17									
- 2 -				XSP'	Г2-2	24			<b>R</b>	o								6
															• • • • • •			8
- 3 -																		
				SP	T 2-3	28		•	16	o								
	СН			$\square$	-													<b>12</b>
- 4 -																	••••••	
			-stiff below					9		•		•			• • • • • • •		•	
- 5 -				XSP [	Г2-4	33			ŀ		•		<b>-1</b> .					<b>E</b> 16
	ł																	<b>E</b> 18
			-grey, some sand below	SP	T 2-5	40	3					•						
				$\square$											• • • • • • •			22
- 7 -																		
	<u> </u>		-SPT refusal at 7.6m; 50 blows for 25mm; no	-									50					
- 8 -		(((	recovery/ Moderately jointed, medium strong to strong, slightly	I														26
	BR	((()	weathered, grey GRANODIORITE	СС														28
- 9 -			TCR = 100% $SCR = 100%$ $RQD = 90%$															
	<b> </b>	$\frown$	End of Borehole at 9.3m	-	-													
			Lid of Borehole at 9.5m										-		••••••••••			32
-10-																		
-11-	1																	36
	1																	
-12-	1														••••••			
14	1	nple T	ype: GS - Grab Sample SPT - Standard Penetration Test			ogged by	<u>  : : : :</u> r: CG	/RI	:   :	<u>;;;</u> ]	<u> </u>	1:::	::::		<u></u>	<u>  : : : :</u>		·F 40
			ST - Shelby Tube PT - Piston Tube CC - Continuou		re R					g		S	ita	ar	nte	<b>2C</b>		
	ST - Shelby Tube       PT - Piston Tube       CC - Continuous Core       Reviewed by: BH         Piezometer       Bentonite       Sloughed       Drill Cuttings       Sand         Date:       Jan 4, 2013																	

			BOREH	OL	E	REC	COR	D						BF	<b>I</b> 12-	-03	
	LIEN		CAPITAL REGIONAL DISTRICT					1					DJECT			70043	31
	ROJE		Core Area Wastewater Treatment Program McLoughlin Point, Esquimalt, B.C.			DATUM ELEVA		eode ~		m			RTHIN STING	G	<u> </u>	3 <u>157</u> 585	—
			DATE Dec 13, 2012 DRILLING CO. Mud											Mud F			<u>c Co</u> rir
				S	AMP	LES	🗆 Insi							ed Shea			
(m)		SYMBOL			~	ц (%	△ Poo		enet 50ķF			a) 🗙 Di OkPa		l Torvan 0 <u>k</u> Pa		)0jkPa	(ft)
DEPTH (m)	usc	SYM	SOIL DESCRIPTION	ТҮРЕ	NUMBER	STUR NT (	Wp	w	<u>и</u>		10		10		_	4	JEPTH (ft)
DEI		SOIL			NUN	MOISTURE CONTENT (%)	E F	ö	— •	M		Content Penetra					DE
- 0	FL	$\sim$		XGS	2 1		1	0	20	:::	30 4	40 5	50 (	60 î	70	80	90 T_ <b>0</b>
	12		FILL - 75mm grey Sand and Gravel, trace silt	AGS	3-1												
- 1 -																	
																	<b>4</b>
																	<b>E</b> 6
- 2 -																	
	•																. <b></b>
- 3 -							2 •										<b>=</b> 10
	-																<b>12</b>
- 4 -																	
																	14
- 5 -				XSP1	3-2	41			ŀ			<b>o</b>	<b>1</b>				2 4 6 8 10 12 14 16 18 20
	СН		-grey below, stiff														- 18
6																	
				SPI	3-3	38	3				o						
				$\square$													22
- 7 -																	<b>24</b>
				Исрт	3-4	43	2		•••••			o				• • • • • •	
- 8 -				Mor 1	5-4	43											
																	28
- 9 -																	30
				XSP1	3-5	38	3				o						
-10-																	
																	<b>34</b>
-11-			Grey sandy SILT, some clay trace gravel, stiff	SP1	3-6	13	5	o									22 24 26 28 30 32 34 34 36 38
-12-	San	nle T	vne: GS_Grah Sample_SPT_Standard Denatration Test		   т	Dogoed by											<sup>⊥‡</sup> 40
	Sample Type: GS - Grab Sample SPT - Standard Penetration Test ST - Shelby Tube PT - Piston Tube CC - Continuous Core Piezometer Bentonite Stoughed Drill Cuttings Stander																
	Bac	kfill 7	Proper Bentonite Sloughed Drill Cuttings	Sand	Г	Date: Jan	4, 2013				Ŀ						

			BOREHO	DLI	E ]	REC	COI	RD							Bł	<b>H12</b> -	<b>03</b> c	ont'd
	LIEN		CAPITAL REGIONAL DISTRICT											DJECT			70043	1
	ROJE		Core Area Wastewater Treatment Program McLoughlin Point, Esquimalt, B.C.			DATUM		ieod		c Om				RTHIN	G	<u> </u>	3157 595	—
	OCA RILI		DATE Dec 13, 2012 DRILLING CO. Mud			LEVAT ling		_						STING	Mud F			<u>Corir</u>
		Ч		5/	AMP			situ Sh ocket F							ed Shea d Torvar			
H (m	0	SYMBOL			Ř	JRE (%)			50k	Pa		100	0kPa	15	50kPa	20	0kPa	H (ft)
DEPTH (m)	nsc		SOIL DESCRIPTION	ТҮРЕ	NUMBER	MOISTURE CONTENT (%)	WP	W	i	WL							1	JEPTH (ft)
		SOIL			z	N N N		-0-	•						berg Lin st, blow			
						0		10	20	)	30	4	10 :	50	60	70	80 9	<b>40</b>
	ML		Grey sandy SILT, some clay trace gravel, stiff	Хsрт	3-7	14		ိံဝ										
-13-																		<b>42</b>
																		<b>E</b> 44
				<u> </u>				8										
-14-				XSPT	3-8	15		0										42 44 46 50 52 54 56 60
																		<b>E</b> 48
-15-	BR		Very severely fractured to fractured, medium strong to strong, slightly weathered, grey GRANODIORITE	СС	1													E
					1													<b>50</b>
	BR		$TCR = 100\% SCR = 97\% RQD = 75\% I^{-1}$	СС	2													E 52
-16-			TCR = 100% SCR = 85% RQD = 17%															
			End of Borehole at 16.2m															<b>54</b>
-17-																		56
							· · · · · · · ·											<b>58</b>
-18-																		
-19-								-										<b>62</b>
																		- 04
-20-																		<b>E</b> 66
																		64
-21-							··· ·· · ·											
	1																	<b>70</b>
	1																	E
-22-	1																	
   	1																	<b>74</b>
-23-	1																	70 72 74 76 78
	1																	E /0
	1																	<b>78</b>
-24-	1																•	
	San	iple T	ype: GS - Grab Sample SPT - Standard Penetration Test		、	ogged by		/RI			Ş		~	1			• • • • • •	L- 80
					ĸ	eviewed	-				Ľ	ß	S	ta	nt	ec		
	Bac	ktill '	Type: Bentonne Rasiougned Drin Cutungs		D	ate: Jan	4, 2013					_						

			BOREH	OL	E ]	REC	COI	RD							B	H12	-04	
	LIEN		CAPITAL REGIONAL DISTRICT											JECT			1700	
		ECT TION	Core Area Wastewater Treatment Program McLoughlin Point, Esquimalt, B.C.			DATUM ELEVA		ieode						RTHIN TING	G _		5311. 0588	3
			DATE Dec 16, 2012 DRILLING CO. Mud												Mudl			ck Cori
			· · · · · · · · · · · · · · · · · · ·		AMP	_		situ Sh							ed She		-	
<u>ج</u>		Ы						cket P	enet	rome	ter (kl	Pa)	🗙 Di	sturbec	Torva			
ц. П	USC	SYMBOL	SOIL DESCRIPTION	ш	ËR	URE 1 (%		4	50kF	a	1	00k	Pa	15	0kPa	2	200kPa	1   <del>U</del>  ⊥
DEPTH (m)	Ĭ	SOIL S	SOIL DESCRIPTION	TYPE	NUMBER	MOISTURE CONTENT (%)	W <sub>P</sub>	W -0	W		oistur	e Coi	ntent	& Atter	berg Lir	nits		DEPTH (ft)
		S			Z	ŠS			٠	St	tanda	rd Pe	enetra	tion Te	st, blow	/s/0.3m		
- 0		$\times$	FILL - 75mm grey Sand and Gravel, trace silt over	XGS	4-1		-	10	20	3	30   : : :	40	5		60	70	80	$\frac{90}{1}$ 0
		$\bigotimes$	grey Sand, some gravel, trace silt															
	FL	$\bigotimes$																Ë
		$\bigotimes$																<b>4</b>
	ТР	$\bigotimes$	-gravelly below		4-2		•	<b>7</b>										Ē
- 2 -			Dark brown clayey SILT, some organics (Topsoil)	SPT	4-2A	_36					c	<b>)</b>						
			to very stiff															<b>8</b>
3																		
				SPT	4-3	29			18 ●	c	<b>)</b>							
				$\square$														E 12
- 4 -								• • • • • • •										
			-firm to stiff below															
- 5 -	СН			SPT	4-4	36					¢			<b>.</b>				E 16
- 6 -			-grey				2			::::::::::::::::::::::::::::::::::::::		· · · · · ·						
				XSP1	4-5	38	•					0						
7																		E 22
-																		-   <b>- 2</b> 4
			-SPT refusal at 8.0m; 50 blows for 50mm	XSPT	4-6	34	-				0			50				E
- 8 -			Very severely fractured to severely fractured,															
	BR		medium strong to strong, slightly weathered, grey GRANODIORITE															E 28
- 9 -		$\left( \left( \right) \right)$	TCR = 100% $SCR = 95.0%$ $RQD = 38%$	CC	1													
	BR.		TCR = 44% SCR = 75% RQD = 0%	; <del>cc</del>	2													E 30
		$\left( \right)$						-		•								≓ <b>3</b> 2
-10-	BR		TCR = 95% SCR = 80% RQD = 37%	CC	3													
				$\ $														
-11-				1	-													<b>3</b> 6
	BR		TCR = 100% SCR = 98% RQD = 28%	CC	4			•										E _
				<u>  </u>	-													<b>38</b>
-12-	<u> </u>	1.7	End of Borehole at 11.8m		  .													<u> </u> 40
			ype: GS - Grab Sample SPT - Standard Penetration Test ST - Shelby Tube PT - Piston Tube CC - Continuou	us Core	<u> </u>	ogged by eviewed		/RI		(	Ŋ	à	C	ta	nt			
	Piez Bac	zomet kfill	er Type: Bentonite Sloughed Drill Cuttings	Sand	-	ate: Jan	-					<b>?</b> '	J		IIU		1	

			BOREH	OL	E ]	REC	C <b>O</b>	R	D								BH	[12-	05	
	LIEN		CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program					G	odat	io				PRO				<u>111</u> 536		
		ECT TION	McLoughlin Point, Esquimalt, B.C.						_~4					NOI EAS				470		
			DATE Dec 18, 2012 DRILLING CO. Mud														ud R	otary	/Roc	<u>k Co</u> rir
				S	AMP	LES			u Shea									Vane (kPa)		
H (m)		SYMBOL			<u>ا</u> بر	RE (%)				)kPa		-	a) 00k			150			0kPa	l (ft)
DEPTH (m)	nsc		SOIL DESCRIPTION	TYPE	NUMBER	ISTU TENT	W	P	W	WL			1						I	DEPTH (ft)
		SOIL			ž	MOISTURE CONTENT (%)			0	•			d Pe	enetra	ation		rg Lim blows	/0.3m		
- 0	╞	$\times$	FILL - 75mm grey Sand and Gravel, trace silt over	XGS	5-1		F::	10	)	20	3	0	40	<u>:</u>	50	60	7	0	80	<u>90</u> = <b>0</b>
		$\bigotimes$	brown gravelly Sand, some silt																	2
- 1 -	FL	$\bigotimes$										• • • • •						• • • • • •		
		$\bigotimes$	-trace black silty Topsoil below (reworked)																	
- 2 -			Light brown SILT and CLAY, trace sand partings,	SPI	5-2	23				2 •	3									6
2	СН		very stiff																	
	3 Light brown SILT and GRAVEL, some clay and SPT 5-3 26																			
- 3 -	$1 + kN_{1}$																			
	I Light brown SILT and GRAVEL, some clay and SPT 5-3																			
- 4 -	<b> </b>	<u>i</u> ß	Bedrock encountered at 4.1m. Refer to Rock Log for	-																14
			continuation of rock description									•						• • • • • •		
- 5 -																				= 16
																				18
- 6 -																				
																				<b>20</b>
7																				
_ / _																				<b>24</b>
												• • • • •								
- 8 -												• • • • •								
- 9 -												• • • • • •								
-10-																				
												•						• • • • • •		34
-11-																				36
-12-												• • • • • •						• • • • • •		38
14	1	nple T	ype: GS - Grab Sample SPT - Standard Penetration Test			ogged by	1 : : 7: (	CG/F		1::	::	· · · · >	<u>:   :</u>		<u> ::</u> -	:: :			1:::	···· 40
		zomet			ĸ	eviewed	-				S	J	<b>,</b>	S	ta	11	<b>ite</b>	£		
	Bac	kfill	Type:	- and	D	ate: Jan	4, 20	13												

CLIENT       CAPITAL REGIONAL DISTRICT       DATUM       Geodetic       NORTHING         LOCATION       McLoughlin Point       ELEVATION       4.2m       EASTING         DRILLING DATE       12/18/2012 to       DRILLING CO.       Mud Bay Drilling       DRILLING METHOD															ic		53	700431 63080 70597	
Γ	RII	LING DATE 12/18/2012 to D	RILI					y Drill	ing				DR	ILL		METHODM	ud		_
	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	V PLOT	∞		RUSHED ( IISSING CO NFERRED	CORE CORE	J-JOINT CL-CLEAV VN-VEIN					ZONE			DLISHED PC-PARTIALLY CC KENSIDED CC-COMPLETELY IN-FILLED IN-FILLED	OATED COATED	VALUE	TESTS
j	4.2		STRATA PLOT	SAMPLE TYPE	STRUCTURE		SOLID CORE %		5 10 FRACTURE 15 FREQUENCY	R4 ROCK R3 STRENGTH R1 INDEX	WI WEATHERING W3 INDEX		ч	٦٢	Ja	TYPE AND SURFACE DESCRIPTION		RMR76-VALUE	OTHER TESTS
		Bedrock encountered at 4.1 m. Refer to Soil Log for overburden description.																	
	0.1	Fractured to moderately jointed, slightly to moderately weathered, weak to																	-
		strong, greenish grey ALTERED GRANODIORITE - Sulphide mineralization observed on fracture surfaces		NQ 1								0.0.	3	3	1	J - UN, R, CL		59	-
				NQ 2								0	9	3	2	J - UN, R, PC		61	
				NQ 3A								0	9	3	3	J - UN, R, CC		46	
	-4.0			NQ 3B								0	3	3	4	J - UN, R, IN		53	
		Intact, fresh, strong, greenish grey ALTERED GRANODIORITE		NQ 4								00	3	3	2	J - UN, R, PC		77	
	-6.3			NQ 5								0	1	3	1	J - UN, R, CL		79	
		End of Borehole BH12-05 at 10.49 m																	

			BOREH	OLI	E ]	REC	CORD		]	BH12-06	
	LIEN ROJI		CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program		T		Geod	etic	PROJECT No NORTHING	<u>11170043</u> <u>5363083</u>	1
			McLoughlin Point, Esquimalt, B.C.			LEVA		3.1m		470627	_
D	RILI	ING	DATE Dec 17, 2012 DRILLING CO. Mud	Bay	Dril	ling		_ DRILLING M	IETHOD <u>Mu</u>	d Rotary/Rock	Corir
		Ļ		S	AMP	LES		lear Vane (kPa) Penetrometer (kPa)		Shear Vane (kPa) rvane (kPa)	
H (m)	0	SYMBOL			۲. ۲.	JRE (%)			kPa 150kl		T (ff
DEPTH (m)	nsc	SOIL SY	SOIL DESCRIPTION	ТҮРЕ	NUMBER	MOISTURE CONTENT (%)	W <sub>P</sub> W		ontent & Atterberg	l imite	JEPTH (ft)
		SC			z	CON	10	<ul> <li>Standard F</li> </ul>	Penetration Test, b	olows/0.3m	
- 0		$\otimes$		ØGS	6-1		10	20 30 40	0 50 60	70 80 9	- 0
		$\bigotimes$	grey silty sandy Gravel								2
- 1 -	FL	$\bigotimes$									- - 4
	<u> </u>	$\bigotimes$	-SPT refusal at 1.7m; 50 blows for 150mm	ХSРТ	6-2						
- 2 -			Bedrock encountered at 1.7m. Refer to Rock Log for continuation of rock description								2 4 6 10 10 12 14 14 16 18
								·····			- 8
- 3 -								·····			- 10
											- 12
- 4 -								····			_ 14
											- 14
- 5 -											- 16
											- 18
- 6 -											
- 7 -											22
, .							•••••••				24
- 8 -											- 26
0											
											28
-9-											<b>30</b>
											32
-10-											34
-11-	ł										22 24 26 28 30 32 34 34 36 38
	ļ										<b>38</b>
-12-	I										<b>40</b>
			ype: GS - Grab Sample SPT - Standard Penetration Test ST - Shelby Tube PT - Piston Tube CC - Continuou		、 <del> </del> _	ogged by eviewed		Ta	Stan	tec	
		zomet kfill		Sand		ate: Jan	-		Juil		

1	RO. LIE	Stantec IECT Core Area Wastewater Treatm NT CAPITAL REGIONAL DIST ATION McLoughlin Point			ram	BO	REI	IOI	LE R	DATU ELEV	JM		<u>Geo</u> 3.11		tic	PROJECT No NORTHING EASTING	BH12 111700 53630 4706	)431 )83		
I	RII	LING DATE <u>12/17/2012 to</u> D	RILI	LIN 2			Mud Ba	-	-			_	DR	ILL			ud		_	_ 
DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & N		TOTAL		R.Q.D.	FRACTURE FREQUENCY	NT-CONTA EDDING AULT -FOLIATIC HLSNOUK HLSNOUK	WEATHERING INDEX	DIP w.r.t. CORE AXIS		-r	R-RO	JUSHED COCOMPLETELY JGH IN-FILLED ISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION		RMR76-VALUE	OTHER TESTS	DEPTH (ft)
- 0	3.1	Bedrock encountered at 1.7 m. Refer to Soil Log for overburden description.		S	Š	20406 20406 20406	688 688 688 688 688 688 688 688 688 688	680 680 680 680 680 680 680 680 680 680	15 20	120										0 1 3 3
2		Severely to very severely fractured, slightly to moderately weathered, medium strong, grey GRANODIORITE - Iron staining observed on fracture surfaces		RC 1A								66	1	3	1	J - UN, R, CL		48	-	1 6 ·
3	-0.1_		- / -	RC 1B								0	15	3	1	J - UN, R, CL		50		9 10 11
4 -		Intact, slightly weathered, medium strong, grey GRANODIORITE		RC 2								0	2	3	1	J - UN, R, CL		76		11 12 13 14 15 16
5	-3.2			RC 3									1	3	1	J - UN, R, CL		76		16 17 18 19 20
7		Severely fractured to intact, slightly weathered, medium strong, grey GRANODIORITE - Andesite dykes observed		RC 4								0 00	6	2-3	2	J - UN, R, PC		47		21 22 23 24 25
0				RC 5								QQ	3	2-3	1-2	J - UN, R, PC		63		25 26 27 28 29
10	-7.4			RC 6								ÓœO	3	2-3	1-2	J - UN, R, PC		76		30 31 32 33 34
11		End of Borehole BH12-06 at 10.52 m																		35 36 37 38 39 40

			BOREH	OL	E	REC	COR	RD							B	BH	12-	07	
	LIEN		CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program					eod	-4:					OJECT				70043	1
		ECT TION				DATUN ELEVA				c 5m				RTHII STINC			<u>5363</u> 470		
			DATE <u>Dec 16, 2012</u> DRILLING CO. <u>Mud</u>									ING							Corin
				s	SAMP	LES	🗆 Ins							emoul				(kPa)	
(E		SYMBOL			~	ц ш		cket l	Pene 50k		nete	•	a) <b>X</b> ⊏ 0 <u>k</u> Pa		ed Tor 50jkP		. ,	0kPa	(ŧ
DEPTH (m)	nsc	SYN	SOIL DESCRIPTION	TYPE	NUMBER	STUR ENT (	Wp	W		WL							-	4	JEPTH (ft)
В		SOIL			NN	MOISTURE CONTENT (%)	<b>I</b>	ö					Content Penetra		•				DE
- 0								$\frac{10}{1::}$	20	0	30	::::	40  ::::	50	60	70	) 8	30 9 1::::	0 T_ 0
		$\bigotimes$	FILL - 75mm grey Sand and Gravel, trace silt over brown gravelly Sand, some silt	XGS	5 7-1														
	FL	$\bigotimes$																	
		$\bigotimes$					2												<b>4</b>
	TP		Dark brown clayey SILT, some organics (Topsoil)	N /	I 7-2 I7-2A	1	• 7					0	0						- 6
2 -			Grey mottled SILT and CLAY, trace sand and organics, very stiff																
	ł		-without organics below																- 8
- 3 -				Kp	T 7-3	34	7					0							<b>=</b> 10
			-brown below, stiff	Mp1 .	1 /-5	7													Ē 12
- 4 -										• • • •									
				Ļ_			4												
- 5 -	ł			SP:	Г7-4	36			ŀ			o			<b>.</b>				2 4 6 8 10 12 14 16 18 20
										• • • • •									18
6	l		-grey																
	СН			SP	I 7-5	39	2 •					ç	>						
																			22 24 24 26
- 7 -										• • • • •									24
				Kp	Г 7-6	39	2			· · · · ·				•					
- 8 -	ł			Mor.	-/-0	57													
										· · · · ·									28
- 9 -				L_			- 9			• • • • •	• • • • •								
				SP:	I 7-7	33	2 •					o							
-10-	ł								· · · · ·										
																			- 34
-11-			Grey sandy SILT, some gravel to gravelly, trace clay,	SP	Г 7-8		5 •												28 30 32 34 34
	ML		firm to stiff		+					• • • • •									38
-12-	<u> </u>	ШШ nple Т	-SPT refusal at 12.3m; 50 blows for 100mm ype: GS - Grab Sample SPT - Standard Penetration Test		   	.ogged by		RI											l <b>F</b> 40
	ST - Shelby Tube PT - Piston Tube CC - Continuous Core Reviewed by: BH																		
		kfill		Sand	Γ	Date: Jan	4, 2013		1			Ľ)							

P. L	OCA	ECT TION	BOREH CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program McLoughlin Point, Esquimalt, B.C. DATE Dec 16, 2012 DRILLING CO. Mud		I	DATUM	PROJECT No. <u>111700431</u> M Geodetic NORTHING <u>5363129</u>
			DATE <u>Dec 10, 2012</u> DRILLING CO. <u>Indu</u>			LES	Insitu Shear Vane (kPa) Remoulded Shear Vane (kPa)
DEPTH (m)	nsc	SOIL SYMBOL	SOIL DESCRIPTION	ТҮРЕ	NUMBER	MOISTURE CONTENT (%)	
-13-	BR	((((((((((((((((((((((((((((((((((((	Severely fractured, medium strong to strong, slightly weathered, grey GRANODIORITE TCR = 83% SCR = 85% RQD = 30%	×SP1	7 <u>-9</u> 1		
-14-			End of Borehole at 13.7m		_		
-15-							
-17-							
- 18 -							
- 19 -							
-20-							
- 22 -							
-23-							
-24-	Sar	nle T	ype: GS - Grab Sample SPT - Standard Penetration Test		T	ogged by	
	Piez	romet	ST - Shelby Tube PT - Piston Tube CC - Continuou er Pontonita Solaushad Drill Cuttings		R	eviewed	
			er Type: Bentonite Sloughed Drill Cuttings	Sand	D	ate: Jan	14, 2013

			BOREH	OL	E	REC	<b>CO</b> ]	RI	)								B	H1	2-	08	
	LIEN		CAPITAL REGIONAL DISTRICT					7	1.4	•					OJE					7 <u>0043</u>	<u>81</u>
	ROJI	ECT TION	Core Area Wastewater Treatment Program McLoughlin Point, Esquimalt, B.C.												RTH STIN		Э —		<u>363</u> 706	159 13	
			DATE Dec 17, 2012 DRILLING CO. Mud														1ud I				<u>Corin</u>
				s	AMP	IFS	🗆 In	situ	She	ar V	ane (	(kPa)			?emo	ulde	d She	ar Va	ane (	kPa)	
Ê		SOL							et Pe	netr	omet	er (kl	Pa)	XC		bed	Torva		(Pa)	,	<b>a</b>
LH (r	USC	SYMBOL	SOIL DESCRIPTION	ш	BER	URE (%			5(	)kPa	a	1	100k	Pa		150	)kPa		20	0kPa 	EH (f
DEPTH (m)	) S	SOIL S	SOIL DESCRIPTION	TYPE	NUMBER	MOISTURE CONTENT (%)	Wp ⊢		<i>N</i> Э—	<i>W</i> <sub>L</sub>		oisture	e Co	ntent	t & A	tterb	erg Lir	mits			DEPTH (ft)
		S				ZQS		10		•							t, blow			0	
- 0	-	$\boxtimes$	FILL - 75mm grey Sand and Gravel, trace silt over	XGS	5 8-1	18		10	c	20		0	40		50	6		70	8		<sup>90</sup> TE <b>0</b>
		$\bigotimes$	light brown gravelly silty Sand																		
- 1 -	FL	$\bigotimes$															•••••				
		$\bigotimes$													•						<b>             </b>
			Grey mottled SILT AND CLAY, trace gravel and	SPI	T 8-2	22			15 •	o											<b>–</b> 6
- 2 -			sand partings, very stiff	Ĥ													•				Ē
																	•				
- 3 -			-trace organics below																		E 10
				XSP1	Г 8-3	32			1		· · · ·	0									
																					12
- 4 -											· · · · · ·										E 14
	СН		-brown, without organics, stiff below	Mape				1	1		: : : ? : : : : : : : :					• • • •	••••••				Ē
- 5 -			brown, whitout organics, still below	ASP.	Г 8-4	33						o									<b>16</b>
																					<b>E</b> 18
											· · · ·						•		· · · ·		
- 0 -			grey, firm below	<b>SP</b>	Г 8-5	35	4					o				• • • •	•				
				<u> </u>																	22
- 7 -											· · · · ·						•••••				
- 8 -	1		Crow and walayers SUT trace arrestal form	IXXI	<b>I8-6</b> A		4		o			o									26
	ML		Grey sandy clayey SILT, trace gravel, firm	SP	18-6B	16			·····		. : : 					-	••••••				
	-		Moderately jointed, medium strong, slightly																		
- 9 -		$\left( \right)$	weathered, grey GRANITIC ROCK				•••••				· · · ·						•		: ::::::::::::::::::::::::::::::::::::		<b>30</b>
	BR	(((	TCR = 100% SCR = 100% RQD = 81%	CC	2 1																
-10-		(((														• • • • •					
	1	$\square$	End of Borehole at 10.3m		$\uparrow$						  								· · · · ·		<b>34</b>
	1																•••••				
-11-	1																				
																					<b>   38</b>
-12-	l																•••••				40
	Sample Type: GS - Grab Sample SPT - Standard Penetration Test Logged by: CG/RI												40								
ST - Shelby Tube PT - Piston Tube CC - Continuous Core Piezometer Backfill Type: ■ Bentonite Sloughed Drill Cuttings Sand																					
	1 Day	, 1111 A		•	L	are. Jan 4	<b>+</b> , ∠01.	ر	1												

			BOREHO	DLI	E ]	REC	<b>CO</b> ]	RD								B	H	12-	09	
	LIEN ROJI		CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program		г			Geod	eti	0					JECT RTHIN			<u>111′</u> 5363	70043	1
			McLoughlin Point, Esquimalt, B.C.			LEVAT									TING			470e		
D	RILI	ING	DATE Dec 15 2012 DRILLING CO. Mud	Bay	Dril	ling			_	DR	ILL	ING	MET	ГНС	DD	Mud	Ro	otary	/Rock	<u>Corir</u>
		Ļ		S	AMP			situ Sl							emould sturbed				kPa)	
H (m)	0	SYMBOL			Ŕ	IRE (%)			50k				0kPa			50kPa			0kPa	T (#
DEPTH (m)	nsc	IL SY	SOIL DESCRIPTION	TYPE	NUMBER	MOISTURE CONTENT (%)	Wp	W	1	W <sub>L</sub>	Moir	oturo	Cont	ont	& Atter	hora l	imit	~	I	JEPTH (ft)
		SOIL			z	CON	•	-			Star	ndard	Pene	etrat	tion Te	est, blo	ws/0	).3m		
-0		$\otimes$	FILL - brown gravelly sandy Silt, some clay					10	20	)	30		40	5		60	70	8	80 9 	0           
		$\bigotimes$																		<b>2</b>
- 1 -	FL	$\bigotimes$												•••••						
		$\bigotimes$	-SPT refusal at 1.6m; 50 blows for 75mm	×SP1	9-1	-16			<b>)</b>						50					
- 2 -			Bedrock encountered at 1.6m. Refer to Rock Log for continuation of rock description																	<b>E</b> 6
										• • • • •				•••••						<b>8</b>
- 3 -																				2 4 6 8 10 12 14 14 16 18 20
- 4 -																				
																				<b>= 14</b>
- 5 -																				<b>E</b> 16
																				<b>–</b> 18
- 6 -	ļ													••••						
- 7 -																				
, .																				24
•													-	•••••						22 24 24 26
- 8 -																				
	l													•••••						
-9-														· · · ·				· · · · · · · · · · · · · · · · · · ·		<b>= 30</b>
																				32
-10-																				34
																		· · · · · · · · · · · · · · · · · · ·		28 30 32 34 34
-11-																				<b>36</b>
	ł																			38
-12-	L																			<b>40</b>
			ype: GS - Grab Sample SPT - Standard Penetration Test ST - Shelby Tube PT - Piston Tube CC - Continuou		、	ogged by eviewed		G/RI H	-		Ľ	T a		5	ta	nf	6			
	Bac	zomet kfill	er Type: Bentonite Sloughed Drill Cuttings	Sand		ate: Jan			1			B								

PR CL	OJ IE	Stantec ECTCore Area Wastewater Treatm NTCAPITAL REGIONAL DIST ATIONMcLoughlin Point			ram	BO				DAT	UM		Geo 5.21		tic		BH12-( 11170043 5363182 470621	1	
DR	IL	LING DATE <u>12/15/2012 to</u> D		LIN 2 8				FX-FRACT	-	NT-CONT/ BEDDING	ACT RZ		DR N COF		UN-UI PO-PO K-SLIG	G METHODMU NDULATING CL-CLEAN PC-PARTIALLY COA SKENSIDED CC-COMPLETELY CO IN-FILLED	ATED		٥
		LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE		TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	-ب ا	Jr		UGH IN-FILLED ISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	COATED IN COATED	OTHER TESTS	
	-					600	80 680 680 680 680 680 680 680 680 680 6	000 000 000 000 000 000 000 000 000 00	5	R3 84		0000							
3.4	Ł.	Bedrock encountered at 1.6 m. Refer to Soil Log for overburden description.																	
2 -		Severely fractured to intact, slightly weathered, strong to very strong, grey GRANODIORITE - Iron staining observed on fracture surfaces		RC 1								Ð	15	3	1	J - UN, R, CL	62		daadaadaadaadaadaadaada
4				RC 2								60	1	3	1	J - UN, R, CL	76		alaadaadaadaadaadaadaadaadaadaadaadaadaa
5				RC 3								690	6	3	1	J - UN, R, CL	69		huuhuuhuuhuuhuuhuuhuuhuuhuuh
o - - - - - - - - - - - - - - - - - - -				RC 4								00	3	3	1	J - UN, R, CL	52		
8 - - - - - - - - - - - - - - - - - - -				RC 5								0.60	3	3	2	J - UN, R, PC	61		udandan kadan k
-4.9	0	Severely fractured, highly weathered, very weak to weak, grey		RC 6A									20	n/a	4		25		
0		GRANODIORITE - Iron staining observed on fracture surfaces		RC 6B								0 98	<b>3</b>	3	2	J - UN, R, PC	47		يستستست
1				RC 7								G	5 3	3	2	J - UN, R, PC	61		
2				RC 7								G	0 3	3	2	J - UN, R, PC		61	61

		Stantec	nent I	Prog	ram	BO	RE	HOI	LE F	REC	OR	D				PROJECT No	<b>BH12-(</b> 11170043		
(	CLIE	ENT CAPITAL REGIONAL DIST								-			Geo			NORTHING	5363182		
I I	LOC DRII	McLoughlin Point           LLING DATE         12/15/2012 to         E	ORIL	LIN	G CC	)N	/lud B	ay Drill		ELEV	ATI					EASTING G METHOD M	470621 ud		
(m)	(m) NO		LOT	E & No.		ROKEN CO RUSHED ( IISSING CO IFERRED I	ORE CORE DRE FAULT	FX-FRACT J-JOINT CL-CLEA\ VN-VEIN	TURE CC B-E /AGE F-F FO	NT-CONTA BEDDING AULT L-FOLIATIC		-BROKEI RUBBLE -PLANAF -STEPPE				NDULATING CL-CLEAN DLISHED PC-PARTIALLY CC CKENSIDED CC-COMPLETELY JGH IN-FILLED		STS	010
DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	STRUCTURE	TOTAL CORE %			FRACTURE FREQUENCY	8 STRENGTH INDEX	2 WEATHERING	DIP w.r.t. CORE AXIS	чſ	٦r	Ja	ISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	COATED IN THE COATED INTERCOATED INTERCOAT	OTHER TESTS	
13		Severely fractured, highly weathered, very weak to weak, grey GRANODIORITE - Iron staining observed on fracture surfaces ( <i>continued</i> )		RC 8	05		680	8645	2015 0	R4 83		60.00	3	3	2	J - UN, R, PC	67		4
14	-8.3	Moderately jointed to intact, slightly weathered to fresh, medium strong to strong, greenish grey ALTERED GRANODIORITE - Frequent microdefects/veins		RC 9								0 0	3	2	2	J - UN, R, PC	67		44 44 44 44 44 44
15-				RC 10								0	3	3	2	J - UN, R, PC	71		144 50 51 51 51 51 51 51 51
17				RC 11A								0	1	3	2	J - UN, R, PC	74		5
18-				RC 11B								30	15	3	2	J - UN, R, PC	42		5 5 6
19				RC 12								0	3	3	2	J - UN, R, PC	42		66 66 66 66 66
	-14.6			RC 13									1	3	2	J - UN, R, PC	74		6
20-	-14.0.	End of Borehole BH12-09 at 19.81 m																	6 6 6 6 6
22																			71 77 77 77 77 74
23 -																			7! 7/ 7/ 7/ 7! 7! 7!

			BOREH	DL	E ]	REC	COF	RD						BF	<b>I12</b> -	-10	
	LIEN		CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program					<b>.</b>				ROJE				<u>70043</u>	1
		ECT TION	McLoughlin Point, Esquimalt, B.C.			DATUM ELEVA		eodet ~5	.2m			IORTI ASTI		ý	470	<u>3189</u> 601	
			DATE Dec 14, 2012 DRILLING CO. Mud											lud F			<u>Corir</u>
				S	AMP	LES	🗆 Ins	itu Shea	ar Vane	(kPa)		Rem	ouldeo	d Shea	r Vane	(kPa)	
Ê		BOL				ш 🖗			netrome )kPa		'a) 🗙 00 <u>k</u> Pa			Torvan kPa	e (kPa)	)0kPa	l (j
DEPTH (m)	nsc	SYMBOL	SOIL DESCRIPTION	ТҮРЕ	NUMBER					1		1	150	кга	20		DEPTH (ft)
DEF		SOIL		μ	NUN	MOISTURE CONTENT (%)	₩ <sub>P</sub>	• •		loisture Standar							DEF
- 0 _			FILL 75 0 1 10 1 1 1				_: : : :	10	1	30	40	50	60	) (	70	80 9	00 T <b>0</b>
		$\bigotimes$	FILL - 75mm grey Sand and Gravel, trace silt over light brown clayey Silt, trace sand, stiff	XGS	10-1	23			0								Ē
	FL	$\bigotimes$															
- 1 -		$\bigotimes$											· · · · · ·				<b>E</b> 4
	TP		Dark brown clayey SILT, some organics (Topsoil)	XSPT	10-2		1										
- 2 -	•		Light brown SILT and CLAY, trace sand, gravel and		0-2/	22			0								2 4 6 8 10 12 14 16 18 20
			organics, very stiff														<b>8</b>
- 3 -									20								
			-without gravel and organics below	XSP1	10-3	26			• 0								
4 -																	<b>E</b> 14
					10-4	34		9		0							
- 5 -	СН					54				Ŭ							
																	<b>E</b> 18
6 -																	
			-firm to stiff below	Хврт	10-5	36	7 •			o							
														••••••			<b>E</b> 22
7 -																	
-	ł			Man			6							• • • • • •			
- 8 -			Grey sandy clayey SILT, trace gravel, firm	ASPI	10-6	16	•	o									<b>26</b>
-	ML																28
9-											:						
			Grey silty SAND, some clay, trace gravel, compact	Хярт	10-7	13		12 •									
					-												<b>= 32</b>
-10-	SM																
-			-SPT refusal at 10.8m; 50blows for 150mm	ХSРТ	10-8	12		o				50					
-11-			Fractured, medium strong to strong, slightly														<b>36</b>
-	BR	$\left( \left( \left( \right) \right) \right)$	weathered, grey GRANODIORITE														<b>E</b> 38
-12-	ł		TCR = 100% $SCR = 90%$ $RQD = 73%$	CC	1									••••••			22 24 26 28 30 32 34 36 38
	——	nple 7	ype: GS - Grab Sample SPT - Standard Penetration Test			ogged by	: : : : : : CG/	'RI	1::::	ari A		 <b>N</b> 4	:::1		1::::	<u></u>	⊥ <sup></sup> 40
		zomet			ĸ	eviewed				Ĭ	<u>}</u>	St	ar	It	ec		
	Bac	kfill '	Type: Entointe Bestoughed Drin Cuttings		D	ate: Jan	4, 2013										

			BOREHO	DL	E ]	REC	COF	<b>D</b>							- <b>10</b> c	
	LIEN	T _ ECT	CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program		г		r G	eodeti	ic			OJECT ORTHIN			<u>70043</u> 3189	<u> </u>
			McLoughlin Point, Esquimalt, B.C.			LEVA						STING	- U	470		
D	RILL	ING	DATE <u>Dec 14, 2012</u> DRILLING CO. <u>Mud</u>	Bay	Dril	ling			DRI	LLING	METH	HOD	Mud F	Rotary	Rock	Corir
(		OL		S	AMP			itu Shea ket Per				Remould Disturbed				
DEPTH (m)	usc	SYMBOL	SOIL DESCRIPTION	ТҮРЕ	NUMBER	STURE ENT (%	Wp	50 W	kPa W <sub>L</sub>	1	00kPa	15	0kPa	20	0kPa 	JEPTH (ft)
DE		SOIL		F	NUN	MOISTURE CONTENT (%)	É	0	l N ● S			nt & Atter ration Te 50	st, blows	s/0.3m	80 9	0
	BR		Fractured, medium strong to strong, slightly $\int$ weathered, grey GRANODIORITE $I$ TCR = 100% SCR = 94% RQD = 50%	СС	2											40 42 42
-13-			End of Borehole at 12.8m													44
-14-																46
-15-																42 44 46 48 50 52 54 56 58 60
-16-																52
																54
17-																56
-18-																<b>58</b>
- 19 -																
20-																66
-21-																<b>70</b>
-23-																62 64 66 70 72 74 76 78
-24-																<b>78</b>
	San	ple T	Ype: GS - Grab Sample         SPT - Standard Penetration Test           ST - Shelby Tube         PT - Piston Tube         CC - Continuou	s Cor	<u> </u>	ogged by		RI		T		<b>1</b>		• •		80
	Piez	zomet	er Bontonita Bolsloughed X Drill Cuttings		K	eviewed	-			Ĭ	ș 5	ita	nt	ec		
	Bac	kfill '	Type: Entonne Basioughed Drin Cuttings	~	D	ate: Jan	4, 2013									

			TEST P	IT	RF	ECO	RD								T	P12	-1	
-	LIEN ROJI		CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program										JECT	No.		117( detic		31
L	OCA	TION	McLoughlin Point, Esquimalt, BC										VATIO		5.21	n (es		_
Е	XCA	VAT	ON DATE <u>Dec 18, 2012</u> CONTRACTOR <u>Don</u>	Ma	nn E	xcavat	ing L	td_ F	XCA	VAT	TION	METH	HOD _	Test	Pittir	<u>Ig</u>		
(		oL		S	SAMP		□ Insi △ Poo						emould isturbed				a)	
DEPTH (m)	USC	SYMBOL	SOIL DESCRIPTION	ТҮРЕ	NUMBER	TURE NT (%	w		)kPa		100	kPa	1:	50kPa		200kI	<b>'</b> a	DEPTH (ft)
		SOIL		Γ	NUN	MOISTURE CONTENT (%)		• •	$W_L$ -1 $\bullet$ 20		dard I	Penetra	& Atter ation Te 50			n 80	90	
0	FL	$\bigotimes$	FILL - 75mm of grey Sand and Gravel, trace silt over light brown clayey Silt, trace sand	GS	5 1	26			C	<b>&gt;</b>								- 0
		$\bigotimes$	FILL - grey sandy Gravel, trace silt	GS	5 2													-
-		$\bigotimes$																- 2
	FL	$\bigotimes$																-
1 -		$\bigotimes$									•••••							-
	TP	$\bigotimes$	100mm of black clayey Silt, some organics (Topsoil)	XGS	5 3	30												- 4
_	<u> </u>		Grey/light brown clayey SILT, trace sand and gravel, very stiff to hard	GS		30				0 0								-
																		- - -
																		- 6
2 -																		-
	СН																	-
-																		- 8
				X GS	5 5	25			0									-
3 -						-												- 10
																		-
-			End of Test Pit at 3.4m Easting: 470586 Northing: 5363198															-
																		- 12
																		-
4 -																		-
																		- 14
-	<b>C</b> orr		Vine: CS. Grab Sample SDT. Standard Departmention Test		 	oggod k-												-
		nple I zomet	ype: GS - Grab Sample SPT - Standard Penetration Test ST - Shelby Tube PT - Piston Tube CC - Continuou er		re R	ogged by eviewed		KI		y	A	S	ta	nf	e			
	Bac	kfill	er Type: Bentonite Sloughed Drill Cuttings	Sand	D	ate: Dec	21, 201	2			Ø'							

			TEST P	IT	RF	ECO	RI	)										,	ТΡ	12-	2
	LIEN		CAPITAL REGIONAL DISTRICT													ECT	No.				)431
	ROJI OCA	ECT TION	Core Area Wastewater Treatment Program McLoughlin Point, Esquimalt, BC											DA EL		M ATIC	)N			etic (est	.)
			ION DATE Dec 18, 2012 CONTRACTOR DOI	n Mar	ın E	xcavat	ing	Ltd	Ŀ	EXC	AV	ATI	ON								
				S	AMP	LES														(kPa)	
(u)		SYMBOL			ш	RE (%)		OCK		netr 0kP		ter (		<b>X</b> ) KPa	Dist		1 Ior 0kP			)0kPa	(tt)
DEPTH (m)	USC	ΓS	SOIL DESCRIPTION	ТҮРЕ	NUMBER	ISTU TENT	W	5 V	W	WI						• • •					DEPTH (
Δ		SOIL		'	Ĩ	MOISTURE CONTENT (%)			0	•	St	tand	ard I	Conter Penet	ratic	on Te	st, bl	lows/0	).3m		
0	<u> </u>	$\boxtimes$	FILL - 150mm of grey Sand and Gravel, trace silt	+				10		20	3	30	4	0	50		60	70		80	<sup>90</sup> 0
	1	$\bigotimes$	over light brown sandy clayey Silt, some gravel	GS	1	19				0											
	FL	$\bigotimes$		Π																	
-		$\bigotimes$												••••							2
	FL	$\bigotimes$	FILL - brown Sand and Gravel, some cobbles, trace silt	GS	2									· · · · · · · · · · · · · · · · · · ·							
1 -	-	$\boxtimes$	BEDROCK (weathered)	-					·····						·						
1	BR	$\left( \left( \left( \right) \right) \right)$												· · · · · · · · · · · · · · · · · · ·							
	1		End of Test Pit at 1.2m																		+   - <b>4</b>
-	1		Easting: 470639 Northing: 5363170																		E
																					- 6
2 -																					
	1																				
																					- 8
-																					
	1													•••••							
3 -	-																				
3 -																					- 10
	1													· · · · ·							
_	1																				
	1							÷						•••••							- 12
	+																				
4 -																					
	1													· · · · · · · · · · · · · · · · · · ·							
																					- 14
-					  -																
			ype: GS - Grab Sample SPT - Standard Penetration Test ST - Shelby Tube PT - Piston Tube CC - Continuo	_	_  -	ogged by eviewed		V/RI H	-			Z		S	ł	2	n	tc	r		
	Bac	zomet kfill	er Type: Bentonite Sloughed Drill Cuttings	Sand		ate: Dec	-					1	S								

			TEST P	IT	RF	ECO	RI	D										r	ГР	12-	3
	LIEN ROJE		CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program											PRC DAT			No.		111 eode		)431
L	CA	TION	McLoughlin Point, Esquimalt, BC										_	ELE	VA	TIO		_6	.2m	(est	)
E	XCA	VAT	ON DATE <u>Dec 18, 2012</u> CONTRACTOR <u>Dom</u>	Mar	n E	xcavat	ing	Lto	<u>1</u> E	EXC	AVA	ATIC	N N	1ETI	HOI	)_]	ſest	t Pit	ting		
~		٦L		S	AMP				ı She et Pe											(kPa)	
DEPTH (m)	usc	SYMBOL	SOIL DESCRIPTION	ш	BER	ПТ (%)			50	OkPa		1	00k	Pa		15	0kPa	1	20	0kPa	LH (ft)
DEP		SOIL S		ТҮРЕ	NUMBER	MOISTURE CONTENT (%)	Wj ⊢	Р	w 0									Limits ows/0			DEPTH (
0						ŏ		10		20	3		40		50		i0	70		30	90 0
-		$\bigotimes$	FILL - grey/brown clayey Silt, trace sand and gravel	Maa	1		· · · · ·														-
-	FL	$\bigotimes$		GS	1	24				0											
_		$\bigotimes$																			
-			End of Test Pit at 0.6m Bedrock encountered						· · · · · ·												- 2
			Easting: 470648 Northing: 5363140				•														
1 -																					
-																					<b>4</b>
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-	San	nple T	ype: GS - Grab Sample SPT - Standard Penetration Test		1	ogged by		V/R													
	Piez	zomet	ST - Shelby Tube PT - Piston Tube CC - Continuou er Pantonita Staughad Sprill Outlings		_ H	eviewed			-		ŝ			S	ta	31	n	te	Ċ		
	Bac	kfill 7	Type: E Demonite Rasiougned Drin Cuttings	Sanu	D	ate: Dec	21, 2	012													

			TEST P	IT	RF	ECO	RI	)												TI	<b>P1</b>	2-4	
	LIEN ROJE		CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program														CT I	No.		 Geog		'004 ic	31
L	CA	TION	McLoughlin Point, Esquimalt, BC											Е		VA	τιο			5.3n	n (e	est.)	
E	XCA	VAT	ON DATE <u>Dec 18, 2012</u> CONTRACTOR <u>Dor</u>	n Mai	nn E	xcavat	ing	Lto	1	EX	CAV	/A7	ION	I MI	ETH	IOI	<u> </u>	Гes	t Pi	ttin	g		
(m) H	0	SYMBOL			AMP	-					rom		(kPa		<b>C</b> Di		bed		vane	Vane (kPa			H (ft)
DEPTH (m)	NSC	SOIL SY	SOIL DESCRIPTION	ТҮРЕ	NUMBER	MOISTURE CONTENT (%)	Wj ⊢		w •	- - -	- 1	Stan		Pen	ietra	tion	Tes	st, bl	ows	0.3m			DEPTH (
0		$\bigotimes$	FILL - grey/brown clayey Silt, trace sand and gravel					10		20		30		40	5	50	6	0	7	)	80	9	0 - <b>0</b> -
- - 	FL	$\bigotimes$		GS	5 1	25					o												- 2
- - 1 -		$\bigotimes$																					
-		$\bigotimes$	-heavy seepage at 1.1m End of Test Pit at 1.2m Bedrock encountered	-																			- <b>4</b>
-			Easting: 470647 Northing: 5363114																				
2 -																							- 6 - - -
-																							- - - 8 -
-																							
3 -																							- 10 -
-																							- 12
- - 4 -																							
-																							- 14
-	San	ple T	ype: GS - Grab Sample SPT - Standard Penetration Test		   I	.ogged by	: E	V/R					<u> </u>							<u></u>			-
	Piez	zomet	ST - Shelby Tube PT - Piston Tube CC - Continuou er		e R	eviewed	by: B	Н				9	A		S	ti	31	n	te	Э			
	Bac	kfill '	Type: Bentonite Sloughed Drill Cuttings	Sand	E	Date: Dec	21, 2	012				7		-					- 4		-		

			TEST P	IT	RF	CO	R	D												,	ΓР	12	-5	
	LIEN		CAPITAL REGIONAL DISTRICT														IEC		No.		11			31
	ROJE	ECT TION	Core Area Wastewater Treatment Program McLoughlin Point, Esquimalt, BC														UM /AT		N		eod .1m			
			ION DATE Dec 18, 2012 CONTRACTOR Don	Mar	nn Ez	kcavat	ing	Lt	d	EΣ	KCA	AV/	ATIO	- ON										_
				S	AMP	LES			u Sł												Vane		ı)	
(E)		SYMBOL			~	щ(%	$\Delta$	Poc			etro kPa				) kPa				Torv )kPa		(kPa) 20	)0jkF	Pa	(#)
DEPTH (m)	nsc		SOIL DESCRIPTION	ТҮРЕ	NUMBER	STUF ENT (	W	D	W		W <sub>L</sub>				-				-					DEPTH
DE		SOIL		Ĥ	IN N	MOISTURE CONTENT (%)	ŀ	1	ō		⊣⊺ ●				Conte Pene						s ).3m			B
0						0		1	0	2	0		0	4		5		6		70		80	90	0
•	FL	XX	FILL - brown Sand and Gravel, some silt and clay End of Test Pit at 0.1m				· · · · · · · · · · · · · · · · · · ·																	-
			Bedrock encountered																					-
-	ļ		Easting: 470637 Northing: 5363101														· · · · · · · · · · · · · · · · · · ·							E
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2 -							• • • • • •				•••••						· · · · · · · · · · · · · · · · · · ·							-
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4-																								-
	1																							- 14
-	l																							-
	San	ple 1	Spe: GS - Grab Sample         SPT - Standard Penetration Test		L	ogged by	: <u>F</u>	EV/I	RI			<u> </u>	s I				•	::		: <u>:  </u>				
	Piez	zome	ST - Shelby Tube PT - Piston Tube CC - Continuou ter Type: Bentonite Sloughed Drill Cuttings		ĸ	eviewed	-					S	ſ	Ś	S	5	ta	31	1	ie	Ċ			
	ј вас	KT111	Type:		D	ate: Dec	21, 2	2012	2															1

			TEST P	IT	RF	ECO	RI	)										r	ГР	12	-6	
	LIEN		CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program												JEC		No.	_	111			31
	ROJI OCA	ECT TION													UM VAT		N		eode 2m			_
			ON DATE Dec 18, 2012 CONTRACTOR DOI	n Ma	nn E	xcavat	ing	Ltd	E	XCA	VA	TIOI										
				S	SAMP	LES				ır Var									/ane	(kPa	)	
(m)		SYMBOL			ш	RE (%)		ockei		ietror kPa	nete		a) )0kP				lorv )kPa		(kPa) 20	0kP	a	(ft)
DEPTH (m)	USC	L SYI	SOIL DESCRIPTION	TYPE	NUMBER	MOISTURE	Wp	W	/	WL							T .					DEPTH (ft)
		SOIL		'	Ĩ	MON -	I	Ļ	,	•	Sta	sture ndarc					•					
0	<u> </u>	$\boxtimes$	FILL - grey/brown Sand and Gravel, some silt					10	2	20	30		40	5	50	60	0	70	3	30	90	0
	ļ	$\bigotimes$																				
	ł	$\bigotimes$		GS	5 1																	-
-	FL	$\bigotimes$																				- 2
		$\bigotimes$																				-
	ł	$\bigotimes$											-									-
		$\bigotimes$																				-
	1	$\bigotimes$	FILL - grey/light brown clayey Silt, some sand,	GS	<b>5</b> 2	33						0					•••••					- 4
-		$\bigotimes$	mixed with black clayey Silt, some organics																			-
	ł	$\bigotimes$	- test pit full of water due to heavy seepage at 1.5 m																			-
	+	$\bigotimes$											-									- 6
2 -	ł	$\bigotimes$																				_
-	FL	$\bigotimes$											-				•••••					-
	ł	$\bigotimes$																				- 8
-		$\bigotimes$																				-
		$\bigotimes$																				-
3 -	ł	$\bigotimes$																				_
3-	$\vdash$		End of Test Pit at 3.0m	-																		- 10
	ļ		Inferred Bedrock from Resistance of Excavator Bucket																			-
-			Easting: 470610 Northing: 5363111																			-
	ł																•					- 12
																						-
4 -																	•••••					-
	ļ																					-
·	ļ																					- 14
-					  -	11																-
			ype: GS - Grab Sample SPT - Standard Penetration Test ST - Shelby Tube PT - Piston Tube CC - Continuo	_	re R	ogged by eviewed			-		ي	Ĩ		5	12	16	71	2				
	Bac	zomet kfill [	Fype: Bentonite Sloughed Drill Cuttings	Sand	E	ate: Dec	21, 20	12			``	Ŀ				41						

			BOREH	OLI	E ]	REC	CO	RI	)								F	3H	[13-	·1	
	LIEN		CAPITAL REGIONAL DISTRICT				. (	7.0.0	dat							ECT				7004 2903	31
		ECT TION	· · · · · · · · · · · · · · · · · · ·			DATUM ELEVA					st.)					THIN ING			<u> </u>		
			DATE Feb 5, 2013 DRILLING CO. Mud	Bay									GN								ing
				S	AMP	LES	🗆 In												Vane		
(E		SYMBOL			œ	ле (%)	Δ Po	ocke		netrc )kPa				∦kPa	Dist		d Tor 50¦kP		(kPa) 20	)0jkPa	(#)
DEPTH (m)	nsc	SYN.	SOIL DESCRIPTION	ТҮРЕ	NUMBER	STUF	Wp	v	v	WL.							1			-	DEPTH
B		SOIL			ΝU	MOISTURE CONTENT (%)	Ē		-	•	Sta	anda	ard F		ratic	on Te	st, bl	lows/	0.3m		
- 0	<u> </u>	$\boxtimes$	FILL - grey gravelly SAND, some silt, trace asphalt,	SPT	1 1		G	10		20		0 2 <b>9</b>	40	0	50		60	70	) {	80	90 0
		$\bigotimes$	compact	ASPI	1-1	/															
- 1 -		$\bigotimes$																			<b>4</b>
		$\bigotimes$	-Silt and Sand, trace organics, wet, loose	SPT	1.0		- 4					· · · · · · · · · · · · · · · · · · ·									<b>4</b>
- 2 -		$\bigotimes$	Sint and Sund, these organies, wet, toose	MSP1	1-2																
	FL	$\bigotimes$							:::: :::::::::::::::::::::::::::::::::		: : : : :	· · · · · · · · · · · · · · · · · · ·									8
- 3 -		$\bigotimes$																			10
		$\bigotimes$	-grey Sand and Gravel, some silt, loose	SPT	1-3				13		· · · ·	· · · · · · · · · · · · · · · · · · ·									÷ E
4		$\bigotimes$		$\square$								••••••									= 12
		$\bigotimes$																			14
		$\bigotimes$	-cobbly; no recovery	SPT						18											
- 5 -	<b> </b>	$\nearrow$	Grey SILT and CLAY, trace sand partings, very stiff	Μ								· · · · · · · · · · · · · · · · · · ·									E
																					18
- 6 -				Mape				1(	)			• • • • •									<b>20</b>
				SPT	1-4	27					O										22
- 7 -												· · · · · · · · · · · · · · · · · · ·								-	ΞE
	СН								· · · · ·			· · · · · · · · ·									24
- 8 -			-firm	SPT	1-5	46	5 •							0							<b>26</b>
				Α								•••••									28
- 9 -												•••••									- 30
	<u> </u>		Grey clayey SILT, soft	<u></u>			3					•••••									Ē
-10-	1			SPT	1-6	49									0						- 32
	1																				- 34
-11-			-sand partings	SPT	1-7	47	1							c							- 36
	CL	$\left \right $			-																Ē
	1											•••••									<b>38</b>
-12-	┣—	nple T	ype: GS - Grab Sample SPT - Standard Penetration Test			ogged by	: D(	:   : 3											<u></u>		<b>40</b>
	Pie	zomet	ST - Shelby Tube PT - Piston Tube CC - Continuou er Bantonite Soloughed Drill Cuttings		R	eviewed	by: BI	ł			S	Ŋ	à	S	t	a	n	te	£		
	Bac	kfill '	lype:	Jound	D	ate: Feb	14, 20	13					-		_		_		-		

			BOREH	OLI	E ]	REC	CO	R	D										B	H	13.	-1	cont'd
	LIEN		CAPITAL REGIONAL DISTRICT														JEC					7004	
		ECT	-														RTH		Ъ_			<u>2903</u> 424	
			<u> Ogden Point, Victoria BC  DATE Feb 5, 2013 DRILLING CO. Mud </u>			ELEVA' ling								JG			TIN OC		- Ind			<u>434</u> /Cor	ing
				-		-																	
		F		5/	AMP	LES			tu S ket												Vane (kPa)	(kPa)	
DEPTH (m)	0	SYMBOL			щ	MOISTURE CONTENT (%)				501	kPa			10	0kP	a		150	kPa		20	)0kPa	(#)
L T L	USC	S	SOIL DESCRIPTION	ТҮРЕ	NUMBER	STU	W	P	w		WL				1				I			I	DEPTH
B		SOIL			NN	N N N			-0		-  ●									_imit	s ).3m		B
						ŏ		1	0	2	0		80		40		0	6		70		80	90 <b>40</b>
			Grey clayey SILT, sand partings, soft	SPT	1-8	40	1								•								
12				Α																			<b>42</b>
-13-																							
			Grey SAND, some silt, some gravel, very dense																				
-14-				SPT	1-9														63 •	<b>7</b>			<b>46</b>
L -	SP			Α																			E
			-SPT refusal at 15m; 63 blows for 50mm; no recovery							(+) + 									e	55			<b>48</b>
-15-			Fractured to moderately jointed, medium strong,							: : :.:.													<b>50</b>
	BR		slightly weathered, grey GRANODIORITE	CC	1																		
-16-	1		TCR = 100% SCR = 53% RQD = 77%		1																		52
	<u> </u>									(+) ( 													E <b>5</b> 4
			TCR = 100% $SCR = 38%$ $RQD = 72%$							: : :-:									•				
-17-	BR			CC	2					: : : : :									•			-	56
										:									.;				
- 18-			End of Borehole at 17.8m		_																		Eso
										:::									•				E 60
-19-																							
																							E 64
-20-									· · · ·	: : : : : : :									•				Ē
20																							E 66
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-21-																			•				
									••••													•	<b>70</b>
-22-																							<b>E</b> 72
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-23-																			• • • • •				
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24									 			:		÷.					•			-	÷ <b>78</b>
-24-	1																					· [	
	San	nple 7	Ype: GS - Grab Sample         SPT - Standard Penetration Test           ST - Shelby Tube         PT - Piston Tube         CC - Continuou	16 Corr		ogged by	/: ]	DG					Ż				L			L			-1- 80
		zome	er Bentonite Sloughed X Drill Cuttings		ĸ	eviewed	-						Ĺ	ß		5	lâ	Ì	1	E	Ċ		
	ГВас	CKTIII '	Type:		D	ate: Feb	14, 2	2013						-									

			BOREH	OL	E	REC	<b>CO</b> ]	RI	)								]	BF	H1	3-2	2	
	LIEN		CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program							+i -						JECT					0043	31
		ECT ATION	_			DATUM ELEVA			<u>ode</u> 3.			t.)				THI TINC				3628 714		
			DATE Feb 6, 2013 DRILLING CO. Mud	Bay														id F				ing
DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	ίδ TYPE	NUMBER	MOISTURE S CONTENT (%)	□ Ir △ P W <sub>F</sub>	ocke	et Pe		rome a M St	ter (	kPa) 100 ure 0	) X )kPa   Conte	Dis	turbe 1 & Atte	ed To 50k	prvar Pa g Lin blow	ne (kl	200	)kPa 	06 DEPTH (ft)
-0	ŀ	$\bigotimes$	FILL - brown gravelly Sand, some silt, traces of asphalt and concrete, compact	SPT	2-1						24 •											
- 1 -			-dark brown sandy clayey Silt, some gravel, trace	// //spi	2-2	24		9			0											4
- 2 -	FL	$\bigotimes$	organics, loose																			8
		$\bigotimes$	-dark brown silty Sand, trace organics, trace gravel, trace shells, compact	SPI	2-3	24					24 •											= 10 = 12
- 4 -		$\bigotimes$	-450mm thick concrete slab encountered																			14
- 5 -			Light brown SILT and CLAY, trace gravel, trace fine sand partings, stiff																			<b>16</b>
- 6 -				SPI	2-4	31	5					o										18 20 22
- 7 - - 8 -			-grey, firm to stiff	SPT	2-5	36	5						0									24
- 9 -			-soft	SPT	2-6	51	3									>						28
- 10-																						30 32
 -	Сн			SPT	2-7	56	2									0						34
-11- 				SPT	2-8	43	1							o								36
	San Pie:	nple T zomet		us Core Sand	e R	Logged by Reviewed Date: Feb	by: Bl	H		:1:	<u>· · · ·</u>	III I	6		51	a	: 1:		<u>1::</u>		<u></u>	<u> </u>

-13       -13       -14       -14       -15       -16       -16       -16       -17       -18       -17       -18       -17       -18       -17       -18       -17       -18       -19       -11       -10       -11       -				BOREH	OL	<b>E</b> ]	REC	COR	RD								ŀ	3H	[13-	2	cont'd
LOCATION         Orgene Point, Victoria BC         ELEVATION         3.2 m (cst.)         EASING         471437           DBLLING DATE         Feb 6, 2013         DRLLING CO.         Mud Bay Delling         DRLLING METHOD         471437           Image: Solid Lines of the solid state									- 1												31
DRILLING DATE       Feb 6, 2013       DRILLING CO.       Mud Bay Drilling       DRILLING METHOD       Mud Rotary/Comp         Image: Second Secon				· · · · · · · · · · · · · · · · · · ·								ot)									
SAMPLES       Inslu Shar Vare (Pa)       Encoded Shar Vare (Pa)       Encoded Shar Vare (Pa)       Encoded Shar Vare (Pa)         SOF       SOF <td< td=""><td></td><td></td><td></td><td>C C</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>d R</td><td></td><td></td><td>ng</td></td<>				C C														d R			ng
B       0					-		-												-		<u></u>
Image: Proceeding of the second se	(		Ы			AMP															
Image: Proceeding of the second se	H (m	ő	YMB		ш	Ш	JRE (%)		-	501	Pa		100	0kPa	ı	1:	50kF	'a	20	)0kPa ⊣	H (Ħ
3       0       3       0       3       4       5       0       10       20       30       40       50       60       70       80       90         13       113       0       10       20       30       40       50       60       70       80       90 <td>EPT</td> <td>S</td> <td>IL S</td> <td>SOIL DESCRIPTION</td> <td>TYPI</td> <td>UMB</td> <td>DISTI TEN</td> <td>Wp</td> <td></td> <td></td> <td></td> <td>Anist</td> <td></td> <td>Cont</td> <td>ont :</td> <td>8. Atto</td> <td>rbora</td> <td>limi</td> <td>ite</td> <td></td> <td>EPT</td>	EPT	S	IL S	SOIL DESCRIPTION	TYPI	UMB	DISTI TEN	Wp				Anist		Cont	ont :	8. Atto	rbora	limi	ite		EPT
13       0       0       10       20       10       10       20       10       10       20       1			So			z	NON NON	•	Ū	•											
13       partings, soft         14       trace sandy silt partings         15       some sand below         16       SPI2.10         37       some sand below         17       Grey silty SAND, some gravel, trace clay, compact         18       SP         SP       SPI2.12         11       SPI2.12         12       Moderately jointed, medium strong, moderately wathreed, greenish-grey GRANDIDORITE         12       End of Borehole at 20.4m         22       End of Borehole at 20.4m         23       End of Borehole at 20.4m         24       SPI2.12         25       End of Borehole at 20.4m         26       SPI2.12         27       End of Borehole at 20.4m         28       SPI2.12         29       SPI2.12         11       SPI2.12 </td <td>_</td> <td></td> <td></td> <td>Gray SILT and CLAN trace gravel trace fine cond</td> <td><u> </u></td> <td></td> <td></td> <td>1</td> <td>10   : : :</td> <td>2</td> <td>)</td> <td>30</td> <td>4</td> <td>10   : :</td> <td>5</td> <td>0</td> <td>60</td> <td>7(</td> <td>3 0</td> <td>30  ::::</td> <td><sup>90</sup> 40</td>	_			Gray SILT and CLAN trace gravel trace fine cond	<u> </u>			1	10   : : :	2	)	30	4	10   : :	5	0	60	7(	3 0	30  ::::	<sup>90</sup> 40
13       trace sandy silt partings       Image: SPT 2-9       38       Image: SPT 2-9       37       Image: SPT 2-9       38       Image: SPT 2-9       38       Image: SPT 2-9       37       Image: SPT 2-9       37       Image: SPT 2-9       37       Image: SPT 2-9       38       Image: SPT 2-9       38 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>·····</td> <td></td> <td></td> <td>• • • • • •</td> <td></td> <td></td> <td></td> <td></td> <td>•••••</td> <td></td> <td></td> <td>· · · · · · · ·</td> <td>• • • • • •</td> <td>.   E.   E</td>								·····			• • • • • •					•••••			· · · · · · · ·	• • • • • •	.   E.   E
INP1259       38       INP1259       38       INP1259       4         Internet       Internet       Internet       1       4         Internet       Internet       Internet       5       5         Internet       Internet       Internet       5       5       5         Internet       Internet       Internet       5       5       5       5         Internet       Internet       Internet       Internet       5       5       5       5       5       5	-13-																		· · · · · · · · ·		
-15       .some sand below       SPT2-10       37       3       0       5         -16       .some sand below       SPT2-11       30       0       5         -17       Grey sity SAND, some gravel, trace clay, compact       SPT2-12       11       0       9         -18       SP       .some sand below       SPT2-12       11       0       9       5         -18       SP       .seme sand below       .s				-trace sandy silt partings	SPI	2-9	38	1					o								- <b>4</b>
-15       .some sand below       SPT2-10       37       3       0       5         -16       .some sand below       SPT2-11       30       0       5         -17       Grey sity SAND, some gravel, trace clay, compact       SPT2-12       11       0       9         -18       SP       .some sand below       SPT2-12       11       0       9       5         -18       SP       .seme sand below       .s	14				Ĥ	<u> </u>															
-15	-14-																				:  <b>∃</b> 46
-15								3			• • • • • •										- <b>48</b>
-16 -16 -17 -30 -some sand below -some sand below -17 -18 SP -19 -19 -19 -19 -19 -19 -19 -19	-15-				SP	12-10	37	•					ο			· · · · · · · · · · · · · · · · · · ·					50
-10       -some sand below       SPID-11       30       0       5         -17       Grey silty SAND, some gravel, trace clay, compact       SPID-12       11       0       9         -18       SP       SPID-12       11       0       9       6         -18       SP       SPID-12       11       0       9       6         -19       SPID-12       11       0       9       6       6         -19       SPID-12       11       0       9       6       6         -20       BR       Moderately jointed, medium strong, moderately weathered, greenish-grey GRANODIORITE       CC       1       6       6         -21       End of Borehole at 20.4m       End of Borehole at 20.4m       1       <																					
-17 -18 SP $\stackrel{\text{some sand below}}{=}$ $\stackrel{\text{some sand below}}{=}$ $\stackrel{\text{some sand below}}{=}$ $\stackrel{\text{some gravel, trace clay, compact}}{=}$ $\stackrel{\text{some gravel, trace diverse GS}}{=}$ $\stackrel{\text{some gravel, trace clay, compact}}{=}$ $\stackrel{\text{some gravel, trace diverse GS}}{=}$ $\text{some gravel, trace dis diverse diverse diverse diverse diverse diverse diverse d$	-16-																				52
-17 -18 SP -18 SP -19 -19 -19 -19 -19 -19 -19 -19	-				NSP	D 11	30											• • • • •			54
-18     SP     SPT2-12     11     SP     65     6       -19     -SPT refusal at 19.36m; 65 blows for 150mm     SPT2-12     11     SP     65     6       -20     BR     Moderately jointed, medium strong, moderately weathered, greenish-grey GRANODIORITE     CC     1     6     6       -20     BR     TCR = 100% SCR = 23% RQD = 73%     CC     1     6     6       -21     End of Borehole at 20.4m     I     I     I     1     1       -22     Find of Borehole at 20.4m     I     I     I     I     1       -23     Sample Type; GS - Grab Sample, SPT - Standard Penetration Text     Loeged by: DG     DG     I     8				-some sand below		12-11	50				· · · · · ·	Ť									
-18       SP       SPT2-12       11       S       19       65       6         -19	-17-			Grey silty SAND, some gravel, trace clay, compact	-											· · · · · · · · · · · · · · · · · · ·					56
$\begin{array}{c c c c c c c c c c c c c c c c c c c $															· · · · · · · · · · · · · · · · · · ·						58
-19 -19 -19 -20 BR Moderately jointed, medium strong, moderately weathered, greenish-grey GRANODIORITE TCR = 100% SCR = 23% RQD = 73% End of Borehole at 20.4m -21 -22 -23 -24 Sample Type: GS - Grab Sample, SPT - Standard Penetration Test Sample Type: GS - Grab Sample, SPT - Standard Penetration Test Logged by DG	-18-				SP	12-12	11		0	•	9										
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		SP			Ĥ	-														•••••••	E 60
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	10																				62
$= 20 = \begin{bmatrix} BR \\ \hline \\ TCR = 100\% & SCR = 23\% & RQD = 73\% \\ \hline \\ TCR = 100\% & SCR = 23\% & RQD = 73\% \\ \hline \\ End of Borehole at 20.4m \\ \hline \\ -21 \\ \hline \\ -22 \\ \hline \\ -23 \\ \hline \\ -24 \\ \hline \\ \\ -24 \\ \hline \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ $	-19-			-SPT refusal at 19.36m; 65 blows for 150mm												• • • • •		65 •			.  E
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			$\left( \left( \left( \right) \right) \right)$																		64
-21       End of Borehole at 20.4m       6         -22       -22       7         -23       -23       7         -24       Sample Type: GS - Grab Sample, SPT - Standard Penetration Test       Logged by: DG       8	-20-	BR	((()	weathered, greenisi-grey OKANODIOKTTE	CC	2 1															
-21 -22 -23 -24 -24 -24 -24 -24 -24 -24 -24 -24 -24			$\square$	·/	<u>  </u>	-															
-22 -23 -23 -24 -24 -24 -24 -24 -24 -24 -24 -24 -24	_ 21 _			End of Borehole at 20.4m																	<b>68</b>
-23 -23 -24 -24 -24 -24 -24 -24 -24 -24 -24 -24	<b>41</b>																				<b>E</b> 70
-23 -24 -24 Sample Type: GS - Grab Sample_SPT - Standard Penetration Test Sample Type: GS - Grab Sample_SPT - Standard Penetration Test																					
-23 -24 Sample Type: GS - Grab Sample_SPT - Standard Penetration Test Logged by: DG	-22-														> <- 			• • • • •			
-24 Sample Type: GS - Grab Sample_SPT - Standard Penetration Test													: : : : : :								<b>74</b>
-24 Sample Type: GS - Grab Sample_SPT - Standard Penetration Test	-23-												· · · ·								.  <u>E</u>
-24 Sample Type: GS - Grab Sample_SPT - Standard Penetration Test Logged by: DG																			· · · · · · · · · ·		<b>  76</b>
Sample Type: GS - Grab Sample SPT - Standard Penetration Test Logged by: DG	-																				- <b>78</b>
Sample Type: GS - Grab Sample SPT - Standard Penetration Test Logged by: DG	-24-																				
51 - Sneidy Luberri - Pision Luber CC - Continuous Core		San	nple 7	ype: GS - Grab Sample SPT - Standard Penetration Test			ogged by	DG	· · · ·			, C	2	· · · ·		<u>.</u>		!		<u></u> :	<b>⊥</b> 80
ST - Shelby Tube PT - Piston Tube CC - Continuous Core Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand		Piez	zomet	er Dortagita 🕅 Slavala I. 🕅 Doill Continue ⊡		ĸ		-				Ľ	ß			la	n	te	£		

			BOREH	OL	E ]	REC	COF	RD									N	<b>1B</b>	<b>H</b> 1	13-1	
	LIEN		CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program			DATUN		hor	4				_	PRO						7004	
	ROJI DCA		Victoria Harbour			DATUN ELEVA								NO EAS		HIN( NG	Ĵ.			3132 746	
			DATE <u>February 1, 2013</u> DRILLING CO. <u>Mud</u>	l Bay													Aud	l Ro	<u>)tary</u>	//Cor	ing_
				S	AMP	LES	□ Ins △ Po													(kPa)	
(m)		SYMBOL			<u>ب</u>	RE (%)		cket	50k		nete			kPa	nstu		0kPa			) 00kPa	H (ft)
DEPTH (m)	nsc		SOIL DESCRIPTION	ТҮРЕ	NUMBER	ISTU TENT	Wp	w	i	WL	Ma:	-4				44 e		1 : :4		I	DEPTH
		SOIL			Ī	MOISTURE CONTENT (%)	•	-			Sta	ndar	rd P	ontent enetra	atior	n Tes	st, blo	ows/(	0.3m	90	
- 0			75mm of Grey, gravelly, silty SAND over dark grey	<b>SPT</b>	2 1	32	0	10	20	)	30	) 	40		50	6	60	70		80	90 E 0
			silty SAND some silt, very loose	Apri	5-1	52															
- 1 -	SM																				
	ł																				
- 2 -			Grey fine SAND, trace shells, compact	-					····												
										· · · · · ·											8
- 3 -				SPT	3-2					2:	3										
				ή	-																<b>12</b>
- 4 -										•											
- 5 -	ļ																				<b>16</b>
	ļ																				18
				SPT								31									E
- 6 -	ļ		-some gravel, some silt	ASPI	3-3										•						20
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- 7 -	SP																				24
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- 8 -	ł																				<b>26</b>
				SPT	2 4	11	2														28
- 9 -	ł			ASPI	3-4	44	•••••••							0	· · · · · ·						30
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-10-																					- 32
	ł									· · · · · ·					•						<b>34</b>
-11-									· · · · · · · · · · · · · · · · · · ·												
	l														•						
-12-				<b>SP1</b>	2.5	43	0			•				~							<b>38</b>
12	I	ple T	Type: GS - Grab Sample SPT - Standard Penetration Test		L	.ogged by	r: CL	: : ′KK/I	G G	<u>:</u> :		<u></u>		<u>o</u> :::		:::		<u>: :  </u>	<u></u>		±- <b>F</b> 40
	Piez	zomet	ST - Shelby Tube PT - Piston Tube CC - Continuou		e R	eviewed	by: BH				Ś	J	<b>?</b>	S	ta	a	n	te	£		
	Bac	kfill	Type: Entoine Stoughed Stoughed		D	ate: Feb	15, 201	3	1										_		

			BOREH	<b>JL</b>	E ]	REC	C <b>O</b>	R	D										N	/IB	3H1	3-	<b>1</b> cc	ont'd
		JT _	CAPITAL REGIONAL DISTRICT					~										СТ			111			L
		ECT	Core Area Wastewater Treatment Program Victoria Harbour			DATUN ELEVA											RTH STIN	HN(	G		536 470			
			DATE February 1, 2013 DRILLING CO. Mud																Лuc					
					AMP								(kPa								Vane			
Ê		SOL								Per	etro	me	ter (ł	кРа	) >	<b>C</b> Di		bed	Tor	vane	(kPa)			E
DEPTH (m)	USC	SYMBOL	SOIL DESCRIPTION	Щ	MER	1 (% 1 (%				50	kPa			100	)kP	a		15	0kPa	a	20	)0kP	a	TH (ft)
DEP		SOIL S		ТҮРЕ	NUMBER	MOISTURE CONTENT (%)	W	P	W 0		<i>W</i> <sub>L</sub> ⊣	Mo	oistu	re (	Cont	ent	& A	tterb	berg	Limit	ts			DEPTH
		S			-	≥ <u>0</u> 0		1	0	2	•		anda 30		Pen 10		ation 50		st, bl	ows/ 70	0.3m	80	90	
				X	_																	T		<b>40</b>
			Grey silty SAND and GRAVEL, trace shells, trace organics, compact		1-5	27			1	3		o												- 42
-13-			organies, compact	μ												•••••								
																								<b>44</b>
-14-	1		-some silt below																					<b>46</b>
	GP																							48
-15-				Mana		22					2	2		::::::::::::::::::::::::::::::::::::::		.: .: :								
				ABPI	3-6	22					•													<b>50</b>
			Grey clayey SILT, trace to some sand, soft to firm																					52
-16-														::::::::::::::::::::::::::::::::::::::		•••••		•						
																								54
-17-														:::::::::::::::::::::::::::::::::::::::										56
																								58
-18-																								- 30
					1-7	26		8								•••••								<b>60</b>
			-grey silty coarse SAND and fine GRAVEL, loose	APL	1-/	36								0										62
-19-																•••••								E
																								64
-20-																								<b>66</b>
																								- (0
-21-	1															•••••								- <b>68</b>
				<u> </u>						14														<b>70</b>
-22-			-trace fine sand, stiff	XSP1	1-8	27			Ó			0												72
	1																							Ē
	1																							<b>74</b>
-23-																								<b>76</b>
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-24-	1																							- <b>78</b>
:	Sar	 nple T	ype: GS - Grab Sample SPT - Standard Penetration Test			ogged by	: : /:		KK/I												<u></u>			<b>80</b>
		zomet	ST - Shelby Tube PT - Piston Tube CC - Continuou			eviewed							I.	2		S	ti	31	n	tF	£			
		ckfill		Sand	D	ate: Feb	15, 2	2013	3					5										

			BOREH	OL	E	REC	CO	RD								M	BH	13-	-1c	ont'd
С	LIEN	лт _	CAPITAL REGIONAL DISTRICT											OJEC			_111			1
		ECT															536			—
			Victoria Harbour DATE <u>February 1, 2013</u> DRILLING CO. <u>Mud</u>			ELEVA lling										ud F	470 Rotary			σ
			DATE <u>Terrany 1, 2012</u> DATE: NO CO. <u>Inau</u>																	-
<u> </u>		Ы			AMP			situ S ocket									ar Vane ie (kPa		1)	
ш Т	U.	SYMBOL			۲.	JRE (%)			50k	Pa		100	kPa		150	kPa	2	00kF	<b>'</b> a	(Ħ)
DEPTH (m)	nsc	IL S	SOIL DESCRIPTION	TYPE	NUMBER	MOISTURE CONTENT (%)	Wp	w	i	WL							- 11 -			DEPTH (ft)
		SOIL		.	ž	MON <sup>T</sup>	•	Ŭ					Content Penetra				s/0.3m			
	_		Grey clayey SILT, trace fine sand, stiff	<u> </u>	-			10	20	)	30	4	0	50	60	)	70	80	90	0 - <b>80</b>
	CL		Grey crayey STL1, trace line sand, sum																	Ē
-25-				NSP'	T 1-9	19		1	3 0											82
	ļ		-trace shells, stiff	<u>Д</u>		17														<b>= 84</b>
-26-	ļ															;;				
																				<b>86</b>
-27-																				<b>88</b>
21																				- - 90
																				<b>F 90</b>
-28-			-firm to stiff																	<b>₽ 92</b>
	ļ																			- 94
-29-	ļ																			
	ļ																			<b>= 96</b>
																				E E 98
-30-																				
																				<b>E</b> 100
-31-	ļ																			- 102
			-trace to some gravel, sand, firm below	NSP'	<b>I</b> 1-11	35			14			<b>b</b>								Ē
22	ļ		-lace to some graver, sand, initi below	A l	+	55										· · · · · · · · · · · · · · · · · · ·				<b>=</b> 104
-32-																				E 106
														  						Ē
-33-																				E108
																				-110
-34-	ļ	$\square$																		Ē
	<b> </b>		-SPT refusal at 34.3m; 40 blows for 0mm Bedrock encountered at 34.3m. Refer to Rock Log	SPI	T1-12	30	T::::				φ	··· (··		<b>5</b> 0 ●						=112 
	ł		for continuation of rock description	$\square$																-114
-35-	ł																			- - 116
	ł																			=116
-36-	ł																			-118
	ł																			
	San	nple T	ype: GS - Grab Sample SPT - Standard Penetration Test			ogged by		. I ./KK/I	G		, S		~	 1			· · · · ·		I	- 120
	Pie	zomet	ST - Shelby Tube PT - Piston Tube CC - Continuou er Evre: Bentonite Soloughed Drill Cuttings		K	eviewed	-				Ľ	6	5	[2	1	I	ec	I		
	рвас	жнш	Type: Bentonne Stoughed Drin Cuttings	J	10	Date: Feb	15, 20	13	1		_									1 I

						BO	REI	HOL	E R	EC	OR	D					ME	BH13-1	_	
						ram				DATI	M		Ch			PROJECT NO		1700431		_
]	LOC	ATION Victoria Harbour Crossing								DATU ELEV			-6.		n	EASTING		363132 170746		_
]		LING DATE <u>2/1/2013</u> D	DRILI	-				ay Dri			OT D7							otary/Cori		
(L)	ELEVATION (m)		PLOT	: & No.		RUSHED ( ISSING CO		FX-FRACT J-JOINT CL-CLEAV VN-VEIN	AGE F-F/	EDDING ULT -FOLIATIO	PL-	BROKEN RUBBLE PLANAR STEPPE	ZONE	100	PO-PO K-SLIC R-ROU	LISHED PC-PARTIALLY KENSIDED CC-COMPLETI	COATED	Q-VALUE BOD × <u>Jr</u> × <u>Jw</u> = Jn × Ja × SRF WHERE: Jw=1 & SRF=1	STS	t)
DEPTH (m)	VATIC	LITHOLOGICAL DESCRIPTION	TA PL	ТУРЕ											DI	ISCONTINUITY DATA		ALL × Jr × Jr × Jr × SRF	OTHER TESTS	DEPTH (ft)
D	ELE		STRATA	SAMPLE TYPE	STRUCTURE	TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	ч	٦	Ja	TYPE AND SURFACE DESCRIPTION			OTHE	DEI
	-6.3			SA	STF	20 0 0 8 0 8 0 8 0 0 0 0 0 0 0 0 0 0 0 0	20 <del>6</del> 6 8 0 2 0 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		R4 R3 R1 81	20084 >							0		
																				81
25-																				81 82
																				83 84 85
26																				
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																				87 88 89
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28																				90 91 92
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29																				96
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- 30 -																				98
																				100
																				101
31-																				102
- 32 -																				103 104
																				105
- 33																				106
																				107 108
																				109
																				110
- 34 -																				111 112
- 34 -		Bedrock encountered at 34.3 m. Refer																		113
- 35 -	41.4	to Soil Log for overburden description.																		114
	-41.4.	Very severely fractured, moderately weathered, weak, dark grey		1																
	-42.4	ANDESITE DYKE		RC 1									20	2	2	J - PL, R, PC		0.5		117
36	-42.4	Moderately jointed, slightly weathered,																		118 119
		strong, grey GRANODIORITE	, / ~	1																120
																I.	Sta	ntec		

						BO	REI	IOI	E F	REC	OR	D					MBH13-	1	
		ENTCAPITAL REGIONAL DI JECTCore Area Wastewater Tre				ram				DAT	IM						<u>111700431</u> 5363132		_
I	.OC	ATION Victoria Harbour Crossing					Mud B			ELEV		ON	-6.	27n	n	EASTING	470746		_
1		LING DATE <u>2/1/2013</u> D									CT RZ-						ud Rotary/Co		<u> </u>
(m)	n) NO		LOT	E & No.		RUSHED ISSING CO FERRED	CORE END ORE OF FAULT S	J-JOINT CL-CLEAV VN-VEIN	/AGE F-I FC	ONT-CONTA BEDDING FAULT DL-FOLIATIC			ZONE R ED	-	PO-PO K-SLIO R-ROI	DUISATING CE-CLEAN DLISHED PC-PARTIALLY COA CKENSIDED CC-COMPLETELY C JGH IN-FILLED		ESTS	(ft)
DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	STRUCTURE		SOLID CORE %		FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX			Jr	Ja	ISCONTINUITY DATA		OTHER TESTS	DEPTH (ft)
	-6.3			RC 2A S	S	2008		20668		522 222 222 222 222 222 222 222 222 222	1200 1200 1200 1200 1200 1200 1200 1200	888	2	2	3	J - PL, R, CC	27.3	+	-
- 37 -	43.5	Vary accords for stored highly																_	122
		Very severely fractured, highly weathered, weak, dark grey ANDESITE DYKE		RC 2B	-								20	3	4	J - UN, R, IN	0.4	-	123
- 38 -				RC 3									20	3	3	J - UN, R, CC	0.5		121911122 122 123 123 123 125 125 126 127 1126
39				RC 4									20	3	3	J - UN, R, CC	0.5	_	128 129 130 131 132
40	46.5	Severely fractured to moderately jointed, slightly weathered, medium strong, grey GRANODIORITE - Very severely fractured from 40.14 - 41.7 m - Occasional disseminated sulphides - Occasional microdefects/veins		RC 5									3	3	2	J - UN, R, PC	10		132 133 134
42 -				RC 6								Ø	3	3	2	J - UN, R, PC	39.5	UCS	134 135 136 137 138 139 139 139
				RC 7								60	3	3	2	J - UN, R, PC	43	_	142 143 144 145
- 45 -				RC 8								00	6	3	2	J - UN, R, PC	8		146 147 148 149
46				RC 9								6-0	6	3	2	J - UN, R, PC	8		151 152 153 154
48 -				RC 10								0-0	6	3	2	J - UN, R, PC	17.5		156 157 158 159 – 160
																The second	Stante	С	

I I	LOC	IECT Core Area Wastewater Tre ATION Victoria Harbour Crossing	eatmo			gram	 HOL		DATU ELEV	JM		Cha -6.2	art		NORTHING EASTING	<u> </u>	<b>3H13-1</b> 1700431 363132 170746		
		LING DATE <u>2/1/2013</u> D		& No.			FX-FRACT J-JOINT CL-CLEAV VN-VEIN		NT-CONTAG BEDDING AULT L-FOLIATIO		BROKEN RUBBLE PLANAR STEPPE				G METHOD				
DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	STRUCTURE	TOTAL CORE %		FRACTURE FREQUENCY	8 STRENGTH INDEX	>		Ч	Jr	la L	TYPE AND SURFACE DESCRIPTION		$\begin{array}{c} Q-VALUE\\ Q-VALUE\\ Q=\frac{ROD}{Jn} \times \frac{Jr}{Ja} \times \frac{Jw}{SRF}\\ WHERE:\\ Jw=1 \& SRF=1 \end{array}$	OTHER TESTS	DEPTH (ft)
- 49	-56.8	End of Borehole MBH13-1 at 50.53 m		RC 11			2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2				<ul> <li>₩ 60 %</li> <li></li></ul>	6	3	2	J - UN, R, PC		17	UCS/BT	162 1162 1163 1164 1165 1166 1167 116
52										-         -									
- 54										-         -									ΕE
56										•         •									1820-00-00-00-00-00-00-00-00-00-00-00-00-0
58																			192 193 193 194 195 196
- 61										-         -						<b>C</b> 1	antec		197 198 199 200

			BOREHO	<b>DL</b>	<b>E</b> ]	REC	COR	<b>XD</b>						M	BH1	3-2	
	LIEN	T _ ECT	CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program					hort					OJECT			70043 3072	1
			Victoria Harbour			LEVA		9					RTHIN STING		470		
D	RILI	ING	DATE January 31, 2013 DRILLING CO. Mud	Bay	Dril	ling			DI	RILI	LING	METH	OD	Mud H	Rotary	/Corir	ıg_
				S	AMP	LES								ed Shea d Torvar			
(E)		SYMBOL			Ľ	RE (%)			0kPa			a) 🔺 L 10 kPa		50kPa		00kPa	(£
DEPTH (m)	USC		SOIL DESCRIPTION	ТҮРЕ	NUMBER	ISTU TENT	Wp		WL					1			ЭЕРТН (ft)
		SOIL			Ĩ	MOISTURE CONTENT (%)		-0	•	Sta	andard	Penetra	ation Te	berg Lin st, blow	s/0.3m		
- 0			Dark grey SILT and SAND, trace organics, very	M			0 0	0	20	30		40	50	60	70	80 9	0 TE 0
			loose	XSP1	2-1	33					0						
- 1 -	SM											-					
	ł																<b>4</b>
- 2 -			Grey fine SAND, trace silt, trace shells, compact														4
																	- 8
- 3 -	ł			<u></u>			-	1	6								10
	ļ		-some silt	XSP1	2-2			•									
																	12
- 4 -	l																14
												-	•				16
- 5 -	ł																1 F - I
												•	•				18
- 6 -			-trace gravel below	SPI	2-3		-				30						20
		••••		<u>A</u>													
- 7 -																	IE I
	SP																24
- 8 -	l																26
													•				28
9-	ł																
	ļ		-gravelly	SPI	2-4			15 ●	5								ESU
										· · · ·			· · · · · · · · · · · · · · · · · · ·				32
-10-																	- 34
-11-													•				
			-trace medium to coarse SAND, trace gravel, trace silt, compact														38
-12-	 									·····							<b>40</b>
			ype: GS - Grab Sample SPT - Standard Penetration Test ST - Shelby Tube PT - Piston Tube CC - Continuou		~ H	ogged by eviewed		KK/DG	ł	Ś	Ta		ta	nt	or		
	Pie: Bac	zomet kfill	er Type: Bentonite Sloughed Drill Cuttings	Sand		ate: Feb		3			B	' <b>J</b>					

			BOREH	OLI	E ]	REC	<b>CO</b>	RI	D								l	MI	BH	[13	<b>5-2</b> c	cont'd
	LIEN		CAPITAL REGIONAL DISTRICT					<u></u>								ECT		).			<u>)043</u>	1
		ECT TION	Core Area Wastewater Treatment Program Victoria Harbour			DATUN ELEVA			art -9							THIN	G			630 7092		
			DATE January 31, 2013 DRILLING CO. Mud														Mu	d R				<u></u>
				S	AMP	LES	🗆 Ir									mould					Pa)	
(E		SYMBOL			~	щ%	ΔP	ock		enetr 0kP		ter (		) 🗙 )kPa		turbeo 14	i To 50¦kI			°a) 2001	кРа	(ft)
DEPTH (m)	USC	SYM	SOIL DESCRIPTION	ТҮРЕ	NUMBER	STUR NT (	W	, ,	w				100			1.		<u>u</u>			u u	DEPTH (
B		SOIL			NN	MOISTURE CONTENT (%)	F		ŏ—	1 •	M					Atter				m		DEI
						ŭ		10		20		30		0	50		60		70	80	9	<b>40</b>
			Grey fine SAND, trace medium to coarse sand, trace gravel, trace silt, compact	SPT	2_5	35				17			) 					: : : : : : : :				
-13-	-		Grey clayey SILT, trace sand, some sand seams, soft	<u></u>	2-5	55																
			to firm																			<b>4</b> 4
-14-																						46
													· · · · · · · · · · · · · · · · · · ·					· · · ·			· · · ·	- 40
																		· · · · · ·				<b>48</b>
-15-			-trace to some sand, trace gravel, firm				<b>.</b>	÷					::::::::::::::::::::::::::::::::::::::					: : : : : : : : : : : : : : : : : : : :			· · · · · · ·	50
			-uace to some said, trace graver, min	SPT	2-6	25					0											52
-16-																						52
	ł																	· · · · ·				54
-17-																						56
	ł																					
-18-																						58
			-trace sand, firm to stiff	SPT	2-7	38	4						0					: : : > : · : : : : : :				<b>E</b> 60
-19-	CL			<u> </u>	_													· · · · ·				62
													::: ::::::::::::::::::::::::::::::::::								· · · · ·	E
																						64
-20-																					· · · · · ·	<b>E</b> 66
																		: : : : : : : : : : : : : : : : : : :				68
-21-								: 					:::: 					 				
			-firm	SPT	2-8	43	4			· · · · · ·				o								
-22-				μ_																		72
																						74
-23-																		· · · ·				E
																						<b>76</b>
																						<b>78</b>
-24-																						80
			ype: GS - Grab Sample SPT - Standard Penetration Test ST - Shelby Tube PT - Piston Tube CC - Continuou	us Core	、 <del> </del> _	ogged by eviewed			k/DG	ì	(	Ż		C			-	44	~4	-		
	Pie: Bac	zomet kfill	er Dontonito Kaloughod X Drill Cuttings		K	ate: Feb	-				_ `		6	2		a		U	3(			

			BOREHO	DL	<b>E</b> ]	REC	C <b>O</b> ]	RI	)									N	ĺΒ	:H1	3-	<b>2</b> co	nt'd
	LIEN		CAPITAL REGIONAL DISTRICT					~.										No.		111			
		ECT																Э.		<u>5363</u>		2	-
			Victoria Harbour DATE January 31, 2013 DRILLING CO. Mud			ELEVAT ling				<u>5m</u>						TIN D		Aud		<u>4709</u> otary		rinc	
			DATE Junuary 51, 2015 DRIELINGCO. IMaa	-		•																	<u>ب</u>
		Ч		8	SAMP		□ In △ Pi													Vane (kPa)		)	
(m)	o	SYMBOL			<u>ب</u>	RE (%				)kPa				)kPa				)kPa			)0kPa	a	H (ft)
DEPTH (m)	nsc		SOIL DESCRIPTION	TYPE	NUMBER	MOISTURE CONTENT (%)	Wp			WL				1				1			I		ЭЕРТН (ft)
ä		SOIL			Z	MUN			)	•									Limit: ows/0				ä
_						0		10		20	3	0	. 4	0		0	6	0	70		80	90	_ 80
			-Grey clayey SILT, trace sand, some sand seams,	M							::: :::::	30	:::					••••					
-25-			Grey SAND and SILT, some gravel, some clay	SP	Г2-9	9		o					: :										82
			(Till), dense																				84
-26-											: : :							• • •					
											::: ::::		: :								•		86
	T																						88
-27-	IL								··· ···														
											:		: : : : : : : : :		•	·		• • • •					<b>= 90</b>
-28-			-Grey clayey, Silty, SAND, some gravel	SP	I2-10	11	•	° 0															92
				Λ							· · · ·												
														40									<b>94</b>
-29-		<u>  </u>	-SPT refusal at 29.1m; 40 blows for 0mm								·····												- 96
			Bedrock encountered at 29.1m. Refer to Rock Log for continuation of rock description																				- 90
-30-			Ĩ								: : :- : :	· · · · · ·	:::					••••					<b>98</b>
-																							-100
																							=100
-31-											: : :. : . : :	 	:::		· · · · ·			••••					-102
												· · · · · ·									·		-104
-32-											····												-104
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-33-																							-108
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-34-																							- - 
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											:		: :										-114
-35-																					·		- -
-																							-116
-36-													: :										-118
													: :. : :										
	San	ple T	ype: GS - Grab Sample SPT - Standard Penetration Test			ogged by	CI	L/KK	/DG	1		A		· · ·	<b>n</b>	1	]		•••	· · · ·	<u> </u>		- 120
	Piez	zomet	ST - Shelby Tube PT - Piston Tube CC - Continuou er Fune: Bentonite Soloughed Drill Cuttings		K	eviewed	-				5	IJ	R		S	lā	31	1	<b>ie</b>	Ċ			
	Bac	kfill '	Lype:		D	ate: Feb	15, 20	13															

DRILING DATE 1/31/2013         DRILING CO         Muld Bay Defining         DRILING METHOD         Muld Roary/Coring           UP4	PF	ROJ	INT CAPITAL REGIONAL DI JECT Core Area Wastewater Tre	atm				REH	IOI	E R	DATU	JM		Cha				. 111	<b>3H13-2</b> 1700431 363072	2	
Link       Link <thlink< th="">       Link       Link</thlink<>	L( Di	DC. RIL	ATION <u>Victoria Harbour Crossing</u> LING DATE <u>1/31/2013</u> D	RIL	LIN	G CO	DN	/lud Ba	ay Dri	lling	ELEV	'ATIO					EASTING G METHOD			ing	_
$ \begin{array}{c cccc}                                 $			LITHOLOGICAL DESCRIPTION	STRATA PLOT	AMPLE TYPE & No.											PO-PC K-SLIC R-ROL	DLISHED PC-PARTIALLY KENSIDED CC-COMPLETE IN-FILLED IN-FILLED ISCONTINUITY DATA TYPE AND SURFACE	COATED ELY COATED	Q-VALUE Q= Jn × Jr × Jw WHERE: Jw=1 & SRF=1	OTHER TESTS	DEPTH (ft)
36 	22 22 22 22 22 33 33 33 33	9.5	to Soil Log for overburden description. Severely fractured to fractured, slightly weathered, strong, dark grey to grey GRANODIORITE		5 RC4 RC3 RC2 RC1	STRUC							<u>888</u> 0-0 0-0 0-0	9996	3 3 3	2 2 2 2	J-UN, R, PC		6.3 6.5 18		$ \square \ \square $

I	RO.	ENTCAPITAL REGIONAL DI IECTCore Area Wastewater Tre ATIONVictoria Harbour Crossing LING DATE 1/31/2013D	eatm	ent	Prog	gram				DATU ELEV.	M	 ON	Cha -9.5	ōm		EASTING	MBH13- <u>111700431</u> <u>5363072</u> <u>470923</u> Mud Rotary/Con		
DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.		ROKEN CO RUSHED ( ISSING CO IFERRED		FX-FRACT J-JOINT CL-CLEA\ VN-VEIN	TURE CON B-B		PL-	BROKEN RUBBLE PLANAR STEPPE	D D	E/ U F	UN-UP PO-PO K-SLIG R-ROI D	NDULATING CL-CLEAN DLISHED PC-PARTIALLY. XENSIDED CC-COMPLETEI JGH IN-FILLED ISCONTINUITY DATA		OTHER TESTS	DEPTH (ft)
	ш -9.5	<u>.</u>	ST	SAMP	STRUC		8648					8 00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	÷	Jr	Ja	TYPE AND SURFACE DESCRIPTION		"O	
- 37 -	-46.2	Moderately jointed to intact, slightly weathered, strong, grey GRANODIORITE - Occasional disseminated sulphides		RC 6		· · · · · · · · · · · · · · · · · · ·					>>>>	000 000	3	3	2	J - UN, R, PC	39	-	121 122 123
- 38 -				RC 7								60	3	2	1	J - UN, R, CL	58.7		
40				RC 8								60	4	2	1	J - UN, R, CL	41	-	129 130 131
- 41 -				RC 9								.60	3	3	1	J - UN, R, CL	84	UCS/BT	133 134 135
-42-				RC 10								660	3	3	1	J - UN, R, CL	92		137 138 139
- 43 -	- <u>52.2</u>	Fractured to moderately jointed, slightly weathered, medium strong, grey to dark		RC 11								0-0	3	3	1	J - UN, R, CL	82	1	140
		grey GRANODIORITE - Occasional disseminated sulphides		RC 12								0-0	6	3	1	J - UN, R, CL	26.5	-	12011111111111111111111111111111111111
- 45 -				RC 13								<del>0-0</del>	6	3	1	J - UN, R, CL	37		147 148 149
				RC 14								60.60	3	3	2	J - UN, R, PC	25		15 12 13 13 14 11 15 15 16 11 17 11 11 15 15 16 16 17 17 16 17 17 17 17 17 17 17 17 17 17 17 17 17
- 48 -				RC 15								දෙඟ	6	3	2	J - UN, R, PC	21.3	UCS	
																The second s	Stante	C	

I		NT <u>CAPITAL REGIONAL D</u> IECT <u>Core Area Wastewater Tre</u> ATION <u>Victoria Harbour Crossing</u>	eatme				RE]	HOI		REC	UM		Ch -9.			PROJECT No NORTHING EASTING	<u>. 111</u> 5	<b>BH13-</b> 2 1700431 363072 170923	2	
			DRILI					ay Dr					DR	RILL	LINC	G METHOD	Mud Ro	otary/Cor	ing	_
(m)	ELEVATION (m)		PLOT	8 No.		ROKEN CO RUSHED ( IISSING CO IFERRED I	DRE INITIALIST	FX-FRAC J-JOINT CL-CLEA VN-VEIN	TURE CO B- VAGE F-I FC	ont-cont Bedding Fault Dl-foliati	ACT RZ PL ON ST	-BROKE RUBBLE -PLANAF -STEPPE	N COI ZON	RE / E	UN-U PO-Po K-SLI R-RO	NDULATING CL-CLEAN OLISHED PC-PARTIALLY CKENSIDED CC-COMPLETE UGH IN-FILLED	COATED	Q-VALUE ROD x Jr y Jn VHERE: WHERE:	STS	t)
DEPTH (m)	VATIC	LITHOLOGICAL DESCRIPTION	ATA PL	SAMPLE TYPE												DISCONTINUITY DATA		2 × Jr Ja MERE	OTHER TESTS	DEPTH (ft)
D	ELE		STRATA	AMPLE	STRUCTURE	TOTAL CORE %	CORE 9	R.Q.D.	FRACTURE	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	5	÷	Ja	TYPE AND SURFACE DESCRIPTION		0 <u>1</u> 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	OTHI	DE
- 49 -	-9.5		\ \	S	IS	20 20 20 20 20 20 20 20 20 20 20 20 20 2	20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			2882			-						+	
																			1	161 162
			-,/~ /_	C 16								0-004	6	3	1	J - UN, R, CL		33.5		
- 50 -				RC																164 165
	60.1	End of borehole MBH13-2 at 50.59 m	<u>-,,</u>																+-	163 164 165
-51-																				167 168
																				169
- 52 -																				170
																				170 171 172 173 174 175 176
																				173
- 53 -																				174
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- 54 -																				177
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- 55 -																				E181
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- 59 -																				193 194
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- 61				<u>I</u>	I	1::::	<u>. : : : :</u>	1::::	1::::	<u></u>	1::::	1:::	1	1	1	Ta	Sta	nte	 C.	<b>⊨</b> 200≡

			BOREH	OLI	E	REC	CO	R	D										N	/ <b>I</b> E	BH	13	-3	
	LIEN		CAPITAL REGIONAL DISTRICT Core Area Wastewater Treatment Program							4.							)JEC				11 536		043	1
		ECT TION	Victoria Harbour			DATUN ELEVA											RTH STIN		Ĵ.		471			
			DATE January 25, 2013 DRILLING CO. Mud	Bay															<u>/uc</u>					<u>ıg</u>
				S/	AMP	LES			tu S												Vane		ʻa)	
(E)		SYMBOL			R	RE (%)		Poc		Pen 50l			ter (		i) 0kP		Isturi		)kPa		(kPa 2	a) 200 k	Pa	(#)
DEPTH (m)	nsc	ΓS	SOIL DESCRIPTION	ТҮРЕ	NUMBER	ISTU ENT	v	V <sub>P</sub>	W		W <sub>L</sub>				I				T					DEPTH (ft)
		SOIL			Ĩ	MOISTURE CONTENT (%)			-0-	(	•	St	and	ard	Per	netra	tion	Tes	st, blo		0.3m			
- 0	<u> </u>		Grey silty SAND, trace organics, very loose	M			0	1	0	2	0	3	30		40	5	50	6	0	70	) ::::	80	9	
				SPT	3-1	32				(			0											2
- 1 -	ISM									: : : : : : :														
	<u> </u>		Grey fine SAND, trace to some silt, trace gravel,	-																				
- 2 -			shells, compact							· · · · ·														<b>E</b> 6
										: 						••••								8
- 3 -				SPT	3-2						2	3												<b>10</b>
				Λ							• • • •													Ē
4										· · · ·														
																								<b>E</b> 14
- 5 -																								= 16
	SP																							18
			-trace silt, compact to dense										31											E
- 6 -				SPT	3-3																			<b>20</b>
										: :.::		÷											• • • • •	22
- 7 -										· · · · · · · · · · · · · · · · · · ·														24
											• • • •												,	
- 8 -																								
	<u> </u>		Grey clayey SILT, trace fine sand, trace shells, soft	- SPT	3_1	44	2								c									28
- 9 -			to firm		5-4															· · · · ·				<b>30</b>
	ļ																							32
-10-																								
																• • • •								
-11-										: :.; ::;														36
-12-	CL			SPT	3-5	43	0		· · · · ·	: :.::		÷			0				· · · · ·				• • • • •	E
	San	nple T	ype: GS - Grab Sample SPT - Standard Penetration Test ST - Shelby Tube PT - Piston Tube CC - Continuou	/ 1		l .ogged by			K/I	G		::	s G				1:: 1		نند. ارس	 L	<u></u>	<u>: 1 :</u>		40
	Piez Bac	zomet kfill		-	K	eviewed Date: Feb			;	-			J	6		5	lá	][	1	[6	e	1		

			BOREH	OL	<b>E</b> ]	REC	COF	RD								Μ	BF	<b>H1</b> .	3-30	cont'd
	LIEN		CAPITAL REGIONAL DISTRICT					<b>.</b>							ECT				0043	31
		ECT	Core Area Wastewater Treatment Program Victoria Harbour			DATUM LEVA				78n				ORTI STI	HIN(	G _		363( 711		
			DATE January 25, 2013 DRILLING CO. Mud													<u>/ud</u>				ng
				5	SAMP	LES	🗆 Ins	itu Sh	near	Vane	e (kPa	a)	D F	Rem	oulde	ed She	ear Va	ine (k	Pa)	
Ê		BOL						cket F	Pene	etrom		kPa	) 🗙 [		urbed	Torva	ane (kl	Pa)	·	(ŧ)
DEPTH (m)	nsc	SYMBOL	SOIL DESCRIPTION	Ш	BER	TURE NT (9			50k			100	)kPa		150	0kPa		200	kPa	TH (i
DEF		SOIL		ТҮРЕ	NUMBER	MOISTURE CONTENT (%)	₩ <sub>P</sub> ⊢	W 0	,				Conten			-				DEPTH
		0)				20		10	20		Stand 30		Peneti 10	ration 50		st, blov 50	ws/0.3 70	8m 80	)	90
		$\overline{/}$	Grey clayey SILT, trace fine sand, trace shells, soft	X	-															
-13-			to firm																	<b>42</b>
																				44
-14-																	· · · · · · · · · · · · · · · · · · ·			
			-trace to some gravel																	48
-15-	<b> </b>		Croweilter SAND come alore trace groups a compact	SP	T 3-6	22				22 •										50
 :	SM		Grey silty SAND, some clay, trace gravel, compact	$\square$	-															
-16-	<u> </u>		-600mm diameter boulder	-																
	SP		Grey SAND, trace silt, shells																	54
-17-	<u> </u>	····	Bedrock encountered at 16.9m. Refer to Rock Log	-																56
			for continuation of rock description																	
-18-																				
							••••••										••••			
																				62
-19-																				1 -
	ļ																			64
-20-																				66
	ļ																			68
-21-																				68 
	ļ																			<b>70</b>
-22-																				72
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22																				IE.
-23-																				76
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-24-	ł																			
	San	ple T	ype: GS - Grab Sample SPT - Standard Penetration Test ST - Shelby Tube PT - Piston Tube CC - Continuou			ogged by		/KK/D	G		رم		ſ				·····		· · · ·	
		zomet kfill	er Dentonita Bol Sloughad Drill Cuttings			eviewed ate: Feb					3	B	3	T	al	I	e	C		

	CLIE PRO.	ENTCAPITAL REGIONAL DI JECTCore Area Wastewater Trea					REI	IOI		ECC			Cha	art		PROJECT No	o. <u>11</u> 1	<b>H13-3</b> A 1700431 363008	<b>\</b>
	LOC	ATION Victoria Harbour Crossing		LIN	G CO	). <u>N</u>	/Iud B	ay Dri		ELEV		ON	-12	.78	m	EASTING	4	71110 htary/Cori	ng
DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.		ROKEN CO RUSHED ( IISSING CO IISSING CO FERRED TOTAL CORE %	SOLID		URE COT B-B FAGE F-F/ FOL AGE F-F/ FOL	NT-CONTAG EDDING AULT -FOLIATIOI HLSX AULT XDOULATIOI	NG	BROKEN RUBBLE 2 PLANAR STEPPEI	I CORI ZONE		un-un Po-po K-slic R-rol	NULATING CL-CLEAN DUSHED PC-PARTIALL' XENSIDED CC-COMPLIED JGH IN-FILLED ISCONTINUITY DATA	COATED ELY COATED	Q-VALUE BOD × <u>Jr</u> × Jn × Ja × WHERE: Jw=1 & SRF=	OTHER TESTS DEPTH (#)
-13- -14- -15- -16- -17- -17- -18-	-12.8	Bedrock encountered at 16.9 m. Refer to Soil Log for overburden description. Fractured to moderately jointed, moderately altered, weak, greenish grey ALTERED GRANODIORITE		RC 1 SAM	STRU	88848	88888	8838						3	2	J - UN, R, PC		44	O44 44 44 44 44 45 50 50 50 50 50 50 50 50 50 50 50 50 50
- 19	-32.5			RC 2								:00	3	2	2	J - UN, S, PC		22.3	62 63 64
20		Intact, moderately altered, weak, greenish grey ALTERED GRANODIORITE		RC 3								o	3	3	1	J - UN, R, CL		93	105 101 101 101 101 101 101 101 101 101
- 22 -				RC4								Ŏ	3	3	2	J - UN, R, PC		50	7( 71 72 73 73 74
23	-37.1			RC 5								0	3	1.5	2	J - PL, R, PC		23.3	75 76 77 77 78 78 78
			<u> </u>		•							· · · · · · ·			1	Ţ	Sta	ntec	

	יו דב	ENTCAPITAL REGIONAL D	ISTE	RIC	т	BO	REI	HOL	E R	RECO	OR	D			PROJECT No	<b>MBH13-3</b> 111700431	A	
I	RO	JECT Core Area Wastewater Tre	eatm			gram								t	NORTHING	5363008		_
]	LOC. DRIL	ATION <u>Victoria Harbour Crossing</u> LING DATE <u>1/25/2013</u> D	S DRILI	LIN	G CO	). <u> </u>	Mud B	ay Dri	lling	ELEV	ATI			78m LLIN		471110 Mud Rotary/Co	ring	_
H (m)	ON (m)		LOT	E & No.		ROKEN C RUSHED IISSING C IFERRED	ORE CORE ORE FAULT	FX-FRACT J-JOINT CL-CLEAV VN-VEIN	URE CO B-B /AGE F-F, FOI	NT-CONTA EDDING AULT FOLIATIO	CT RZ- F PL- N ST-	BROKEN RUBBLE Z PLANAR STEPPED	CORE ZONE	/ UN-l PO-f K-SL R-R0	UNDULATING CL-CLEAN POLISHED PC-PARTIALLY ICKENSIDED CC-COMPLET DUGH IN-FILLED		ESTS	(ft)
DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	STRUCTURE	TOTAL CORE %			FRACTURE	STRENGTH INDEX	>	DIP w.r.t. CORE AXIS	٩. -	Ja Ja	DISCONTINUITY DATA		DTHER TESTS	DEPTH (ft)
- 25 -	-12.8	Fractured to moderately jointed, moderately altered, medium strong, greenish grey ALTERED GRANODIORITE - Frequent microdefects/veins		RC6 S	0	000 000 000 000 000 000 000 000 000 00	680 610 610 610 610 610 610 610 610 610 61	200 200 200 200 200 200 200 200	100	R3 R3 R1 R2 R2 R2 R2 R2 R2 R2 R2 R2 R2 R2 R2 R2		6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	3 2	2 1	J - UN, S, CL	44.7		81 82 83 84
- 26 -				RC 7								රොල	3	3 2	J - UN, R, PC	38.5	UCS/BT	85 86 87 88
- 28 -				RC 8		-         -						650	6	3 2	J - UN, R, PC	16.3		90 91 92 93 93
- 29 -	12.0			RC9								@	3 3	3 2	J - UN, R, PC	31	-	95 96 97 98
	43.0	Very severely fractured to intact, moderately weathered, medium strong, grey GRANODIORITE		RC 10BRC 10A									3 3		J - UN, R, PC	5	-	999 100
- 31 -												0	3 3	3 2	J - UN, R, PC	11	_	
				RC 11A								●÷0:::	3 3	3 2	J - UN, R, PC	46	-	103 104
32	45.6			RC 11B								0	3	3 1	J - UN, R, CL	92		105 106
- 33 -		Intact, moderately altered, medium strong to strong, greenish grey ALTERED GRANODIORITE - Occasional disseminated sulphides		RC 12A								60	3	3 2	J - UN, R, PC	46		108 109
- 34 -	-46.6 -47.1	Severely fractured, moderately weathered, medium strong, dark greenish grey ANDESITE DYKE	/	RC 12B								0	6	3 2	J - UN, R, PC	11.8		111
- 35 -	-48.4	Severely fractured to fractured, moderately altered, medium strong to strong, greenish grey ALTERED GRANODIORITE - Andesite dykes from 35.2 - 35.6 m and 36.6 - 36.8 m		RC 13								6	3	3 2	J - UN, R, PC	24.5	UCS	
- 36 -				RC 14								60	3 3	3 1	J - UN, R, CL	36		118 119 120
															T	Stante	C	

]	PRO.	ENTCAPITAL REGIONAL D JECTCore Area Wastewater Tre ATIONVictoria Harbour Crossing LING DATE 1/25/2013	eatm	ent	Prog	gram	REI			DATU ELEV	JM			.78	m	EASTING	MBH13-3 <u>111700431</u> <u>5363008</u> <u>471110</u> Mud Rotary/Con		
DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	PLE TYPE & No.		TOTAL		R.Q.D.	RE	NT-CONTA EDDING AULT L-FOLIATIC HL SOLIATIC	NEATHERING NDEX INDEX			E/	K-SLIC R-ROL	NDULATING CL-CLEAN DUSHED PC-PARTIALLY ( SKENSIDE) CC-COMPLETEL IN-FILLED ISCONTINUITY DATA	A HERE CALLUE Jun X Jun X HERE 1 V HERE CALLUE	OTHER TESTS	DEPTH (ft)
	-12.8		ω Ι	SAMPLE	STRL	20	20 20 20	80 60 20		R3 STI				,		DESCRIPTION	ð	0	
37-	49.6			RC 15								66	4	3	2	J - UN, R, PC	23.6		121 122 123 124 125 126
- 39	-51.8.	Fractured to intact, slightly weathered, medium strong to strong, grey GRANODIORITE		RC 17 RC 16								ф. С	3	3	1	J - UN, R, CL J - UN, R, PC	34	_	27 28 29 30 31 32 33 34 35 36 77 38 39 37 38 39 37 38 39 39 30 31 32 33 34 35 35 37 38 39 39 39 39 39 39 39 39 39 39 39 39 39
42				C 19A RC 18								( <b>b</b> ). O	3	2	2	J - UN, S, PC J - UN, R, CL	23.3	_	140 141
	-56.2	Severely fractured, moderately weathered, weak to medium strong, dark grey ANDESITE DYKE		RC 19B RC								0-0	6	2	2	J - UN, S, PC	4.2		142 143 144
44	-57.1	Moderately jointed, moderately altered, medium strong, greenish grey ALTERED GRANODIORITE		RC 20								0	2	3	2	J - UN, R, PC	67.5		146 147
46	787	Moderately jointed to intact, medium strong, grey GRANODIORITE		RC 21								0.0	3	3	2	J - UN, R, PC	49		149 150 151 152
47 -				RC 22								000	3	3	1	J - UN, R, CL	91		42 43 44 45 46 47 48 49 50 51 53 45 55 56 57 58 59 60
																Ť	Stante	C	160

]	LOC.	ECT Core Area Wastewater Tre ATION Victoria Harbour Crossing	atme	ent	Prog	gram		HOL Bay Dri		DATU ELEV	JM	 DN	Cha -12.	.78	m		o. 111 5 4	H13-3 1700431 363008 71110 otary/Cor		
DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	PLOT	& No.				FX-FRACT J-JOINT CL-CLEAV VN-VEIN	URE CO B-E AGE F-F FO	NT-CONTA EDDING AULT L-FOLIATIC		BROKEN RUBBLE Z PLANAR STEPPEL			UN-UI PO-PO K-SLIO R-RO	G METHOD NDULATING CL-CLEAN DLISHED CC-PARTIALL CKENSIDED CC-COMPLET IN-FILLED		1		Ī
DEPT	-12.8		STRATA	SAMPLE TYPE	STRUCTURE		SOLID CORE %		FRACTURE FREQUENCY	R4 ROCK R3 STRENGTH R1 INDEX	WEATHERING		٩	٦	Ja	DISCONTINUITY DATA		$Q = \frac{ROD}{J^n} \times U$ WHEF	OTHER TESTS	DEPTH (ft)
- 49	12.0			RC 23	0,	2000	80 60 74 20	20400	01110		<u></u>	888 0:0:0€	> 3	3	1	J - UN, R, CL		88		161
	-62.9			RC 24									3	3	1	J - UN, R, CL		100		163 164
50		End of borehole MBH13-3A at 50.08 m																		
- 52 -																				169 170 171
53																				173 174 175
- 54 -																				177 178 179
- 57 -						I         I         I         I           I         I														1823
58 -																				189 190 191 192 193 193 194
56 57 58 59 60 60																				92 93 93 94 97 97 98 99 98 99 90 200
-61					ļ											T	Sta	nte		-=200=

			BOREH	OL	E ]	REC	CO	RD								Μ	BE	<b>I1</b> 3	3-4	
	LIEN		CAPITAL REGIONAL DISTRICT					- 11							СТ				0043	81
		ECT TION	Core Area Wastewater Treatment Program			DATUM LEVA								ORTI STI	HIN( NG	G _		3629 7127		
			DATE <u>February 2, 2013</u> DRILLING CO. <u>Mud</u>													Aud				ng
				S	AMP	LES		situ Sł									ear Va		Pa)	
E)		SYMBOL			Ľ	RE (%)	Δ Pi		-ene 50k		neter		) <b>X</b> ⊑ 0¦kPa	Jistu		lorva 0 <mark>kPa</mark>	-	-a) 200∤	kPa	(ft)
DEPTH (m)	USC	L SYI	SOIL DESCRIPTION	ТҮРЕ	NUMBER	MOISTURE CONTENT (%)	Wp		1	WL										DEPTH
Ē		SOIL			Z	MO		-0			Stand	dard	Conten Penetr	ratio			vs/0.3			Ö
- 0	╞		Dark grey SAND, some silt, trace shells, very loose					10	20	) :::::	30	4	40   : : : :	50	6		70	80	<u>,</u>	<sup>90</sup> TE <b>0</b>
				SPI	4-1		•													
- 1 -																	· · · · · · · · · · · · · · · · · · ·			
L -	SP																			4
- 2 -															· · · · ·					<b>E</b> 6
L -																				8
- 3 -	<u> </u>		Brown/grey SILT and CLAY, some gravel to	<u></u>					40											8
			gravelly, very stiff	SPI	4-2	33		•	16 •		c	<b>)</b>								E
- 4 -																				14
																	· · · · · · · · · · · · · · · · · · ·			16
- 5 -																				IE I
																				18
- 6 -			-grey, stiff		4.2	27	4													<b>E</b> 20
				(SP1	4-3	37						o								22
- 7 -																	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · · · · · · · · · · · ·	1 - 1
																				24
- 8 -																				26
																				28
- 9 -			-trace sand, soft to firm									: : : ; : : : : : :								30
				SPI	4-4	39	0					с								
10				$\square$	-															
-10-																				34
F -		$\left \right $										· · · · ·								36
-11-																				
																				38
-12-	┣—			X																40
			ype: GS - Grab Sample SPT - Standard Penetration Test ST - Shelby Tube PT - Piston Tube CC - Continuou		_ H	ogged by eviewed		./KK/E ł	G		وطح	A	S		a	nf				
	Bac	zome ckfill	er Type: Bentonite Sloughed Drill Cuttings	Sand	- H-	ate: Feb			1			B								

				BOREHO	<b>JL</b>	E ]	REC	CO	R	D										N	AI	BH	13	3-4	cont'd
LOCATION       Vietoria Harbour       FEEVATION       -4.16m       FASTING       -471275         DRILING DATE       Extrust of ATE       February 2, 2013       DRILING CO.       Mud Bay Dilling       DRILING METHOD       Mud Rotary/Co.         SAMPLES       SAMPLES       SAMPLES       Distance Server (Fe)       Demonded Sheer Vare (Fe)       Demonded Sheer Vare (Fe)       Demonded Sheer Vare (Fe)       Demonded Sheer Vare (Fe)       Solution Server (Fe) <td></td> <td>81</td>																									81
DRILLING DATE       February 2. 2013       DRILLING CO.       Mud Bay Drilling       DRILLING METHOD       Mud Rotary/Co.         SAMPLES       Solution																				G					
Soll DESCRIPTION       Image: status of the st																				Au	d R				ng
Solution       B       Solution       B       Solution       B       Solution       B       Solution       B       Solution       Solution </td <td></td> <td></td> <td></td> <td></td> <td>S</td> <td>AMP</td> <td>LES</td> <td></td> <td>Pa)</td> <td></td>					S	AMP	LES																	Pa)	
Image: Set of the set of	(E)		BOL			~	ш%	ΔF	Pock				nete					stur						kPa	(#)
Grey, SILT and CLAY, some gravel, trace sand, firm       SPT 4-5       43       0       10       20       30       40       30       40       10       40         -13       -14       -SPT refusal at 14.6m; 50 blows for 50mm; no recovery       -	DTH (	JSC	SYM	SOIL DESCRIPTION	Щ	1BER	NTUR NT (°	W						1			u		15		u			uu	DEPTH (
Grey, SILT and CLAY, some gravel, trace sand, firm       SPT 4-5       43       0       10       20       30       40       30       40       10       40         -13       -14       -SPT refusal at 14.6m; 50 blows for 50mm; no recovery       -	DEF		SOIL		<del> </del>	NUN	MOIS	F	p		i ●	1											ı		DEF
- ISPT refusal at 14.6m; 50 blows for 50mm; no recovery 50 Bedrock encountered at 14.6m; Refer to Rock Log for continuation of rock description 	-					1 5		0	10	)	20					0									<sup>90</sup> <b>40</b>
-14 -SPT refusal at 14.6m; 50 blows for 50mm; no recovery Bedrock encountered at 14.6m. Refer to Rock Log for continuation of rock description -16 -17 -18 -19 -20 -21 -21 -22 -23		ł		Grey, SILT and CLAY, some gravel, trace sand, firm		4-3	43									Ŭ			•		• • • • •	• • • •			
	-13-																								
		ļ															•		•						<b>   4</b>
	-14-																								<b>     46</b>
-15       for continuation of rock description         -16       -         -17       -         -18       -         -19       -         -20       -         -21       -         -22       -         -23       -																		50	•						
	-15-																				• • • • • •				
		ļ		tor continuation of fock description															•						<b>50</b>
	16																								52
	-10-																		• • • •		• • • • •	• • • • •			
																	•		•			• • • •			
	-17-																		•						<b>56</b>
																									<b>58</b>
	-18-																		••••						<b>–</b> 60
																									IE.
	-19-																		•		• • • • •	• • • • •			62
																									<b>E</b> 64
	-20-							··· ·· ·											• • • •		• • • • •	• • • •			
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	-21-	ļ																							68 70
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																									<b>72</b>
	-22-																		•						
																									74
	-23-	ł																							<b>E</b> 76
																									<b>78</b>
	-24-																		•		· · · · ·	• • • •			
Sample Type: GS - Grab Sample SPT - Standard Penetration Test		San	nple T	ype: GS - Grab Sample SPT - Standard Penetration Test			l .ogged by	::: : C	L/K	K/D	:I G	:::	:   	<u>.</u>					::	1::	<u>::</u>	:::	:1:		1 80
ST - Shelby Tube PT - Piston Tube CC - Continuous Core Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand				er Dentenite Bolsloughad Drill Cuttings		ĸ							5		?		5		31	n	te	X	1		

						BC	REI	IOI	LE F	REC	OR	D					MBH13-		
		INTCAPITAL REGIONAL DI IECTCore Area Wastewater Tre				7ram				DAT	M						<u>111700431</u> <u>5362952</u>		_
Ι	.OC	ATION Victoria Harbour Crossing								ELEV					n	EASTING	471275	<u> </u>	_
		LING DATE <u>2/2/2013</u> D	RIL	1			Mud B				CT P7						Iud Rotary/Co		
(E	ELEVATION (m)		OT	8 No.		RUSHED		J-JOINT CL-CLEAV VN-VEIN	AGE F-F	BEDDING AULT L-FOLIATIC	PL-	-BROKET RUBBLE -PLANAR -STEPPE	ZONE	1	PO-PO K-SLIO R-ROU	NDULATING CL-CLEAN DLISHED PC-PARTIALLY CC CKENSIDED CC-COMPLETELY UGH IN-FILLED		STS	÷
DEPTH (m)	VATIC	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE												ISCONTINUITY DATA		Jw=1 & SRF=1 OTHER TESTS	DEPTH (ft)
DE	ELEY		STRA	APLE	STRUCTURE	TOTAL CORE 9	% SOLID CORE %	R.Q.D. %	FRACTURE	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	Ч	ŗ	Ъ	TYPE AND SURFACE DESCRIPTION	a P N N N N N N N N N N N N N N N N N N	Jw=1 DTHE	DEF
	-4.2			SAN	STF	8 9 9 6	2 6 0 2 2	2000		R1 S		896					Ő		
· ·																			41 42
-13-																			E 1
																			43 44
																			45
- 14 -		Bedrock encountered at 14.6 m. Refer to Soil Log for overburden description.																	46
	18.8		<u> </u>															$\perp$	47
- 15 -		Fractured to intact, slightly weathered to fresh, strong, grey GRANODIORITE																	49
												0œ	3	3	4	J - UN, R, IN	18.8		50
																			51 52
- 16																		-	53
																			E 54-
- 17 -			,	-								œœ	6	3	2	J - UN, R, PC	21.3		55
																			56 57
																		1	E 4
- 18 -												œ	3	2	2	J - UN, S, PC	30.7		58 59
																		_	60 61
- 19 -				-															62
												000	6	3	2	J - UN, R, PC	13.8		63
																			64 65
20					-				-				15	3	2	J - UN, R, PC	2.9	-	66
	24.6	Very severely fractured, highly altered,	\ \ \	-									1.5	5	-	,	2.7	$\neg$	67
-21-		very weak, greenish grey GRANODIORITE											20	2	2	J - UN, S, PC	0.5		68
	25.4	Moderately jointed to intact, slightly			-													$\neg$	69 70
		weathered, medium strong, grey GRANODIORITE																	71
-22-		<ul> <li>Frequent microdefects/veins</li> <li>Occasional disseminated sulphides</li> </ul>		-								.@	3	3	2	J - UN, R, PC	49		72
																			73
									1									-	172 173 174 174 175 176 177 177 177 177 177 177 177 177 177
- 23 -																			76
												0 00	3	3	2	J - UN, R, PC	43.5		77
24			-,/~ / I	-															79
			- /-						1									1	- 80
																Ta	Stante	ſ	
																	Junic		

	LOC	ECT Core Area Wastewater Tr ATION Victoria Harbour Crossin	reatme g	ent	Prog	gram	 HOL	 DATU ELEV	JM		Ch: -4.1			PROJECT No NORTHING EASTING	MBH13-4 . 111700431 5362952 471275	•	
DEPTH (m)	ELEVATION (m)	LING DATE <u>2/2/2013</u> LITHOLOGICAL DESCRIPTION	DRILI STRATA PLOT	SAMPLE TYPE & No. Z		ROKEN C RUSHED IISSING C IFERRED	R.Q.D.	NT-CONTA EDDING AULT -FOLIATIO HENOREX NDEX S	MEATHERING NT LT	BROKEN RUBBLE PLANAR STEPPE			UN-UP PO-PO K-SLIO R-ROI	NDULATING CL-CLEAN DLISHED PC-PARTIALLY CKENSIDED CC-COMPLETE			DEPTH (ft)
25	-4.2			SAN	STF		 20 20 20 20 20	R4 R3 R1 R4 R2 R1 R2 R2 R1 R2 R2 R2 R3 R2 R3 R2 R3 R3 R3 R3 R3 R3 R3 R3 R3 R3 R3 R3 R3			3	3	2	J - UN, R, PC	50	UCS/BT 0	81 82 83 84 85 86
26										@+0	3	3	2	J - UN, R, PC	44	-	87 88
											3	3	2	J - UN, R, PC	50		89 90 91
- 27 -										00	3	3	2	J - UN, R, PC	5		92 93 94
29 30										00	3	3	2	J - UN, R, PC	39.5		90) 91 92 93 94 95 96 97 98 99 9 99 9 100
										60	6	3	2	J - UN, R, PC	20.5		99 100 101
- 31										@ 00	3	3	2	J - UN, R, PC	36		102 103 104 105 106
- 34 -										œ.	3	2	2	J - UN, S, PC	30.7	-	109 110 111 112
- 35 -	<u>-38.9</u>	Fractured, slightly weatehred, strong, dark grey GRANODIORITE								œ	3	2	2	J - UN, S, PC	21.7		105 10 10 10 10 10 10 10 10 10 10 10 10 10
														ŤĔ	Stanteo		119 120

(	LIF	NTCAPITAL REGIONAL DI	ISTF	RIC	Т	BO	REF	IOI	E R	ECO	OR	D					<b>BH13-</b> 4	1	
I	ROJ	ECT Core Area Wastewater Tre	e Area Wastewater Treatment Program       DATUM       Chart       NORTHING       5362952         oria Harbour Crossing       ELEVATION       -4.16m       EASTING       471275         2/2013       DRILLING CO.       Mud Bay Drilling       DRILLING METHOD       Mud Rotary/Coring         ICAL DESCRIPTION       Image: Contract R2BROKEN CORE       Image: Contract R2BROKEN CONTRACT R																
I	RIL	LING DATE <u>2/2/2013</u> D	22203     DRILING ON     Mod Bay Drilling     DRILING METHO     Mad RoaryContext       SIGAL DESCRIPTION     Image: Base in the second of the																
DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	13       DRILLING CO.       Mud Bay Dolling       DRILLING METHOD       Mud Roary/Comp.         ESCRIPTION       Image: Strategram and the strategraman and the strategraman and the strategraman and the strategram an																
DEP	-4.2		STRAT/	SAMPLE T	STRUCTUF							1	ч	٦r	Ja	TYPE AND SURFACE DESCRIPTION	$Q = \frac{ROD}{J^n} \times WHE$	OTHER	DEPT
37			Victoria Harbour Crossing         DRIL 14000         DRIL 140000			121 122 123													
- 38 -			2.A.C.W.MSSCWALET Treatment Program       DATUM       Charling Continues       S3603231         212013       DRILLING CO.       Mold Bay Drilling       DRILLING CO.       Mold Bay Drilling       DRILLING CO.       Mold Bay Drilling         CAL DESCRIPTION       USE STREES       DRILLING CO.       Mold Bay Drilling       DRILING CO.       Mold Bay Drilling																
- 39	43.5	Very severely fractured to severely fractured, moderately to highly altered, weak to medium strong, greenish grey ALTERED GRANODIORITE - "flaky", friable character - From 41.31 - 41.59 m, rock strength	Jakewater Transmet Program.       DATUM																
		reduced to residual soil	Tige of a Burbour Crossing       ELEVATION       ALSON       ASTING       AUX DOLLARS         0.00ICAL DESCRIPTION       Image: State and State																
- 41 -												ΘÐ	3	3	2	J - UN, R, PC	23.5		135
42-				_								60	15	3	2	J - UN, R, PC	1		136 137 138
43			CA-DEA       NORTHING       COMPATING       CASEND       CASEND </td <td>E =</td>		E =														
- 44 -		INCOME       LELVATION       LELVATION       LELVATION       LELVATION       LELVATION       LELVATION       LELVATION       DIRITION       Multi Barry Drillion         NG DATE       2222013       DRITINGO       Multi Barry Drillion       DRITINGO       DRITINGO       Multi Barry Drillion       DRITINGO       Multi Barry Drillion       Multi Barry D																	
- 45 -			Unit Halpbur Crossing         DRITTATION         PARTING         PARTIN			146 147 148													
- 46 -			SCHIFTION         No.         N																
47												0	3	3	2	J - UN, R, PC	17		154 155 156
48-				-								(D)	3	3	2	J - UN, R, PC	7.5		157 158 159
			DATE 2/2/013     DRULING CO. Muld Bay Dulling     DRULING METHON     DRULING METHON     DRULING METHON     Muld Reproduce       UITHOLOGICAL DESCRIPTION     International and the second sec																

						BO	RE	HOL	LE R	REC	OR	D						BH13-4	1	
	CLIE					mam										PROJECT N		1700431		-
	LOC	ATION Victoria Harbour Crossin			1105					DAT ELE			Cha -4.1			NORTHING EASTING		362952 71275		
	ORII		DRILI	LIN				ay Dri								G METHOD		otary/Cor	ing	_
H (m)	ON (m)		LOT	E & No.		ROKEN CO RUSHED ( MISSING CO NFERRED		FX-FRACT J-JOINT CL-CLEAV VN-VEIN	URE CO B-B /AGE F-F FOI	NT-CONTA EDDING AULT L-FOLIATIO			D COR	RE /	UN-U PO-P K-SLI R-RO	NDULATING CL-CLEAN OLISHED PC-PARTIALL CKENSIDED CC-COMPLET UGH IN-FILLED	COATED ELY COATED	LUE A SRF -1 SRF	STS	(ft)
DEPTH (m)	(m) NOILEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	STRUCTURE	TOTAL CORE % ≋ ≋ ≅ ≅ ≅	SOLID CORE %	R.Q.D. %	5 10 FRACTURE 15 FREQUENCY	R4 ROCK R3 STRENGTH R1 INDEX	WI WEATHERING WI INDEX		٩	Jr	Ja	DISCONTINUITY DATA		$\begin{array}{c} Q-VALUE\\ Q-VALUE\\ Q=\frac{POD}{Jn} \times \frac{Jr}{Ja} \times \frac{Jw}{SRF}\\ WHERE:\\ MHERE:\\ MHERE:\\ MHERE: \\ MHERE$	OTHER TESTS	DEPTH (ft)
- 49 -												000	6	3	2	J - UN, R, PC		4.5		161
- 50	54 5											0	6	2	2	J - UN, S, PC		1.7		163 164
- 49	<u>-54.5</u>	End of borehole MBH13-4 at 50.3 m																		165 166 167 168
52																				
55																				= =
- 57																				2011.0311.0411.0511.0611.0701.0811.0801.0011.0111.0111.0111.01
- 58																				191911920000000000000000000000000000000
-61																				199 200
																T	Sta	nte	-	

Geotechnical Data Report

Core Area Wastewater Treatment Program Final

# **APPENDIX C**

**CPT Results** 



One Team. Infinite Solutions.



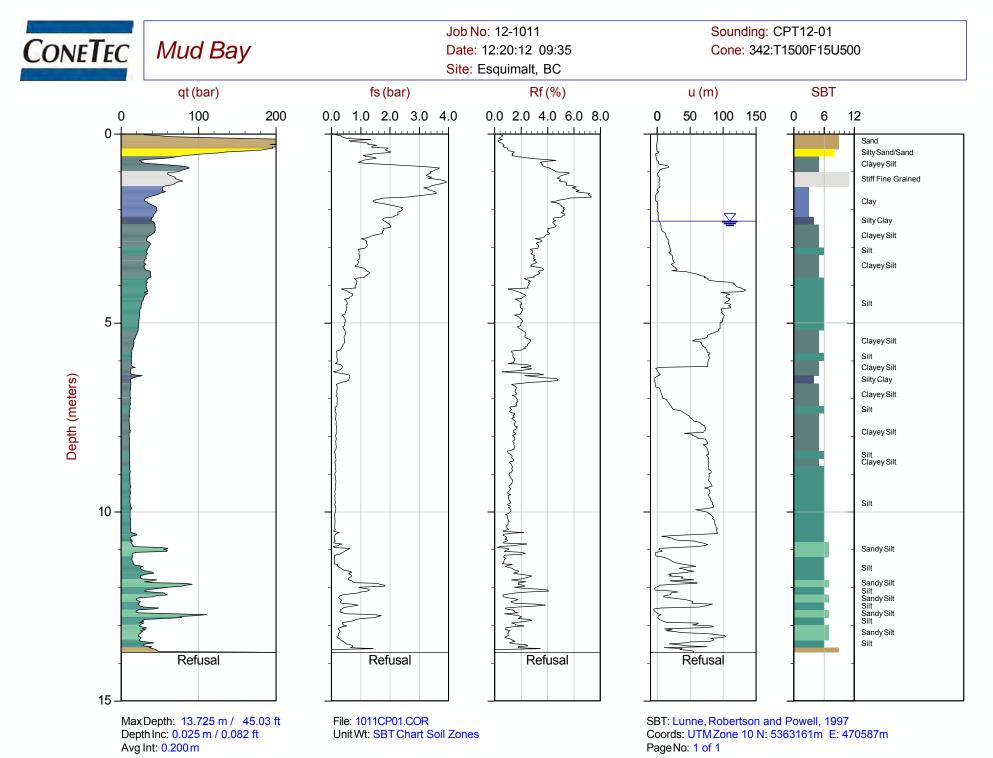
12-1011 Mud Bay Drilling Co. Ltd. Esquimalt, BC December 20th, 2012

			CPT S	UMMARY			
CPT Sounding	File Name	Date	Cone	Assumed Phreatic Surface (m)	Final Depth (m)	Handheld GPS UTM Northing (m)	Handheld GPS UTM Easting (m)
CPT12-01	1011CP01	12/20/12	342:T1500F15U500	2.3	13.725	5363161	470587
CPT12-02	1011CP02	12/20/12	342:T1500F15U500	3.0	10.275	5363192	470597
CPT12-03	1011CP03	12/20/12	342:T1500F15U500	2.6	11.975	5363130	470604

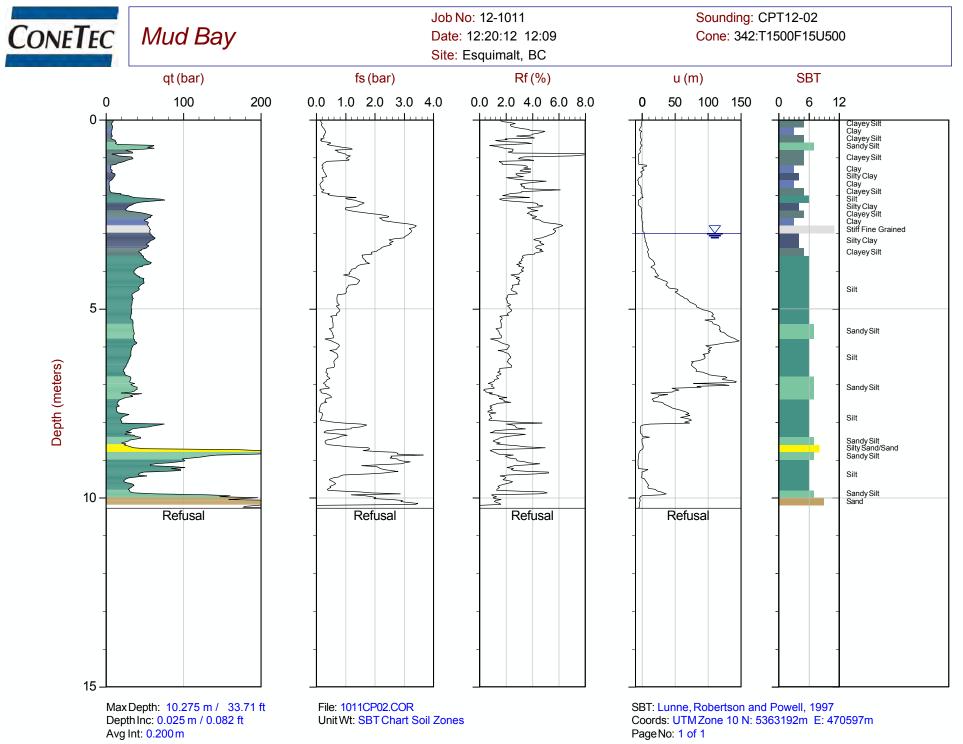
Datum: WGS 84 / UTM Zone 10 North

Note: Assumed phreatic surface based on dynamic pore pressure response.

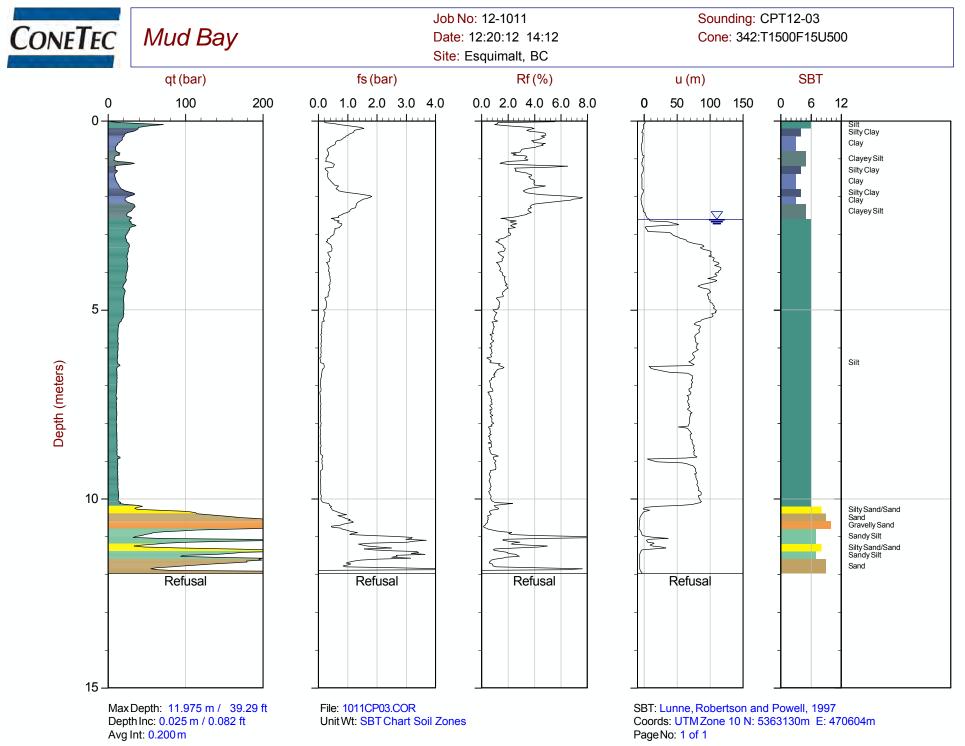
Hydrostatic conditions assumed for interpretation tables.



The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



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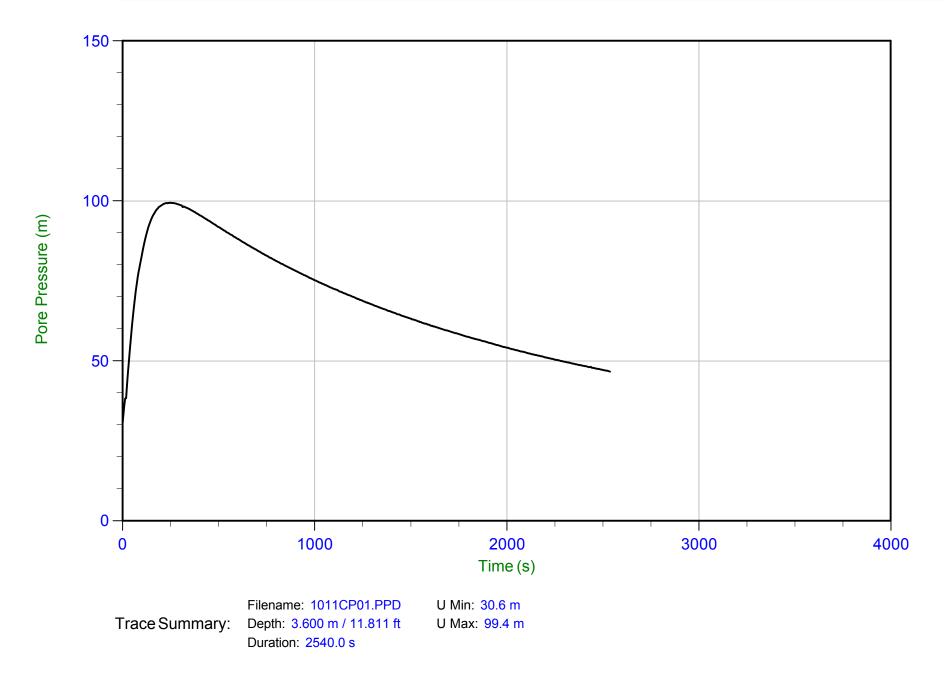


12-1011 Mud Bay Drilling Co. Ltd. Esquimalt, BC December 20th, 2012

		PPD SUMMA	ARY	
CPT Sounding	Duration (s)	Test Depth (m)	Equilibrium Pore Pressure U <sub>eq</sub> (m)	Calculated Phreatic Surface (m)
CPT12-01	2540	3.600	Not Achieved	



Job No: 12-1011 Date: 12/20/2012 09:35 Site: Esquimalt Sounding: CPT12-01 Cone: 342:T1500F15U500 Cone Area: 15 sq cm



Geotechnical Data Report

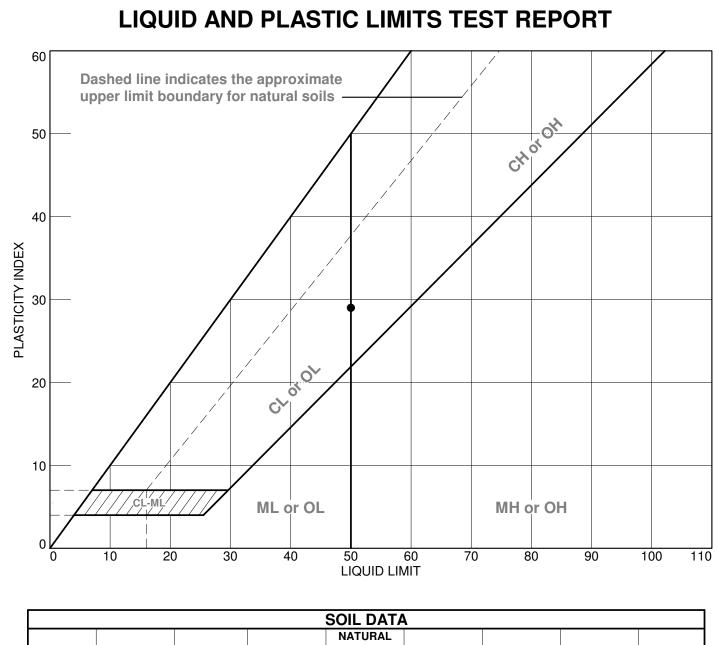
Core Area Wastewater Treatment Program Final

## **APPENDIX D**

Laboratory Test Results



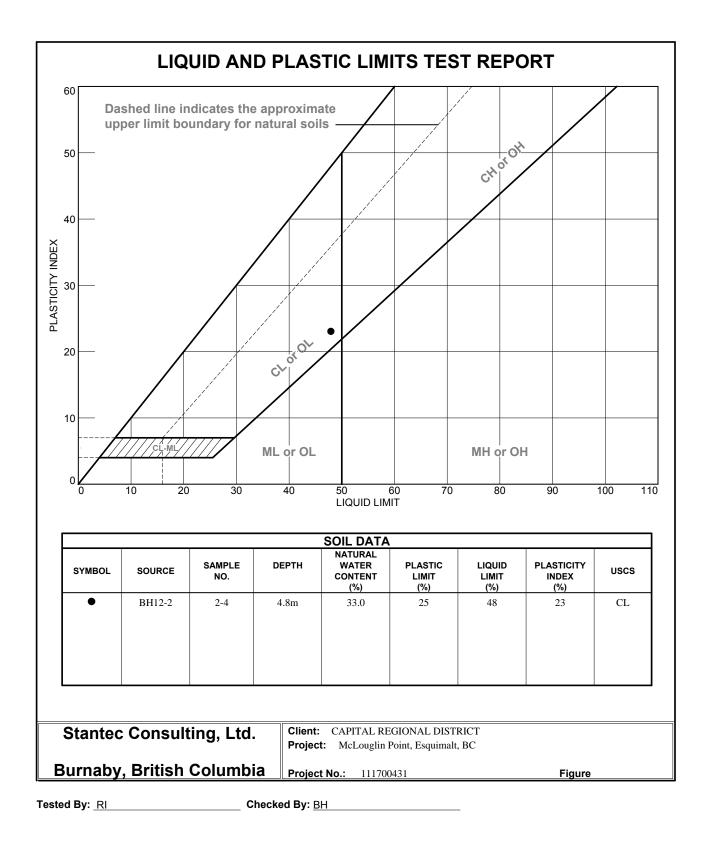
One Team. Infinite Solutions.

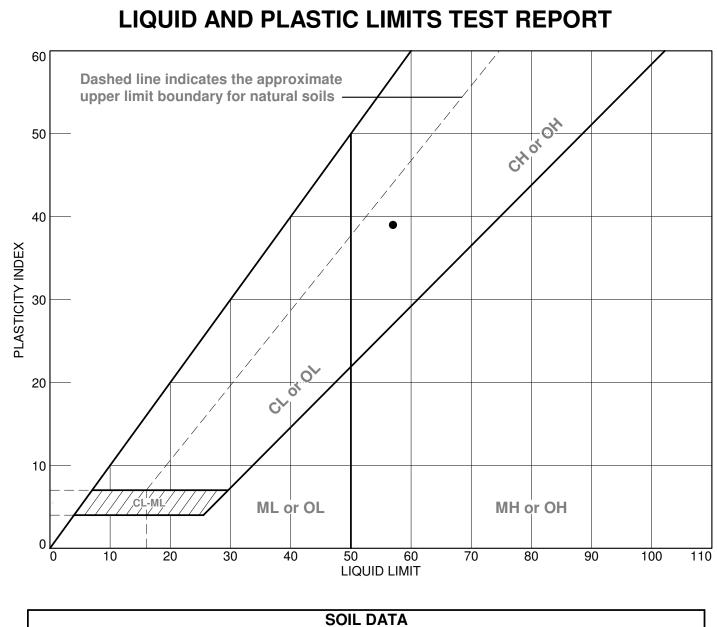


				SOIL DATA				
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
•	BH12-1	1-4	3.3m	29.0	21	50	29	CL-CH

Stantec Consulting, Ltd.	Client: CAPITAL REGIONAL DISTRICT Project: McLouglin Point, Esquimalt, BC	
Burnaby, British Columbia	Project No.: 111700431	Figure

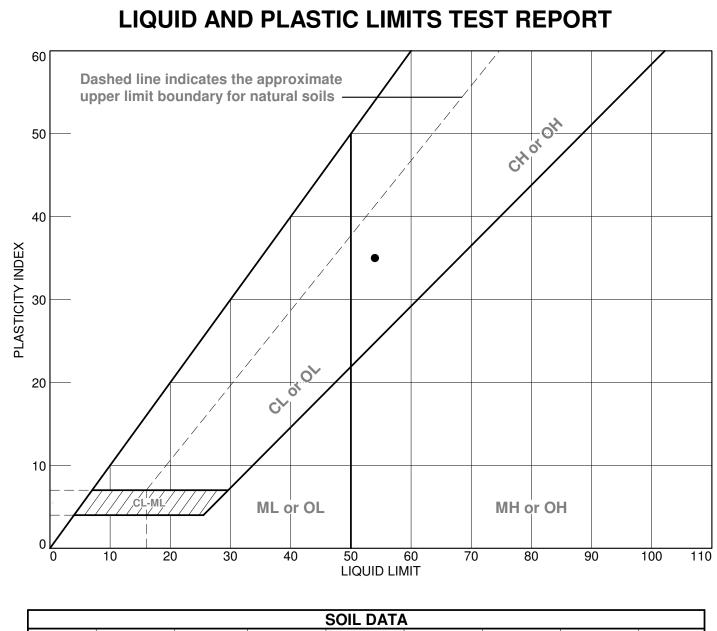
Checked By: BH





				SOIL DATA	L			
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
•	BH12-3	3-3	4.8m	41.0	18	57	39	СН

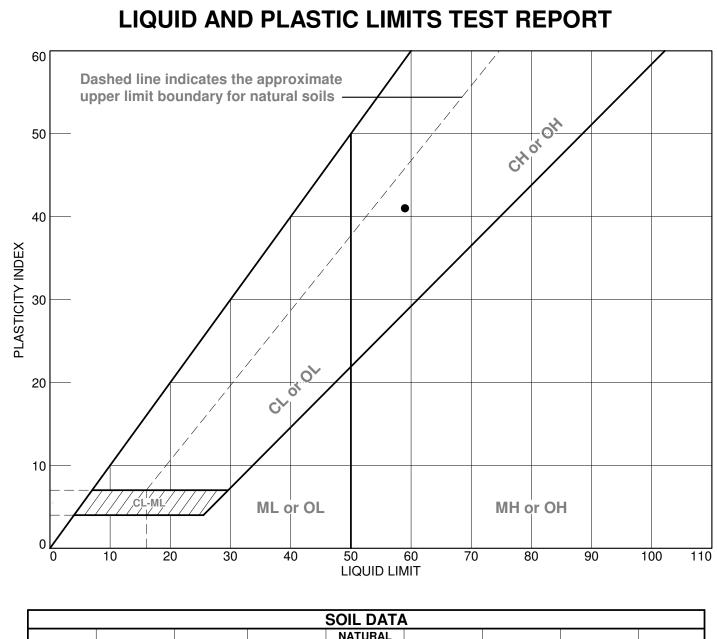
Stantec Consulting, Ltd.	Client: CAPITAL REGIONAL DISTRICT	
,	Project: McLouglin Point, Esquimalt, BC	
Burnaby, British Columbia	Project No.: 111700431	Figure



	SOIL DATA										
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS			
•	BH12-4	4-4	4.8m	36.0	19	54	35	СН			

Stantec Consulting, Ltd.	Client: CAPITAL REGIONAL DISTRICT Project: McLouglin Point, Esquimalt, BC	
Burnaby, British Columbia	Project No.: 111700431	Figure

Checked By: BH



	SOIL DATA										
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS			
•	BH12-7	7-4	4.8m	36.0	18	59	41	СН			

Stantec Consulting, Ltd.	<b>Client:</b> CAPITAL REGIONAL DISTRICT <b>Project:</b> McLouglin Point, Esquimalt, BC	
Burnaby, British Columbia		Figure

### Project No: 111700431 Core Area Wastewater Treatment Program - McLoughlin Point Geotechnical Investigation Table D-1 Point Load Testing Summary



Borehole ID	Sample Depth		Rock Type	Test Type	Core Diameter [mm]	Length [mm]	ls(45mm) [Mpa]	ls(50) [Mpa]
	[ft]	[m]						
BH12-05	19.00	5.79	Granodiorite	D	44.41	90.00	3.70	3.50
BH12-05	31.00	9.45	Alt Granodiorite	D	44.41	110.00	2.84	2.69
BH12-06	14.67	4.47	Granodiorite	D	44.41	95.00	7.15	6.78
BH12-06	15.00	4.57	Granodiorite	D	44.41	130.00	4.96	4.70
BH12-06	25.42	7.75	Granodiorite	D	44.41	120.00	7.07	6.70
BH12-06	29.50	8.99	Granodiorite	D	44.41	120.00	11.11	10.54
BH12-06	34.00	10.37	Granodiorite	D	44.41	95.00	7.91	7.50
BH12-08	28.08	8.56	Granodiorite	D	44.41	100.00	0.87	0.83
BH12-08	31.08	9.48	Granodiorite	D	44.41	130.00	10.62	10.07
BH12-09	13.08	3.99	Granodiorite	D	44.41	90.00	9.85	9.34
BH12-09	16.42	5.01	Granodiorite	D	44.41	100.00	4.49	4.26
BH12-09	21.75	6.63	Granodiorite	D	44.41	100.00	7.22	6.84
BH12-09	25.33	7.72	Granodiorite	D	44.41	100.00	7.77	7.36
BH12-09	37.17	11.33	Granodiorite	D	44.41	80.00	12.05	11.42
BH12-09	50.00	15.24	Alt Granodiorite	D	44.41	80.00	7.28	6.90
BH12-09	55.33	16.87	Alt Granodiorite	D	44.41	60.00	5.60	5.31

#### **Statistics**

#### ls(50)

Rock Type	Avg	Min	Max
Granodiorite	6.91	0.83	11.42
Alt Granodiorite	4.97	2.69	6.90
ALL	6.55	0.83	11.42



Borehole ID	Sample Depth		Rock Type	Test Type	Core Diameter	Length [mm]	ls(60mm) [Mpa]	ls(50) [Mpa]
	[ft]	[m]			[mm]	[]	[լտիզ]	[Inha]
MBH13-1	138.42	42.2	Granodiorite	D	60.78	70	2.2	2.4
MBH13-1	150.17	45.8	Granodiorite	D	60.78	105	3.5	3.8
MBH13-1	156.25	47.6	Granodiorite	D	60.78	116	5.8	6.4
MBH13-1	164.50	50.2	Granodiorite	D	60.78	90	6.0	6.6
MBH13-2	97.42	29.7	Granodiorite	D	60.78	90	1.1	1.2
MBH13-2	117.17	35.7	Granodiorite	D	60.78	85	0.6	0.6
MBH13-2	125.42	38.2	Granodiorite	D	60.78	100	3.3	3.6
MBH13-2	132.83	40.5	Granodiorite	D	60.78	65	5.9	6.4
MBH13-2	142.67	43.5	Granodiorite	D	60.78	100	3.3	3.7
MBH13-2	152.08	46.4	Granodiorite	D	60.78	85	2.2	2.4
MBH13-2	154.00	47.0	Granodiorite	D	60.78	85	1.8	2.0
MBH13-2	161.00	49.1	Granodiorite	D	60.78	95	1.0	1.1
MBH13-3A	59.67	18.2	Alt Granodiorite	D	60.78	80	2.0	2.2
MBH13-3A	69.33	21.1	Alt Granodiorite	D	60.78	100	0.8	0.8
MBH13-3A	71.17	21.7	Alt Granodiorite	D	60.78	110	0.9	0.9
MBH13-3A	81.00	24.7	Alt Granodiorite	D	60.78	95	0.4	0.5
MBH13-3A	94.00	28.7	Alt Granodiorite	D	60.78	70	1.7	1.9
MBH13-3A	97.42	29.7	Alt Granodiorite	D	60.78	70	1.2	1.4
MBH13-3A	104.50	31.9	Granodiorite	D	60.78	100	3.5	3.8
MBH13-3A	131.42	40.1	Granodiorite	D	60.78	100	1.5	1.7
MBH13-3A	138.00	42.1	Granodiorite	D	60.78	90	6.1	6.7
MBH13-3A	141.00	43.0	Granodiorite	D	60.78	90	1.6	1.7
MBH13-3A	143.50	43.8	Andesite	D	60.78	90	0.4	0.4
MBH13-3A	150.00	45.7	Granodiorite	D	60.78	90	5.4	5.9
MBH13-3A	150.25	45.8	Granodiorite	D	60.78	90	8.7	9.5
MBH13-3A	154.33	47.1	Granodiorite	D	60.78	90	5.9	6.5
MBH13-3A	157.75	48.1	Granodiorite	D	60.78	110	2.3	2.5
MBH13-3A	161.58	49.3	Granodiorite	А	60.78	45	2.8	3.1
MBH13-4	52.08	15.9	Granodiorite	D	60.78	90	6.9	7.5
MBH13-4	61.75	18.8	Granodiorite	D	60.78	95	5.3	5.8
MBH13-4	62.08	18.9	Granodiorite	D	60.78	100	7.1	7.7
MBH13-4	70.50	21.5	Granodiorite	D	60.78	110	6.6	7.2
MBH13-4	84.75	25.8	Granodiorite	D	60.78	90	5.6	6.1
MBH13-4	90.42	27.6	Granodiorite	D	60.78	100	7.1	7.7
MBH13-4	93.42	28.5	Granodiorite	D	60.78	105	4.2	4.6
MBH13-4	108.42	33.1	Granodiorite	D	60.78	100	2.2	2.3
MBH13-4	116.08	35.4	Granodiorite	D	60.78	100	2.3	2.5
MBH13-4	123.58	37.7	Granodiorite	D	60.78	80	3.9	4.3
MBH13-4	132.83	40.5	Alt Granodiorite	D	60.78	90	1.4	1.5

## Project No: 111700431 Core Area Wastewater Treatment Program - Victoria Harbour Crossing Geotechnical Investigation Table D-2 Point Load Testing Summary



**Statistics** 

ls(50)

Rock Type	Avg	Min	Max
Granodiorite	3.7	0.4	9.5
Alt Granodio	4.2	1.5	7.7
Andesite	0.1	0.1	0.1
ALL	3.8	0.4	9.5



#### POINT LOAD STRENGTH INDEX TEST ASTM D5731-08

Pro Pro Clie	ect	Number	er 09-1416-0062/5000 CRD WWTP Geotechnical Investigation Stantec							LocationNot ProvidedSchedule #52Machine IDA1252-9-05			
Test #	Type	Borehole	Sample #	Depth (ft)	Width W (mm)	Diameter D (mm)	Load P (kN)	De <sup>2</sup> (mm <sup>2</sup> )	De (mm)	l <sub>s</sub> (MPa)	F	I <sub>s(50)</sub> (MPa)	Remarks
1	D	MBH13-1	N/A	139.00-140.00		60.56	15.615	3667.51	60.56	4.26	1.09	4.64	Failed partially along foliation
2	D	MBH13-1	N/A	162.17-163.67		60.77	18.661	3692.99	60.77	5.05	1.09	5.52	
3	D	MBH13-3A	N/A	112.83-113.92		61.21	3.687	3746.66	61.21	0.98	1.10	1.08	Failed along foliation
4	D	MBH13-4	N/A	82.58-84.33		60.68	22.308	3682.06	60.68	6.06	1.09	6.61	Failed partially along foliation
5	D	MBH13-4	N/A	123.83-125.42		60.86	13.064	3703.94	60.86	3.53	1.09	3.85	Failed partially along foliation
6	D	BH12-05	N/A	25.58-26.83		44.5	20.784	1980.25	44.50	10.50	0.95	9.96	
7	D	BH12-06	N/A	11.58-12.75		44.73	16.793	2000.77	44.73	8.39	0.95	7.98	
8	D	BH12-09	N/A	11.17-12.50		44.01	12.534	1936.88	44.01	6.47	0.94	6.11	Failed partially along foliation

	TESTING GEOMETRIES											
Diametral (D)	Axial (A)	Block (B)	Irregular Lump (L)									
	Equivalent core 03W < D < W	L > 0 5 D	L> 050 W <sub>2</sub> Section through loading points 0.3W < D < W W · W · V 2									
M. Miller	M. Miller March 25, 2013		March 26, 2013									
Technician	Date	Checked	Dated									



			Unconfin	ed Co	mpressi	ve Stre	ngth of	Intact	Rock Co	ore Spe	cimens			Refe ASTM D7012	rence 2-10 Meth	nod C
Proj	ect No.:		09-1416-00	062/5000	)					Failure Mode						
Proj	ect:		CRD WW1	P Geote	chnical In	vestigatio	on			(1) Diago	nal shear p	plane(s)	(5) C	onical		
Clier	it:		Stantec							(2) Vertical fracture(s) (6) Spalling						
Loca	tion:		Not Provid	ed						(3) Vertic	al splitting		(7) C	other		
Lab	ID		52	2							along folia	tion / disco	ntinuity Note	: (deg) measured	from co	re axis
									Wet		Dry	Maximum	Stress			
No.	Borehole	Sample	Depth	Dia	Ht	Α	v	Mass	Density	w	Density	Load	σ	Rock Type	Failur	e Mode
	#	#	(ft)	(mm)	(mm)	(cm <sup>2</sup> )	(cm <sup>3</sup> )	(g)	(Kg/m <sup>3</sup> )	(%)	(Kg/m <sup>3</sup> )	(kN)	(MPa)		Туре	(deg)
1	MBH13-1	N/A	139.00-140.00	60.66	128.41	28.90	371.10	976.40	2631	0.15	2627	257.60	89.1	Granodiorite	1,2	20
2	MBH13-1	N/A	162.17-163.67	60.71	123.94	28.95	358.77	951.30	2652	0.12	2648	214.70	74.2	Granodiorite	1,2	25
3	MBH13-2	N/A	134.58-135.67	60.92	128.90	29.15	375.72	984.00	2619	0.09	2617	317.90	109.1	Granodiorite	4	22
4	MBH13-2	N/A	158.92-159.42	60.68	128.20	28.92	370.74	972.40	2623	0.09	2620	143.50	49.6	Gneiss	4	30
5	MBH13-3A	N/A	84.33-85.75	60.74	125.73	28.98	364.32	913.30	2507	0.61	2492	39.50	13.6	Gneiss	4	15
6	MBH13-3A	N/A	112.83-113.92	60.84	128.89	29.07	374.70	985.00	2629	0.11	2626	51.10	17.6	Gneiss	1	20
7	MBH13-4	N/A	82.58-84.33	60.71	124.28	28.95	359.76	946.60	2631	0.18	2626	146.90	50.7	Granodiorite	4	18
8	MBH13-4	N/A	123.83-125.42	60.65	125.72	28.89	363.21	953.70	2626	0.24	2619	186.80	64.7	Gneiss	2,1	30
9	BH12-05	N/A	25.58-26.83	44.51	94.77	15.56	147.46	395.20	2680	0.10	2677	346.50	222.7	Gneiss	1	22
10	BH12-06	N/A	11.58-12.75	44.81	95.81	15.77	151.10	395.30	2616	0.05	2615	187.20	118.7	Granodiorite	2,1	10
11	BH12-08	N/A	30.08-30.75	44.75	94.00	15.73	147.84	392.20	2653	0.10	2650	130.90	83.2	Gneiss	4,2	23
12	BH12-09	N/A	11.17-12.50	44.02	93.79	15.22	142.74	377.70	2646	0.08	2644	152.90	100.5	Granodiorite	6,2	
		M. Mill	er		N	larch 21,	2013		E. Kostyukov March				March 26, 20	13		
		rested	BY			DATE			CHECKED BY					DATE		

Un	confined Compres	sive Strength of In	tact Rock Core Spec	imens	Reference ASTM D7012-10 Method 0			
roject No.:	09-1416-0062/5000		Borehole:	MBH13-1				
roject:	CRD WWTP Geotech	nical Investigation	Sample Number:	N/A	N/A 139.00-140.00			
ocation:	Not Provided		Depth (ft):	139.00-140				
lient:	Stantec		Lab ID No:		52			
Max Loa Stress c Pace Ra Litholog Type: Degrees	x (MPa)       89.1         ate (kN/s)       1.25         y       Granodiori         Failure Mode       1,2         s:*       20         es measured with rest	Diameter (mm) Height (mm) Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g) Moisture Conte Wet Density (K Dry Density (Kg 	$\frac{128.41}{28.90}$ $\frac{371.10}{976.40}$ ent (%) 0.15 (g/m <sup>3</sup> ) 2631.08 2627.03 Notes t as received hear plane(s) cture(s)		Image: Constraint of the constraint			
	s a testing service onl		vided only. This report data given here may be	D	AFTER TEST			
N	1. Miller	March 21, 2013	E. Kostyuk	ov	March 26, 2013			

Un	confined	Compressive	Strength of Int	act Rock Core Spec	imens	Reference ASTM D7012-10 Method (		
oject No.:	09-1416-0	062/5000		Borehole:	MBH13-1			
ject:	CRD WW1	TP Geotechnical I	nvestigation	Sample Number:	N/A			
cation:	Not Provid		Ū	Depth (ft):	162.17-163.6	162.17-163.67		
ent:	Stantec			Lab ID No:	52			
	Testing Re	esults	Sample I	Measurements		· /		
Max Loa	ad (kN)	214.70	Diameter (mm)	60.71				
Stress o	ס (MPa)	74.2	Height (mm) Area (cm <sup>2</sup> )	123.94 28.95		IC2		
Pace R	ate (kN/s)_	1.25	Volume (cm <sup>3</sup> ) Mass (g)	$\frac{358.77}{951.30}$		113-16-111-16		
Litholog		Granodiorite	Moisture Conte Wet Density (Kg Dry Density (Kg	g/m <sup>3</sup> ) 2651.52		2.8. 3.8.		
	Failure M	lode		Notes		ROJECT # 09-1416-0062/5000 AMPLE MBH13-1		
Type:		1,2	- Water content <b>Mode:</b>	as received	1.2	EPTH (ft) 162.17-163.67		
			(1) Diagonal sh	,		BEFORE TEST		
Degrees	s:*	25	(2) Vertical frac	( )				
			(3) Vertical split	•				
			(4) Shear along (5) Conical	foliation /discontinuity				
* Degre	es measur	ed with respect				MEREN		
core a		I	(7) Other					
		Co	mments			PROJECT # 09-1416-0062/5000 SAMPLE MBH13-1 DEPTH (ft) 162.17-163.67		
		service only. Inte		vided only. This report data given here may be		AFTER TEST		
Ν	I. Miller	M	arch 21, 2013	E. Kostyuk	ov	March 26, 2013		
				+				

Un	confined	Compressive	Strength of Inta	ict Rock Core Specir	nens	Reference ASTM D7012-10 Method	
oject No.:	09-1416-0	062/5000		Borehole:	MBH13-2	·	
oject:	CRD WW1	TP Geotechnical I	nvestigation	Sample Number:	N/A		
cation:	Not Provid	ed		Depth (ft):	134.58-135.67 52		
ient:	Stantec			Lab ID No:			
Max Loa Stress c	σ (MPa) ate (kN/s) _ y Failure M	317.90 109.1 1.25 Granodiorite	Diameter (mm) Height (mm) Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g) Moisture Conten Wet Density (Kg/n Dry Density (Kg/n - Water content a <b>Mode:</b> (1) Diagonal she (2) Vertical fractu (3) Vertical splitti	$(m^3)$ 2618.98 $m^3)$ 2616.59 lotes as received ar plane(s) ure(s)		PROJECT # 09-1416-0062/5000         SAMPLE       MBH13-2         DEPTH (ft)       134.58-135.67	
* The tes constitutes	t data give	n herein pertain service only. Inte	(7) Other mments to the sample provi	ided only. This report ata given here may be		ROJECT # 09-1416-0062/5000         AMPLE       MBH13-2         EPTH (ft)       134.58-135.67	
Ν	I. Miller	М	arch 21, 2013	E. Kostyukov		March 26, 2013	

Un	confined Co	mpressive	Strength of Inta	act Rock Core Spec	cimens	Reference ASTM D7012-10 Method (	
oject No.:	09-1416-0062/5	5000		Borehole:	MBH13-2		
oject:	CRD WWTP G	eotechnical In	vestigation	Sample Number:	N/A		
cation:	Not Provided		Depth (ft): Lab ID No:		158.92-159.42		
ent:	Stantec				52		
Max Los Stress of Pace Ra Litholog Type: Degrees	5 (MPa) ate (kN/s) lyG Failure Mode 4 s:*30	43.50 49.6 1.25 aneiss	Diameter (mm) Height (mm) Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g) Moisture Conten Wet Density (Kg/ Dry Density (Kg/ Dry Density (Kg/ Content Mode: (1) Diagonal she (2) Vertical fractor (3) Vertical splitt (4) Shear along for (5) Conical	$(m^3)$ 2622.86 $(m^3)$ 2620.43 Notes as received ear plane(s) ure(s)		PROJECT # 09-1416-0062/5000 SAMPLE 09-1416-0062/5000 SAMPLE MBH13-2 DEPTH (ft) 158.92-159.42	
* The tes	t data given he	Com rein pertain to ice only. Inte	(7) Other	ided only. This report ata given here may be		PROJECT # 09-1416-0062/5000 AMPLE MBH13-2 DEPTH (ft) 158.92-159.42	
Ν	1. Miller	Ma	arch 21, 2013	E. Kostyuk	ov	March 26, 2013	

Un	confined Cor	npressive	Strength of Inta	act Rock Core Spec	imens	Reference ASTM D7012-10 Method 0			
oject No.:	09-1416-0062/5	000		Borehole:	MBH13-3				
oject:	CRD WWTP Ge	eotechnical In	vestigation	Sample Number:	N/A				
ocation:	Not Provided			Depth (ft):	84.33-85.75				
ient:	Stantec		Lab ID No:		52	52			
Max Loa Stress c	o (MPa)1	9.50 13.6 1.25 neiss	Diameter (mm) Height (mm) Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g) Moisture Conten Wet Density (Kg Dry Density (Kg/	/m <sup>3</sup> ) 2506.89		PROJECT # 09-1416-0062/5000 SAMPLE MBH13-3A			
Type: Degrees	4 s:*15		<ul> <li>Water content</li> <li>Mode:</li> <li>(1) Diagonal she</li> <li>(2) Vertical fractor</li> <li>(3) Vertical splitt</li> <li>(4) Shear along for</li> <li>(5) Conical</li> </ul>	ear plane(s) ure(s)		BEFORE TEST			
* Degree core a	es measured w xis.	ith respect to							
		rein pertain t ce only. Inte		ided only. This report ata given here may be		PROJECT # 09-1416-0062/5000 SAMPLE 09-1416-0062/5000 SAMPLE MBH13-3A DEPTH (ft) 84.33-85.75			
N	I. Miller		arch 21, 2013	E. Kostyuk	ov	March 26, 2013			
			,			-,			

Un	confined	Compressive	e Strength of Inta	act Rock Core Spec	imens	Reference ASTM D7012-10 Method	
oject No.:	09-1416-00	)62/5000		Borehole:	MBH13-3	A	
oject:	CRD WWT	P Geotechnical I	nvestigation	Sample Number:	N/A		
cation:	Not Provide	ed		Depth (ft):	112.83-113.92 52		
ient:	Stantec			Lab ID No:			
				•			
	Testing Re			leasurements		(F1 (2)	
Max Loa	· · <u> </u>	51.10	Diameter (mm) Height (mm)	60.84 128.89		T I IS	
Stress of		17.6	Area (cm²) Volume (cm³)	29.07 374.70			
Pace Ra	ate (kN/s)	1.25	Mass (g)	985.00		1201	
Litholog	у _	Gneiss	Moisture Conter Wet Density (Kg Dry Density (Kg/	/m <sup>3</sup> ) 2628.75		-0 =	
	Failure M	ode	- Water content	Notes as received		PROJECT # 09-1416-0062/5000 SAMPLE MBH13-3A DEPTH (ft) 112.83-113.92	
Туре:	Туре: <u>1</u>		<b>Mode:</b> (1) Diagonal she			BEFORE TEST	
Degree	s:*	20	<ul><li>(2) Vertical fract</li><li>(3) Vertical splitt</li></ul>	ure(s)			
			、 <i>,</i>	oliation /discontinuity		1	
* Degre	es measure	ed with respect				THE THE	
core a			(7) Other			E SE	
* The tes	t data giver		mments	ided only. This report	S.	ROJECT # 09-1416-0062/5000 AMPLE MBH13-3A EPTH (ft) 112.03-113.92	
		service only. Int		ided only. This report ata given here may be		AFTER TEST	
N	1. Miller	N	larch 21, 2013	E. Kostyuk	ov	March 26, 2013	

Un	confined	Compressive	Strength of Inta	act Rock Core Spec	imens	Reference ASTM D7012-10 Method		
oject No.:	09-1416-0	062/5000		Borehole:	MBH13-4			
oject:	CRD WW	TP Geotechnical I	nvestigation	Sample Number:	N/A 82.58-84.33			
cation:	Not Provid	led		Depth (ft):				
ient:	Stantec			Lab ID No:	52			
	Testing Re	esults	Sample N	leasurements		. /		
Max Loa	ad (kN)	146.90	Diameter (mm)	60.71	·			
		140.00	Height (mm)	124.28		(TEALER)		
Stress of	o (MPa)	50.7	Area (cm <sup>2</sup> )	28.95				
_			Volume (cm <sup>3</sup> )	359.76		A		
Pace Ra	ate (kN/s)	1.25	Mass (g)	946.60		g		
Litholog	V	Granodiorite	Moisture Content (%)         0.18           Wet Density (Kg/m <sup>3</sup> )         2631.21           Dry Density (Kg/m <sup>3</sup> )         2626.48		-	E Star		
	-					I ANT I		
	Failure N	lode	1	Notes	1 100	ROJECT # 09-1416-0062/5000		
			- Water content	as received		EPTH (ft) 82.58-84.33		
Type:		4	Mode:					
51			(1) Diagonal she	ar plane(s)		BEFORE TEST		
Degrees	S:*	18	(2) Vertical fract	ure(s)				
			(3) Vertical splitt	-				
				oliation /discontinuity		1		
* Degree	es measur	ed with respect	(5) Conical			1		
core a			(7) Other					
						Contraction of		
		Co	mments			THE AND		
					-	and the second		
					-	1 1 -		
						M.		
					I.			
					P	ROJECT # 09-1416-0062/5000		
					S	AMPLE MBH13-4		
					- D	EPTH (ft) 82.58-84.33		
				ided only. This report		AETED TEST		
constitutes	s a testing		erpretation of the d upon request.	ata given here may be		AFTER TEST		
	1. Miller		larch 21, 2013	E. Kostyuk		March 26, 2013		
IV		IV	aich 21, 2015	E. ROSIYUK	Jv	March 20, 2015		

Un	confined	Compressiv	e Strength of Int	act Rock Core Spec	imens	Reference ASTM D7012-10 Method 0		
oject No.:	09-1416-00	62/5000		Borehole:	MBH13-4			
oject:	CRD WWT	P Geotechnical	Investigation	Sample Number:	N/A			
ocation:	Not Provide	d		Depth (ft):	123.83-125.42 52			
ient:	Stantec			Lab ID No:				
_								
	Testing Res	sults	Sample N	leasurements		1		
Max Loa	ad (kN)	186.80	Diameter (mm)	60.65		A CONTRACTOR		
	· · · <u> </u>	64.7	Height (mm) Area (cm <sup>2</sup> )	125.72 28.89		and the second		
Stress of		64.7	Volume (cm <sup>3</sup> )	363.21		N		
Pace Ra	ate (kN/s)	1.25	Mass (g)	953.70	1	2		
	· · ·		Moisture Conter	nt (%) 0.24		Canver To Fa		
Litholog	іу <u> </u>	Gneiss	Wet Density (Kg		-	· Provide Contraction		
			Dry Density (Kg/	<sup>/m³</sup> ) <u>2619.43</u>		A STATES		
	Failure Mo	ode	1	Notes	Ī	PROJECT # 09-1416-0062/5000		
						SAMPLE MBH13-4		
			- Water content	as received	[	DEPTH (ft) 123.83-125.42		
Type:	2	2,1	Mode:					
			(1) Diagonal she	,		BEFORE TEST		
Degrees	s:* <u> </u>	30	(2) Vertical fract	. ,				
			(3) Vertical splitt (4) Shear along f	oliation /discontinuity				
			(5) Conical	onation , alcoontinuity				
* Degre	es measure	d with respect	to (6) Spalling			STORE IN		
core a	axis.		(7) Other					
r			omments					
			Jiinents			1		
						12		
						20		
					0 m			
						Z S		
					A Stranger			
						ROJECT # 09-1416-0062/5000		
						AMPLE MBH13-4 EPTH (ft) 123.83-125.42		
<b></b>	( -l= ( '			ided and This		()		
				ided only. This report ata given here may be		AFTER TEST		
oonolitatot	o a tooting o	-	upon request.	ala given nere may se				
N	I. Miller	1	March 21, 2013	E. Kostyuk		March 26, 2013		
TESTED BY								

Un	confined	Compressiv	e Strength of Int	act Rock Core Speci	mens	Reference ASTM D7012-10 Method		
oject No.:	09-1416-00	062/5000		Borehole:	BH12-05			
oject:	CRD WWT	P Geotechnical	Investigation	Sample Number:	N/A			
cation:	Not Provide	ed		Depth (ft):		<b>i</b>		
ient:	Stantec			Lab ID No:	52	52		
Max Loa Stress o Pace Ra Litholog Type: Degrees	σ (MPa) ate (kN/s) y Failure M	346.50 222.7 1.25 Gneiss ode 1 22 ed with respect	Diameter (mm) Height (mm) Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g) Moisture Conter Wet Density (Kg) Dry Density (Kg) - Water content <b>Mode:</b> (1) Diagonal she (2) Vertical fract (3) Vertical splitt (4) Shear along f (5) Conical	(m <sup>3</sup> ) 2680.04 (m <sup>3</sup> ) 2677.36 Notes as received ear plane(s) ure(s)	- SAI	DIECT # 09-1416-0062/5000         DIECT # 09-1416-0062/5000         MPLE BH12-05         DTH (ft) 25.58-26.83		
		service only. In		ided only. This report ata given here may be	- SAN	DJECT # 09-1416-0062/5000 PLE BH12-05 TH (ft) 25.58-26.83 AFTER TEST		
N	1. Miller		Aarch 21, 2013	E. Kostyuko	v	March 26, 2013		
		•			1			

Un	confined Compre	ssive Strength of Int	tact Rock Core Spec	imens	Reference ASTM D7012-10 Method	
oject No.:	09-1416-0062/5000		Borehole:	BH12-06		
oject:	CRD WWTP Geotech	nical Investigation	Sample Number:	N/A		
cation:	Not Provided		Depth (ft):	11.58-12.75 52		
ent:	Stantec		Lab ID No:			
Max Loa Stress of Pace Ra Litholog Type: Degrees	x (MPa)       118.7         ate (kN/s)       1.25         y       Granodior         Failure Mode       2,1         s:*       10         es measured with rest	Diameter (mm) Height (mm) Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g) Moisture Conte Wet Density (K Dry Density (Kg 	95.81 15.77 151.10 395.30 nt (%) 0.05 g/m <sup>3</sup> ) 2616.23 2614.85 Notes t as received ear plane(s) ture(s)	SAM	JECT # 09-1416-0062/5000         DECT # 09-1416-0062/5000         DEE BH12-06         H(ft) 11.58-12.75         BEFORE TEST	
	s a testing service on	ertain to the sample pro ly. Interpretation of the o vided upon request.	vided only. This report data given here may be	- SAM	DJECT # 09-1416-0062/5000 MPLE BH12-06 DTH (ft) 11.58-12.75 AFTER TEST	
Ν	1. Miller	March 21, 2013	E. Kostyuko	νv	March 26, 2013	

alaat Na .	contined	Compressive	Strength of Inta	act Rock Core Specin	nens	Reference ASTM D7012-10 Method	
oject No.:	09-1416-00	62/5000		Borehole:	BH12-08		
oject:	CRD WWT	P Geotechnical I	nvestigation	Sample Number:	N/A		
ocation:	Not Provide	ed	Depth (ft): Lab ID No:		30.08-30.75 52		
ient:	Stantec						
	Testing Re	sults	Sample M	leasurements		130	
Max Loa	· · <u> </u>	130.90	Diameter (mm) Height (mm)	44.75 94.00		PT AT	
Stress of Pace Ra	o (MPa) ate (kN/s)	<b>83.2</b> 1.25	Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g)	15.73 147.84 392.20		19=5 a:	
Litholog	· · · ·	Gneiss	Moisture Conten Wet Density (Kg	Noisture Content (%) $0.10$ Vet Density (Kg/m <sup>3</sup> ) $2652.80$ Dry Density (Kg/m <sup>3</sup> ) $2650.07$		R	
Туре:	Failure Mode		Notes - Water content as received <b>Mode:</b>		- SAN	DJECT #         09-1416-0062/5000           IPLE         BH12-08           TH (ft)         30.08-30.75	
Degrees	5:*	23		ure(s)		BEFORE TEST	
* Degree core a		ed with respect	(5) Conical (6) Spalling (7) Other			130/1	
* The test data given herein pertain to constitutes a testing service only. Interp				- SAM	TH (ft) 30.08-30.75		
		provided	upon request.	1		AFTER TEST	
N	1. Miller	Μ	arch 21, 2013	E. Kostyukov	,	March 26, 2013	

Un	confined Compre	ssive Strength of Int	act Rock Core Speci	mens	Reference ASTM D7012-10 Method
Project No.: 09-1416-0062/5000			Borehole:	BH12-09	
Project: CRD WWTP Geotechnical Inve		nical Investigation	Sample Number:	N/A	
cation:	Not Provided		Depth (ft):		0
ient:	Stantec		Lab ID No:	52	
Max Loa Stress c Pace Ra Litholog Type: Degrees	x (MPa)       100.5         ate (kN/s)       1.25         y       Granodio         Failure Mode       6,2         s:*	Diameter (mm) Height (mm) Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g) Moisture Conter Wet Density (Kg Dry Density (Kg Dry Density (Kg (1) Diagonal sho (2) Vertical fract (3) Vertical split (4) Shear along (5) Conical	$ \frac{93.79}{15.22} \\ 142.74 \\ 377.70 \\ nt (%) 0.08 \\ g/m^3) 2646.06 \\ 2643.96 \\ Notes \\ x as received \\ ear plane(s) \\ ture(s) $	SAM DEF	DJECT #       09-1418-0062/5000         MPLE       BH12-09         DTH (ft)       11.17-12.50
	s a testing service or	ertain to the sample prov ly. Interpretation of the c vided upon request.			AFTER TEST
N	1. Miller	March 21, 2013	E. Kostyuko	v	March 26, 2013

Asso	der ciates			428	0 Still Creek Drive
	Ten	sile Strength By The	Brazil Test		Reference ISRM 1981 (p120-12
oject No.:	09-1416-0062/5000		Borehole:	MBH13-1	
Project: CRD WWTP Geotechnical Inve		cal Investigation	vestigation Sample Number:		
ocation:	Not Provided		Depth (ft):	162.17-163.67	
ient:	Stantec		Lab ID No:	52	
Max Loa	Testing Results         ad (MN)       0.0272         Stress (MPa)       8.3         Failure Mode	Sample Meas Diameter (mm) Thickness (mm) Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g) Moisture Content (%) Wet Density (Kg/m <sup>3</sup> ) Dry Density (Kg/m <sup>3</sup> )	60.90 34.12 29.13 99.39 260.50 0.08 2621.04 2619.04	SA DE	DJECT # 09-1416-0062/5000 MPLE MBH13-1 PTH (ft) 162.17-163.67 RONT BEFORE
Type: Vertical Splitting			Machine ID <u>TestNet-GP</u> Transducer ID N/A		DJECT # 09-1416-0062/5000 MPLE MBH13-1 PTH (ft) 162.17-163.67 ACK BEFORE
	on of loading axis with t to bedding or foliation rees <u>90</u>	Ram Area cm <sup>2</sup>	N/A N/A		
	o <b>gy:</b> Granodiorite	Comments		F	DJECT # 09-1416-0062/5000 APLE MBH13-1 PTH (ft) 162.17-163.67 RONT AFTER OJECT # 09-1416-0062/5000 MPLE MBH13-1
	a testing service only.	ain to the sample provide Interpretation of the data led upon request.		DE	MPLE MBH13-1 PTH (ft) 162.17-163.67 BACK AFTER
М	. Miller	March 25, 2013	E. Kostyu	Ikov	March 26, 2013

<b>H</b> Asso	lder ciates			Lab	Associates Ltd Burnaby ill Creek Drive	
	Tens		Reference ISRM 1981 (p120-12			
roject No.:	09-1416-0062/5000		Borehole:	MBH13-2		
Project: CRD WWTP Geotechnical Investigation		al Investigation	Sample Number:	N/A		
ocation:	Not Provided		Depth (ft):	134.58-135.67		
lient:	Stantec		Lab ID No:	52		
Max Loa	Testing Results           ad (MN)         0.0333           Stress (MPa)         10.6	Sample Meas Diameter (mm) Thickness (mm) Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g) Moisture Content (%) Wet Density (Kg/m <sup>3</sup> )	60.91 32.93 29.14 95.95 252.20 0.12 2628.37 2625.25	PROJE SAMPL DEPTH FROM	Е мвн13-2	
Type:	Failure Mode Vertical Splitting Load Orientation	Dry Density (Kg/m <sup>3</sup> ) Calibrat Machine ID Transducer ID		PROJE SAMPL DEPTH BAC	Е мвн13-2	
	on of loading axis with t to bedding or foliation rees90	Ram Area cm <sup>2</sup>	N/A N/A	6		
Litholo	o <b>gy:</b> Granodiorite	Comments		PROJECT SAMPLE DEPTH (f	MBH13-2	
	t data given herein perta a testing service only. I provide			PROJECT SAMPLE DEPTH (fr	MBH13-2	
М	. Miller N	March 25, 2013	E. Kostyu	ıkov	March 26, 2013	
	STED BY	DATE	CHECKED		DATE	

<b>A</b> Gol	lder ciates	La	Golder Associates Ltd Burnaby Lab 4280 Still Creek Drive		
	Tens	sile Strength By The	Brazil Test		Reference ISRM 1981 (p120-12
roject No.:	09-1416-0062/5000		Borehole:	MBH13-3A	
Project: CRD WWTP Geotechnical Investigat		al Investigation	Sample Number:	N/A	
ocation:	Not Provided		Depth (ft):		
lient:	Stantec		Lab ID No:	52	
Max Loa	Testing Results         ad (MN)       0.0106         Stress (MPa)       3.3         Failure Mode	Sample Meas Diameter (mm) Thickness (mm) Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g) Moisture Content (%) Wet Density (Kg/m <sup>3</sup> ) Dry Density (Kg/m <sup>3</sup> )	60.82 33.17 29.05 96.37 240.90 0.37 2499.82 2490.50	S) DI	ROJECT # 09-1416-0062/5000           AMPLE         MBH13-3A           EPTH (ft)         84.33.45.75
		Machine ID <u>T</u> 			ROJECT # 09-1416-0062/5000 AMPLE MBH13-3A EPTH (ft) 84.33-05.75 BACK BEFORE
	on of loading axis with t to bedding or foliation rees 90	Ram Area cm <sup>2</sup>	N/A N/A		
* The test	o <b>gy:</b> Gneiss t data given herein perta	Comments		S D	ROJECT #         09-1416-0062/5000           AMPLE         MBH13-3A           EPTH (ft)         84-33-85.75           FRONT AFTER           ROJECT #         09-1418-0062/5000           AMPLE         MBH13-3A           EPTH (ft)         84-33-85.75
constitutes		Interpretation of the data ed upon request.	given here may be		BACK AFTER
М	. Miller	March 25, 2013	E. Kostyu	ikov	March 26, 2013
	STED BY	DATE	CHECKED	DV	DATE

() Asso	lder ciates				Golder Associates Lab 4280 Still Creek Dr	
	Ten	sile Strength By The	Brazil Test		ISRM	Reference 1981 (p120-12
roject No.:	09-1416-0062/5000		Borehole:	MBH13-4	lorum	1001 (p120-12
Project: CRD WWTP Geotechnical Investigation		cal Investigation	Sample Number: N/A			
ocation:	Not Provided		Depth (ft):			
lient:	Stantec		Lab ID No:	52		
				r		
Max Loa	Testing Results ad (MN) <u>0.0396</u> Stress (MPa) <u>12.1</u> Failure Mode	Sample Meas Diameter (mm) Thickness (mm) Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g) Moisture Content (%) Wet Density (Kg/m <sup>3</sup> ) Dry Density (Kg/m <sup>3</sup> ) Calibrat	60.75         34.30         28.99         99.42         258.70         0.15         2602.08         2598.07		FRONT BEFOR	
	Load Orientation	Transducer ID	N/A	-	BACK BEFOR	E
	on of loading axis with t to bedding or foliation rees <u>90</u>	Ram Area cm <sup>2</sup>	N/A N/A			
Litholo	ogy: Granodiorite	Comments			PROJECT # 09-1416-005 SAMPLE MBH13 DEPTH (ft) 82-58-84 FRONT AFTE	4 333
	a testing service only.	tain to the sample provide Interpretation of the data led upon request.			PROJECT # 09-1416-000 SAMPLE MBH13 DEPTH (ft) 82.56-64 BACK AFTER	4
М	. Miller	March 25, 2013	E. Kostyu	ıkov	Marc	h 26, 2013
TE	ESTED BY	DATE	CHECKED	BY		ATE

<b>B</b> Asso	lder ciates			Lab	Associates Ltd Burnaby till Creek Drive	
	Tens		Reference ISRM 1981 (p120-12			
oject No.:	09-1416-0062/5000		Borehole:	BH12-05		
Project: CRD WWTP Geotechnical Investigation		Sample Number:	N/A			
ocation:	Not Provided		Depth (ft):	25.58-26.83		
ient:	Stantec		Lab ID No:	52		
Max Loa	Testing Results         ad (MN)       0.0228         Stress (MPa)       13.2         Failure Mode	Sample Meas Diameter (mm) Thickness (mm) Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g) Moisture Content (%) Wet Density (Kg/m <sup>3</sup> ) Dry Density (Kg/m <sup>3</sup> )	44.49 24.62 15.55 38.27 102.00 0.11 2665.00 2661.97	PROJE	E BH12-05 (ft) 25:58-26:83 NT BEFORE	
Type:	Vertical Splitting Load Orientation	Machine ID Transducer ID	estNet-GP N/A	SAMPL DEPTH BAC		
	on of loading axis with t to bedding or foliation rees <u>90</u>	Ram Area cm <sup>2</sup>	N/A N/A			
Lithold	o <b>gy:</b> Gneiss	Comments		PROJEC SAMPLE DEPTH	BH12-05	
	t data given herein perta s a testing service only. I provide			PROJEC SAMPLI DEPTH BA	E BH12-05	
М	. Miller M	March 25, 2013	E. Kostyu	lkov	March 26, 2013	
	STED BY	DATE	CHECKED	PV	DATE	

<b>A</b> Go Asso	lder ciates			Lab	Associates Ltd Burnaby II Creek Drive
	Tens		Reference ISRM 1981 (p120-12		
roject No.:	09-1416-0062/5000		Borehole:	BH12-09	101101 1001 (p120-12
Project: CRD WWTP Geotechnical Investigation		al Investigation	Sample Number:	N/A	
ocation:	Not Provided	0	Depth (ft):	11.17-12.50	
lient:	Stantec		Lab ID No:	52	
				-	
Max Lo	Testing Results ad (MN) <u>0.0152</u> Stress (MPa) <u>8.4</u>	Sample Meas Diameter (mm) Thickness (mm) Area (cm <sup>2</sup> ) Volume (cm <sup>3</sup> ) Mass (g) Moisture Content (%) Wet Density (Kg/m <sup>3</sup> ) Dry Density (Kg/m <sup>3</sup> )	44.03 26.04 15.23 39.65 104.10 0.19 2625.56 2620.55	PROJE SAMPL DEPTH FROM	E BH12-09
Type:	Failure Mode Vertical Splitting Load Orientation	Calibrati	on estNet-GP	PROJEC SAMPL DEPTH	E BH12-09
	on of loading axis with t to bedding or foliation	Ram Area cm <sup>2</sup>	N/A		
in deg	rees <u>90</u>	Data Logger	N/A	PROJEC	the second se
Lithold	ogy: Granodiorite	Comments		SAMPLE DEPTH ( FRO	
	a testing service only.	in to the sample provide Interpretation of the data		PROJEC SAMPLE DEPTH ( BAC	BH12-09
M	I. Miller	March 25, 2013	E. Kostyu		March 26, 2013
	ESTED BY	DATE	CHECKED	RV	DATE

Geotechnical Data Report

Core Area Wastewater Treatment Program Final

## **APPENDIX E**

**Rock Core Photos** 



One Team. Infinite Solutions.



BH12-1B - Depth from 18' to 23' – Dry



BH12-1B - Depth from 18' to 23' – Wet





BH12-1 - Depth from 25'6" to 30'6" – Dry



BH12-1 - Depth from 25'6" to 30'6" – Wet





BH12-3 - Depth from 48' to 53' – Dry



BH12-3 - Depth from 48' to 53' – Wet





BH12-4 - Depth from 27'2" to 38'9" – Dry



BH12-4 - Depth from 27'2" to 38'9" – Wet





BH12-5 - Depth from 13'5" to 34'4" – Dry



BH12-5 - Depth from 13'5" to 34'4" – Wet





BH12-6 - Depth from 5'6" to 34'6" – Wet





BH12-6 - Depth from 5'6" to 34'6" – Dry

111700431-308.150



BH12-7 - Depth from 40'9" to 44'11" – Dry



BH12-7 - Depth from 40'9" to 44'11" – Wet





BH12-8 - Depth from 28'5" to 33'8" – Dry



BH12-8 - Depth from 28'5" to 33'8" – Wet





BH12-9 - Depth from 6' to 65' – Dry



BH12-9 - Depth from 6' to 65' – Wet



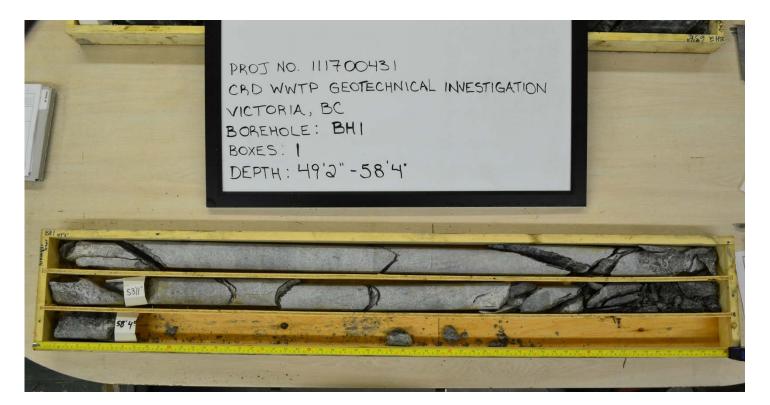


BH12-10 - Depth from 36'6" to 40'6" – Dry

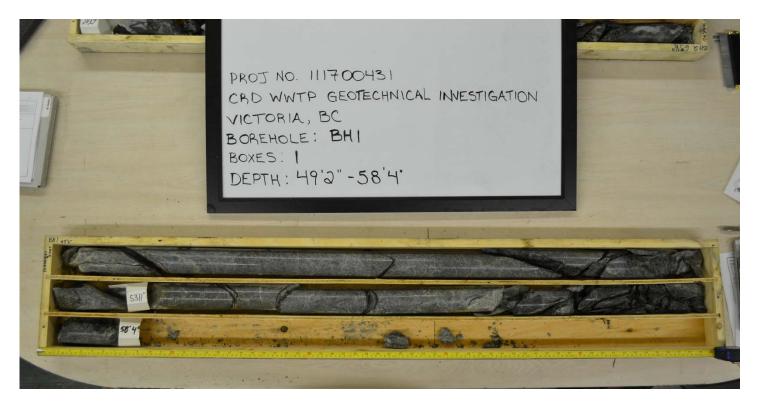


BH12-10 - Depth from 36'6" to 40'6" – Wet



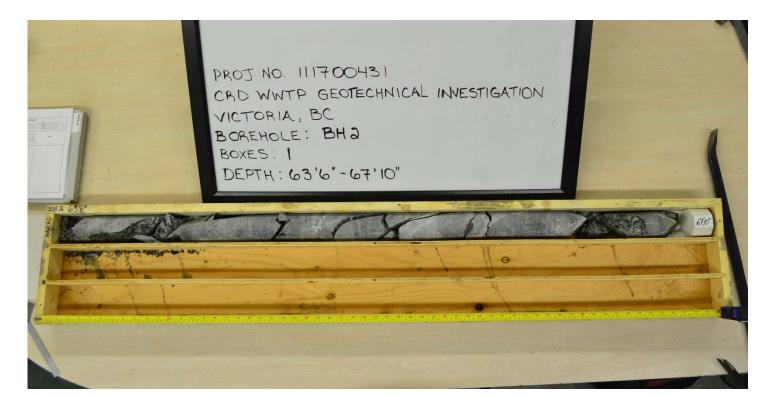


BH1 – Depth from 49'2" to 58'4" - Dry



BH1 – Depth from 49'2" to 58'4" – Wet





BH2 – Depth from 63'6" to 67'10" – Dry



BH2 – Depth from 63'6" to 67'10" – Wet





MBH13-1 - Depth from 115'2" to 146' - Dry



MBH13-1 - Depth from 115'2" to 146' – Wet





MBH13-1 - Depth from 146' to 165'9" – Dry



MBH13-1 - Depth from 146' to 165'9" - Wet





MBH13-2 - Depth from 95'4" to 138'5" – Dry



MBH13-2 - Depth from 95'4" to 138'5" – Wet





MBH13-2 - Depth from 138'5" to 165'11" - Dry

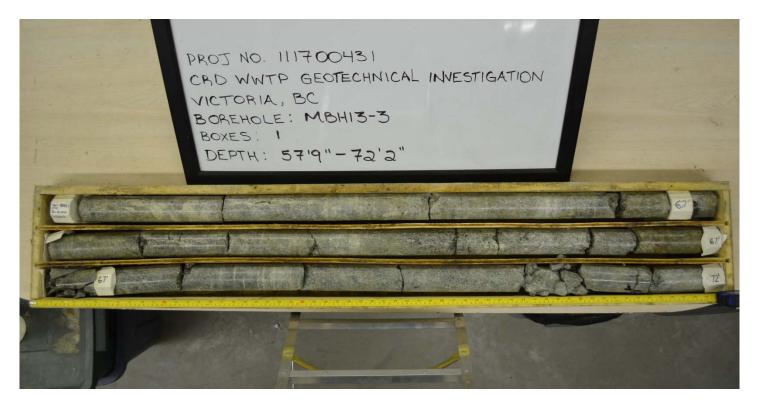


MBH13-2 - Depth from 138'5" to 165'11" - Wet





MBH13-3 - Depth from 57'9" to 72'2" – Dry



MBH13-3 - Depth from 57'9" to 72'2" – Wet





MBH13-3A - Depth from 54'8" to 99'2" – Dry



MBH13-3A - Depth from 54'8" to 99'2" - Wet





MBH13-3A - Depth from 100' to 140'1" – Dry



MBH13-3A - Depth from 100' to 140'1" – Wet





MBH13-3A - Depth from 140'4" to 164'3" - Dry

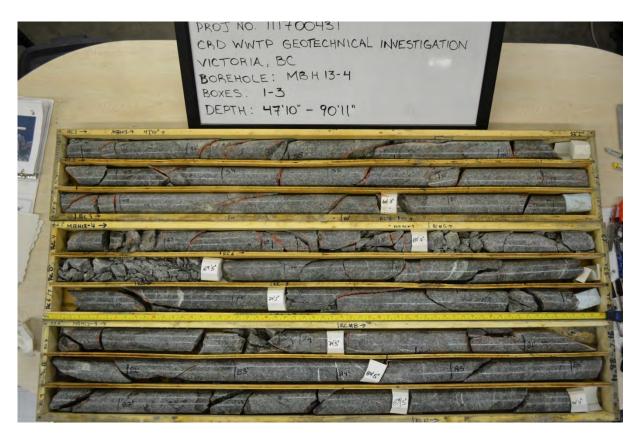


MBH13-3A - Depth from 140'4" to 164'3" – Wet



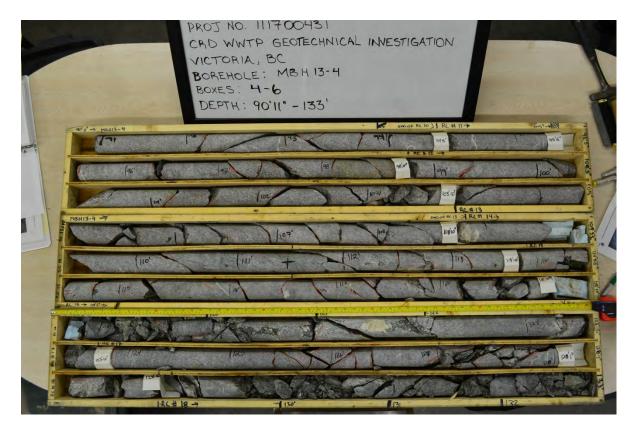


MBH13-4 - Depth from 47'10" to 90'11" - Dry



MBH13-4 - Depth from 47'10" to 90'11" - Wet





MBH13-4 - Depth from 90'11" to 133' - Dry



MBH13-4 - Depth from 90'11" to 133' - Wet





MBH13-4 - Depth from 133' to 165'1" – Dry



MBH13-4 - Depth from 133' to 165'1" – Wet



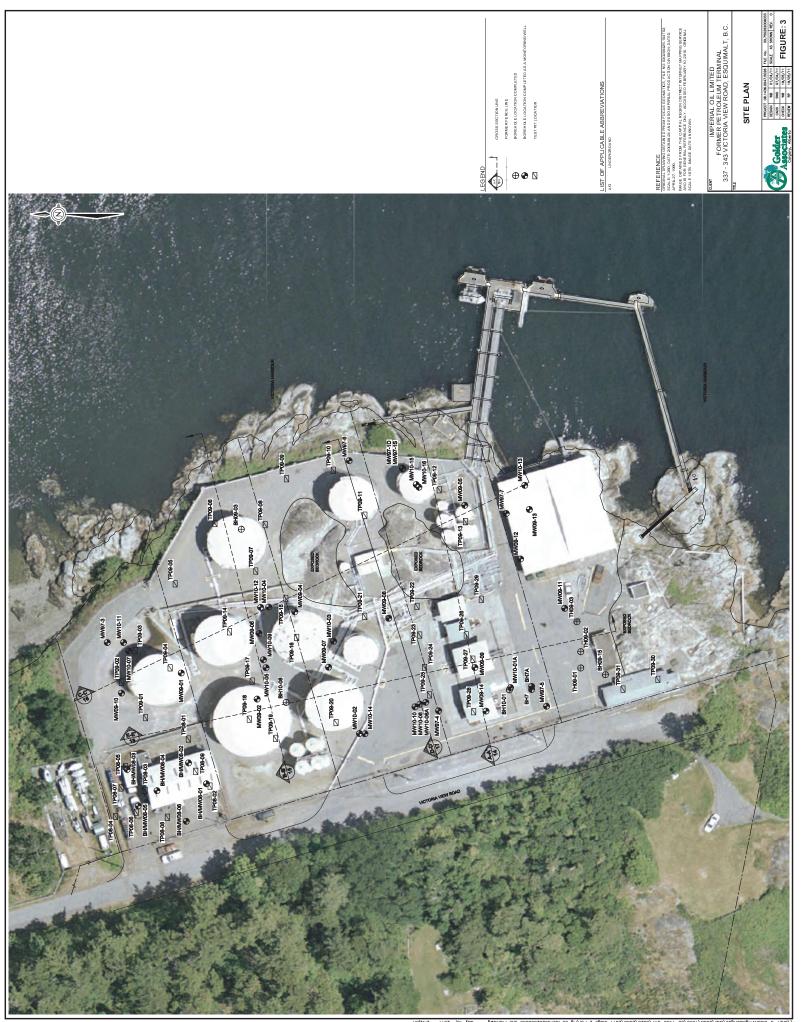
Core Area Wastewater Treatment Program Final

# **APPENDIX F**

Drawing and Test Hole Logs from Stage 2 PSI by Golder Associates



One Team. Infinite Solutions.



	SOIL PROFILE			SAM	IPLES	Organic	Vapour N	/leter					
DEPTH SCALE METRES		⊢ I				ppm						$\oplus$	
H SC TRE		STRATA PLOT	ELEV.	BER	щ		10	20	)	30	40		ADDITIONAL LAB TESTING
EPTI	DESCRIPTION	ATA	DEPTH	NUMBER	ТҮРЕ	ppm							
		STR	(m)	2			100	20	0	300	400		
— o	Ground Surface												
-	Loose, moist, dark brown, coarse SAND and GRAVEL, rootlets. [FILL]		0.00										
-													-
-						_							-
-				01-1	GS	÷							
-													
-													-
-													-
-													-
-													
- 1													-
-													-
													-
F	Loose, wet to saturated, dark brown, coarse SAND, some gravel, root and septic pipe tile inclusions. [FILL]		1.40			-							.
F	inclusions. [FILL]			01-2	GS	₽							
-						-							
+	Soft moist to wet grey and light-brown with		1.80										-
-	Soft, moist to wet, grey and light-brown with orange-brown banding, fine SAND and SILT, silt seams.												-
- 2	sit seams.												-
-													-
-				01-3	GS	₽							-
													-
_													-
-	Firm maint area and aronge brown method		2.70										-
-	Firm, moist, grey and orange-brown mottled CLAYEY SILT, trace fine sand seams.	И	2.70										-
-													-
- 3		ſμ				-							-
F		ΥL		01-4	GS	€							-
-		И											-
-		И											-
F	End of TEST PIT.		3.50										
F													
+													
F													-
- 4													-
F													-
F													
<del>-</del> [													
5/19/													
Ц Ц													
L.GD													
Ð.													
dL- 5													-
0													
IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11	PTH SCALE												LOGGED: AK
⊢   1 :	: 25				5	Go	Dider	tes					CHECKED:
≚∟'						- X BOO	JUIG						

	SOIL PROFILE			SAN	IPLES	Organic	c Vapo	ur Meter				•	
DEPTH SCALE METRES		OT		~		ppm	10	2	0	30	40	₽	
TH S METR	DESCRIPTION	A PL	ELEV.	NUMBER	ТҮРЕ				Ĩ	1			ADDITIONAL LAB TESTING
DEP		STRATA PLOT	DEPTH (m)	ÎN	⊢ ⊢	ppm	100	20	00 3	300	400		
		ى: ا						20			400		
- 0	Ground Surface Loose, moist, brown and orange-brown,	<b>***</b>	0.00				-						
_	Loose, moist, brown and orange-brown, coarse SAND and GRAVEL, roots, brick rubble fragments. [FILL]		3										-
-													-
			3										
_			\$										-
-						_							-
-				02-1	GS	÷							-
-						_							-
-			Š.										-
- 1													
			2										-
_	Dense, moist, grey with orange-brown mottling silty SAND. - slight hydrocarbon-like odour.		1.20										-
-	- slight hydrocarbon-like odour.					_							=
-				02-2	GS				Ð				-
_						-							-
-													-
	Firm, moist, grey with light brown banding CLAYEY SILT. - some black and dark grey staining. - hydrocarbon-like odour.		1.80										-
- 2	- some black and dark grey staining.	ΥU											_
		Ш											_
_		И											-
-			1			-							-
-		ſIJ	1	02-3 02-4	GS							160	₽ –
_		ΥU											-
		И											
_	Firm, moist, orange-brown with grey banding CLAYEY SILT.		2.70										_
_		ſμ		02-5	GS	<b>₽</b>							-
- 3		ΥIJ											_
-		Ш											-
-		И											-
	End of TEST PIT.	1	3.30										
_	Note: Sample 02-4 is a Field Duplicate of Sample 02-3.												_
-													-
-													-
-													-
-													-
4													_
_													_
-													-
9/11													-
05/1													-
TOS													-
IOL.C													-
L L													
O.L. 5													-
- IO													
IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11						Seator Sector							
	PTH SCALE					G	oldg	er ates					LOGGED: AK
₫ <u>1</u> :	25					ASS	<u>ioci</u>	ates					CHECKED:

	SOIL PROFILE			SAM	IPLES	Organic V	apour Met	er				
DEPTH SCALE METRES						ppm			20	40	$\oplus$	
TH SC	DECODIDION	STRATA PLOT	ELEV.	NUMBER	H		10	20	30	40		ADDITIONAL LAB TESTING
DEPT	DESCRIPTION	RATA	DEPTH	MUN	ТҮРЕ	ppm						
		STI	(m)			1	100	200	300	400		
— o	Ground Surface		0.00					_				
-	Loose, dry, brown and orange-brown, GRAVEL and SAND, coarse, concrete debris, rootlets. [FILL]	$\bigotimes$										
-		$\otimes$										
-												-
-		$\otimes$										
		$\otimes$										
-												
-						-						
- 1				03-1	GS (	Ð						-
-						-						-
-												-
-												-
-	Stiff, moist, light grey and orange-brown	KXX I	1.70									
-	Stiff, moist, light grey and orange-brown CLAYEY SILT, trace coarse gravel. - very slight hydrocarbon-like odour.	КЦ										-
2				03-2	GS	Ð						
				03-2	65	Ð						
-		ſИ										
+	Stiff moist grey with orange-brown and	<u>  </u>	2.30									-
-	Stiff, moist, grey with orange-brown and brown banding SILT, some clay. - at 3.0m depth: becoming brown throughout, very stiff, breaking in planes with dark brown staining in fractured zones. No odour.											-
-	very stiff, breaking in planes with dark brown staining in fractured zones. No odour			03-3	GS (	Ð						-
-	stanning in nactured zones. No odour.											-
						-						
-				03-4	GS (	₽						-
- 3						-						_
-												-
-												-
	End of TEST PIT.		3.30									
-												
-												
-												
-												-
4							1					-
Ļ												
F												
9/11							1					
05/1							1					
GDT												
L95							1					
5 – 19.							1					-
IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11					Â							
	PTH SCALE					Gol	lder					LOGGED: AK CHECKED:
	20					ASSO	<u>crate</u>	5				UNEUNED.

	SOIL PROFILE			SAM	PLES	Organic Va ppm	pour Met	er			•	
DEPTH SCALE METRES		OT					0	20	3	0 4	0	
AETR	DESCRIPTION	LA PL	ELEV.	NUMBER	ТҮРЕ		·					ADDITIONAL LAB TESTING
DEP		STRATA PLOT	DEPTH (m)	INN	Ĥ	ppm 1	00	200	) 3(	00 40	00	
	Ground Surface	S							/ 50			
- 0	Concrete (oil water separator).		0.00									
_												
_												
_												
-												-
-												-
_												
- 1	Loose wet arev SAND HC-like dour		1.00			-						_
-	Loose, wet, grey SAND, HC-like odour, stained. [FILL] - hydrocarbon-like odour and grey stained.		1.00	04-1	GS						11	
-				5.1							11	· [ ·
Ĺ						1						
Ļ												
-												
-												-
-	Soft, moist, grey and orange-brown SILT,		1.80									-
2	some clay. - hydrocarbon-like odour.			04-2	GS					Ð		-
				04-2		-				Ŷ		-
-												-
-												-
-												-
_	Stiff, moist, brown with grey mottling CLAYEY SILT, trace fine sand.		2.60									-
-		ſ₩	1									-
-		nµ										-
- 3		ΥŲ										_
_		КL		04-3 04-4	GS (	€						-
-		KI.				-						-
-	End of TEST PIT.	μŀ	3.40					-				
-	Note: Sample 04-4 is a Field Duplicate of Sample 04-3.											-
-												
-												-
- 4												-
[												
-												
9/11												-
05/1												-
IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11												
GPJ												
- - - - - - - - - - - - - - - - - - -												-
0												
	PTH SCALE						dor					LOGGED: AK
10	: 25				V	Gol	ciate	S				CHECKED:

	SOIL PROFILE			SAM	IPLES	Organic V	apour Me	eter					
DEPTH SCALE METRES		5				ppm	10	20		30	40	$\oplus$	
TH S( ETRE	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ			20		1	40		ADDITIONAL LAB TESTING
DEP.	DESCRIPTION	RAT/	DEPTH (m)	NUN		ppm							
		ST	(11)				100	200	3	00	400		
— o	Ground Surface Loose, brown, wet to moist, medium SAND		0.00				-						
-	Loose, brown, wet to moist, medium SAND and GRAVEL, rootlets. [FILL]												
-													
-													-
-													
_													-
-													
-													
- 1													-
-													-
-													-
				05-4	GS (	<b>]</b> ∌							
-													
-													-
-													-
-													-
2	Loose, wet, dark grey and black, medium to coarse SAND. - odours and sheen.		2.00										_
	- odours and sheen.			05-1	GS						<b>•</b>		
-						-					Ī		-
-	Stiff to very stiff, moist, blue-grey and banded	ПИ	2.40										-
-	Stiff to very stiff, moist, blue-grey and banded brown CLAYEY SILT, trace fine sand.	$ \mathcal{M} $											-
-						-							-
-				05-2	GS (	Ð							-
		nи											
- 3		ΥIJ											-
-													-
-		$\mathcal{A}$											-
-						-							-
-		ſμ		05-3	GS (	Ð							-
	End of TEST PIT.		3.50										
_													-
-													-
-													-
- 4													-
													-
- 11													
1													
													-
DL.G													
L L													
LP.GF													
°,													
IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11	1	1		L			1			1			I
	PTH SCALE					Gol	lder						LOGGED: AK
리 :	25					Asso	ciat	es					CHECKED:

	SOIL PROFILE			SAM	PLES	Organic ppm	Vapour N	Neter					
DEPTH SCALE METRES		5				ppm		20	<b>`</b>	20	40	$\oplus$	
ETRE	DECODIPTION	STRATA PLOT	LEV.	NUMBER	TYPE		10	20	)	30	40		ADDITIONAL LAB TESTING
DEPI	DESCRIPTION	EAT/	EPTH	NN	Ţ	ppm							
		STI	(m)				100	200	0 3	300	400		
— o	Ground Surface		0.00				_						
-	Loose, moist, brown and rust-orange/brown, coarse SAND and GRAVEL, rootlets. [FILL]		0.00										
-													
-													
-													
-													-
-													-
-													-
-													-
-													-
- 1													-
-				06-1	GS (	€							-
-													-
L													
_	Soft to stiff, moist, brown and grey banded CLAYEY SILT, trace fine sand seams.		1.50										-
_		ŊИ		06-2 06-3	GS (	€							-
-		КЦ				-							-
+													-
- 2													-
-		ſИ											-
F		КЦ											-
-													-
-													-
-		ſИ											-
		КЦ											-
_													-
- 3	End of TEST PIT.		3.00				_						
-			3.00										-
-	Note: Sample 06-3 is a Field Duplicate of Sample 06-2.												
-													
-													-
-													· · · ·
F													-
L													
- 4													-
-													
F													
9/11													
05/1													· · ·
101													· · ·
OL.G													- · · ·
L L													· · ·
F-10													_
IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11	1				A			1		1			
ت DE	PTH SCALE					Go	Ider						LOGGED: AK
d 1 :	: 25				V	Ass	DCia	tes					CHECKED:

	SOIL PROFILE			SAM	PLES	Organic Va ppm	pour Me	ter			•	
DEPTH SCALE METRES		DT.		r			0	20	3	i0 4	₩ 40	
PTH S	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ						1	ADDITIONAL LAB TESTING
DEP		TRAT	DEPTH (m)	NU	⊢	ppm 1	00	200	.3(	00 4	00	
	Ground Surface	S										
- 0	Soft, most, black and brown with grey SAND and SILTY CLAY, some coarse sand, rootlets, brick pieces. [FILL]		0.00									
	brick pieces. [FILL]											
_												
-												
_												
-												
_						-						
- 1				07-1	GS 🤅	Ð						_
-						-						
-												
Ļ												
_	Dense dark brown and rusty-brown coarse		1.60	07-2	GS (	₽						
-	Dense, dark brown and rusty-brown, coarse GRAVEL, some coarse sand.											
-	Stiff, moist, grey and brown CLAYEY SILT, trace fine sand seams.		1.80									
2	trace fine sand seams.	ΚĻ										
		KL										
-		И										
-		$\mathcal{V}$										
-												
		ſ //		07-3	GS (	•						
_		ſμ				-						
-		ΗJ										
-		КL										
- 3	End of TEST PIT.		3.00									
_												
-												
-												
_												
-												
-												
- 4												-
Ĺ												
_												
9/11												
IOL-TP.GPJ IOL.GDT 05/19/11												
GDT												
GPJ												
JC-TP												-
					Â							
DE DE TO	PTH SCALE					Gol	der					LOGGED: AK
1 :	25					Asso	ciate	es				CHECKED:

	SOIL PROFILE			SAM	IPLES	Organic	Vapour M	leter					
DEPTH SCALE METRES		5				ppm	10	20		30	40	$\oplus$	
TH S( ETRE	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ			20		1	40		ADDITIONAL LAB TESTING
DEP.	DESCRIPTION	RAT/	DEPTH (m)	NUN		ppm							
		ST	(11)				100	200	) 3	·00 ·	400		
— O	Ground Surface Loose, moist, rust-brown, SAND and	$\otimes$	0.00								_		
-	GRAVEL, coarse, rounded, concrete and brick inclusions. [FILL] - at 0.9m depth: Brick/Terra cotta pipe approximately 254mm diameter.												-
-	- at 0.9m depth: Brick/Terra cotta pipe												-
-	approximately 254mm diameter.												-
-													-
-													-
_													_
-													-
-													-
- 1				08-1	GS	ŧ							-
-													-
-													-
-													-
		$ \otimes $											
-	0.1%	$\bigotimes$											-
-	Stiff, moist to wet, tan and blue-grey mottled CLAYEY SILT, with coarse sand, some	И	1.60										-
-	gravel.			08-2	GS (	ŧ							-
-		ŊИ											-
- 2		КIJ											-
-													-
	Stiff to very stiff, moist, grey with brown-tan mottling, CLAYEY SILT, trace fine sand seams.		2.20										
_	seams.	ŊИ											-
-		ИJ											-
-													-
-		И											-
-		IV/											-
3		ſИ		08-3	GS (	€							
_		КЦ	3.10				_						
-	End of TEST PIT.		3.10										-
-													-
-													-
-													-
-													-
- 4													-
-													-
													-
=													
5/19/													-
10													
JL-GL													-
2-2													
Ъ.													-
5   													-
8	l	1											
IOL TP LOG IOL-TP:GPJ IOL.GDT 05/19/11	PTH SCALE				Ô	Go	lder						LOGGED: AK
1 :	25				V	Ass	ociat	tes					CHECKED:

	SOIL PROFILE			SAM	IPLES	Organic Va	pour Meter					
DEPTH SCALE METRES		F						~		40	$\oplus$	
H SC		STRATA PLOT	ELEV.	NUMBER	щ	1	0	20	30	40		ADDITIONAL LAB TESTING
ME	DESCRIPTION	RATA	DEPTH	MUM	ТҮРЕ	ppm						
		STF	(m)	2		1	00 2	200	300	400		
— 0	Ground Surface											
-	Loose, moist, brown, coarse SAND and GRAVEL, with fragments of concrete and		0.00									
-	brick. [FILL]											-
-												-
-												-
-												-
-												-
-												-
-												-
-												-
- 1				09-1	GS	€						-
-												-
-	Loose, wet, rusty-brown, SAND and GRAVEL, trace silt, coarse sand. - at 2.2m depth: blue-grey, some silt,	0	1.20									-
	- at 2.2m depth: blue-grey, some silt,	°,0										
	hydrocarbon-like odour to 2.4m depth.	000										_
-		° 0										-
-		0				-						-
-		ι. Λ		09-2	GS	Ð						-
-		0	1			-						-
- 2		0°.										
-												-
-		° Ö										-
-		° ()		09-3	GS						1206	Ð -
-		0										-
		° ()										
	Stiff, moist, brown with blue-grey mottling, CLAYEY SILT, trace fine sand seams,		2.60			_						-
_	CLAYEY SILT, trace fine sand seams. - at 2.9m depth: becoming brown throughout.	$\Pi$		09-4	GS	€						-
-		KIL				-						-
- 3		И										
-		И	]									-
-	End of TEST PIT.	ŤШ.	3.20									
-												-
-												-
												-
F												
$\vdash$												-
- 4												
F												-
F												-
_F												-
19/1												-
05/												-
GDT												-
G-												
0. d - 5												-
- D												
IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11												
DE	PTH SCALE					Gol	der					LOGGED: AK
J 1 :	: 25					Asso	<u>ciates</u>					CHECKED:

	M TYPE: RKI Eagle RING DATE: December 16, 2008 TUM: Local			RE	COR	D OF	MON	NITO	RIN	g we	ELL:	MW08-	-01
DEPTH SCALE METRES	SOIL PROFILE	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	SAM	RECOVERY %	BLOWS/0.3m	Soil Va	apour Co	0 30 Intent (%LE	40 I	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION Top of Pipe
0	Ground Surface Loose, dry, brown, medium SAND. [FILL]		6.58 0.00										Elevation = 7.44m
- 1	Firm, moist, dark brown SILT, some sand, trace gravel, concrete and brick pieces. [FILL] - at 1.37m depth: Large chunks of concrete (100 - 152mm).		<u>6.12</u> 0.46	Sa1	DO								Bentonite Seal $\overline{\Sigma}$
	Loose, wet, dark brown SAND and GRAVEL.		5.06 1.52	Sa5	DO			-					Filter Sand
2	[FILL] Very stiff, moist, brown with grey mottling, silty CLAY.		<u>4.75</u> 1.83	Sa3	DO			- - -					Slotted PVC Pipe
3				Sa4	DO			- - -					
4			1.70										Hydrated Bentonite
5	End of MONITORING WELL.	<u> </u>	4.88										
6													
7													
8													
9													

	RING DATE: December 16, 2008 IUM: Local							DOF	REHOLE:		00-02		1	
	SOIL PROFILE	Ŀ				SAN	IPLES	۶	PID ppm		•	ING		
	DESCRIPTION	STRATA PLOT	El DE (	LEV. EPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	BLOWS/0.3m	10   2     Soil Vapour Cor     20   4	itent (%LEL)	40 	ADDITIONAL LAB TESTING	PIEZOMETE OR STANDPIPE INSTALLATIO Top of Pipe Elevation = 7.	E ON
) -	Ground Surface Soft, moist, dark brown, sandy SILT, coarse sand, some gravel. [FILL] - wet at 0.61m depth. - at 1.37m depth: brick and concrete pieces.			6.37 0.00									Filter Sand	
1					Sa1	DO							Bentonite Seal	Ā
	Firm to stiff, dry, light grey and rusty-brown		8	4.69 1.68	Sa2	DO								
2	banded SILT. - at 3.35m depth: grey with brown mottling.				Sa3	DO							Filter Sand	
3														
ı.					Sa4	DO			 ⊕ 				Bentonite Seal	
					Sa5	DO			-					
5	Stiff, dry to slightly moist, grey and brown			0.88									Filter Sand	
	CLAYEY SILT. - at 6.1m depth: Soft.				8.06	DO								
ò				-0.34	Sa6	DO			-				Slotted PVC Pipe	
,	Very dense to stiff, moist, grey-brown, fine sandy SILT, some gravel, contains cobbles.			6.71 -0.95	Sa7	DO			-   ⊕					
	Refusal - grey BEDROCK.			7.32									Filter Sand	
3	End of BOREHOLE.			7.62										
,														
,														

	SOIL PROFILE				SAM	PLES		PID ppm				Ð			
METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	BLOWS/0.3m	1 Soil Va	apour Co	0 3 ntent (%L	.EL)	0	ADDITIONAL LAB TESTING	PIEZOMETE OR STANDPIPE INSTALLATIC Top of Pipe Elevation = 6.	E DN
0	Ground Surface Soft, moist to wet, brown to dark brown, coarse sandy SILT some gravel [FIL1]		5.80 0.00											Filter Sand	
	coarse sandy SILT, some gravel. [FILL] - at 0.91m depth: Brick and Concrete pieces.			Sa1	DO										
1			4.43	Sa2	DO			- -						Bentonite Seal	Į.
2	Stiff to very stiff, dry to moist, brown with grey banding, SILT, some clay. - at 4.27m depth: Increased clay, plasticity increasing.		1.37												
3				Sa3	DO			- 						Bentonite Seal	-
4				Sa4	DO			- 						Filter Sand	
4				Sa5	DO			- -							
5.	Medium dense, moist, brown and grey, SAND and GRAVEL, some cobbles, trace silt.		0.77	Sa6/7	DO			- €						Slotted PVC Pipe	
6	Refusal (BEDROCK) End of MONITORING WELL.		0.01 5.79 -0.30 6.10											FilterSand	
	Note: Sample 7 is a Field Duplicate of Sample 6.														
7															
8															
9															

	SOIL PROFILE				SAM	PLES		PID ppm				Ð	(1)	
METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	BLOWS/0.3m	1	pour Coi	ntent (%L	LEL)		ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION Top of Pipe Elevation = 7.04m
0	Ground Surface Soft, moist to wet, dark brown, coarse sandy SILT, some gravel. [FILL]		6.66 0.00											FilterSand Bentonite Seal
1	Stiff to very stiff, dry, olive brown and grey mottled SILT, trace to some clay. - at 4.27m depth: Increased moisture, grades to CLAYEY SILT - at 5.18m depth: Colour change to light brown, becoming wet.		5.75 0.91	Sa1	DO			<b>•</b>						∑
2				Sa2	DO			-						FilterSand
4				Sa3	DO			- - -						Bentonite Seal
5				Sa4	DO			- 						FilterSand
6	Refusal (BEDROCK) Cored to 6.25m depth		0.87	Sa5	DO			-						Slotted PVC Pipe
7	End of MONITORING WELL.		0.41 6.25											
8														
-														
9														

	RING DATE: December 16, 2008 TUM: Local			KE					KING		_L. N	/IW08-0	J5 
	SOIL PROFILE	< .	ELEV. DEPTH (m)	NUMBER	SAM I Abe	RECOVERY %	BLOWS/0.3m	PID ppm 10 Soil Vap 20	20 Jour Conte	30 ent (%LEL) 60	⊕ 40 □ 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION Top of Pipe
0	Ground Surface Loose, moist, dark brown, coarse sandy SILT, trace gravel, contains cobbles. [FILL]		6.58 0.00	Sa1/2	DO								Elevation = 7.34m Bentonite Seal
	Loose, moist, olive brown with grey fissure SILT.		5.82										Filter Sand
2				Sa3	DO			0					Bentonite Seal
3.	Loose, moist to wet, brown SAND and GRAVEL, coarse, contains cobbles.	0,00	3.53 3.05	Sa4	DO			- 					Filter Sand
4				Sa5	DO			- +					Slotted PVC Pipe
5	End of MONITORING WELL.	a, ()	1.70 4.88										
6													
8													
9													

	TUM: Local											. IV	<b>/IW08-0</b>		
METRES	SOIL PROFILE DESCRIPTION Ground Surface	STRATA PLOT	ELEV. DEPTH (m) 6.91	NUMBER	SAM BUCK	RECOVERY %	BLOWS/0.3m	_ ppm 1 Soil Va	apour Co	0 3 ntent (%L	EL)		ADDITIONAL LAB TESTING	PIEZOMETE OR STANDPIPI INSTALLATIC Top of Pipe Elevation = 7.	E DN
0	Loose, moist, brown, silty SAND, some gravel, brick and concrete pieces. [FILL]		0.00	Sa1	DO			- - -						Filter Sand Bentonite Seal	Ţ
2				Sa2	DO			- - -						Filter Sand	
3	Stiff to very stiff, dry, olive-brown with blue grey fissure SILT, trace clay.		<u>4.47</u> 2.44	Sa3	DO			- -						Slotted PVC Pipe	
5	End of MONITORING WELL.		3.25 3.66	Sa4	DO			- <del>-</del>							
4															
5															
6															
7															
8															
9															
10															

	SOIL PROFILE	-		SAN	IPLES	Organic Vapour N	leter		$\oplus$	
METRES		STRATA PLOT		н.		400	800	1200	1600	ADDITIONAL
METF	DESCRIPTION	TA PI	ELEV.	NUMBER	ТҮРЕ	Soil Vapour Conte	ent (%LEL)			ADDITIONAL LAB TESTING
2		[RA]	DEPTH (m)	NN	⊢ ⊢	10				
		ی ا			-	10	20	30	40	
0	Ground Surface Compact, dry, grey SAND and GRAVEL.		4.66							
	(FILL)		× 0.00							
	- no ódour. - some red staining below 0.2m.									
	- some red starning below 0.2m.			1	GS	♥				
			4.16							
	Loose, moist, green-grey SAND, with some gravel, peat (black) interbedded lenses.		0.50							
	(FILL)									
	- musty odour.			2	GS	₽				
1										
			3.46							
	Firm, moist, brown and grey, blocky, sandy		1.20			1				
	Firm, moist, brown and grey, blocky, sandy SILT, trace clay. - no odour or staining. - moisture increases and silt content with			3	GS	<b>↓</b>				
	- moisture increases and silt content with									
	depth. - very dense, grey at 2.8m.		1			1				
			.							
		团								
			1							
			1							
2										
			1							
			]			4				
				4	GS	L I				
			.			4				
ļ			1.86		GS	L				
	End of TEST PIT.		2.80	-						
3										
Ŭ										
4										
5										
		-						1	I	1
DEI	PTH SCALE					Golder	•			LOGGED: PM/RM
	25									CHECKED: WB/RP

ļ	SOIL PROFILE			SAM	PLES	Organic Va	apour Mete	er'			⊕	
METRES		STRATA PLOT		H			00	800	1200	1600		ADDITIONAL LAB TESTING
ME	DESCRIPTION	ATA	ELEV. DEPTH	NUMBER	ТҮРЕ	Soil Vapou	ir Content	(%LEL)				LAB TESTING
		STR.	(m)	z			10	20	30	40		
0	Ground Surface		4.14									
0	Compact, dry, brown, angular SAND and GRAVEL. (FILL)		0.00									
	- no odour. - some grey staining at 0.4m.											
	- some grey starning at 0.4m.											
						-						
-	Loose, wet, grey stained SAND, with gravel	₩	3.64 0.50	1	GS	-						
	(sub-rounded).											
	(FILL) - water ponding at 0.9m. - sidewalls caving.			2/3	GS	Ð						
	- sidewalls caving.			2/5	00	l Ű						
1												
		×										
		×	2.64									
ſ	Loose to compact, moist, brown and grey mottled, silty SAND to sandy SILT, occasional		1.50	4	GS (	₽						
	peat inclusions.		1									
	<ul> <li>becoming grey, with some clay below 2.3m.</li> <li>trace hydrocarbon-like odour to 2.6m.</li> </ul>											
2												
			1									
						-						
				5	GS	₽						
			1.54			-						
ŀ	Dense, grey, moist, silty CLAY, blocky.		1.04	6	GS (	-  ₽						
Ī	End of TEST PIT.		2.70									
3												
4												
+												
5												
						L						
	PTH SCALE				Â	Gol						
	III OUNEL					i F Go	lder					LOGGED: PM/RM

╎┝	SOIL PROFILE			SAM	PLES	Organic Vapo	u weter				⊕	
METRES		STRATA PLOT		H		400		00	1200	1600		ADDITIONAL LAB TESTING
MET	DESCRIPTION	VTA F	ELEV. DEPTH	NUMBER	ТҮРЕ	Soil Vapour (	Content (%	LEL)				LAB TESTING
		STRA	(m)	N		10		20	30	40	-	
-+	Crewed Durfree	0)						-	1		-+	
0	Ground Surface Compact, dry, brown SAND and GRAVEL.	***	4.02 0.00								-+	
	(FILL)											
ŀ	Loose, wet, grey to silver, sub-rounded SAND		3.52 0.50									
	and GRAVEL. (FILL)											
	<ul> <li>strong hydrocarbon-like odour.</li> <li>water seepage at 0.7m with heavy</li> </ul>			1	GS						2150	
	hydrocarbon-like sheen.										2150	
1												
			2.82									
ŀ	Firm to stiff, moist, brown, grey mottled,	IIII	1.20									
	Firm to stiff, moist, brown, grey mottled, fractured SILT, trace sand to 2.5m. - very dense below 2.5m. - brown, dense, silty sand (almost sandstone			2	GS (	€						
	- brown, dense, silty sand (almost sandstone like at base of test pit).											
	like at base of test pit). - moist, grey pockets near base.					1						
2												
-												
				3	GS	Ð						
3												
				4	GS (	€						
						1						
4												
·												
╞	End of TEST PIT.		-0.18 4.20	5/6	- GS - (	▶						
	LIN ULIEST FIL		4.20									
5												
		<u> </u>			L							
חבי	PTH SCALE				Á	Gold						
	IIIOUALL					JE Gold	er					LOGGED: PM/RM

: [	SOIL PROFILE			SAN	IPLES	Organic Va	apour Me	ler				<b>⊕</b>	
METRES		STRATA PLOT		ĸ			00	800	120	00	1600		ADDITIONAL LAB TESTING
WEI	DESCRIPTION	TAP	ELEV. DEPTH	NUMBER	ТҮРЕ	Soil Vapou	r Conten	t (%LEL)					LAB TESTING
3 -		TRA	DEPTH (m)	NN			10	20	30	)	40		
		S					1			, 			
0	Ground Surface Loose, brown, dry, GRAVEL, some fine sand.		4.57 0.00								_		
	(FILL)												
			3										
ŀ	Loose, moist, grey, gravelly SAND.		4.07 0.50										
	(FILL) - hydrocarbon-like odour.												
				1	GS					$\oplus$			
1													
			3										
		×	3.07			-							
	Dense, moist, brown red, oxidized, silty SAND, some grey mottlings. - dense, dry to moist, brown and grey SILT, fractured, trace hydrocarbon-like odour to		1.50	2	GS	Ð							
	- dense, dry to moist, brown and grey SILT, fractured, trace hydrocarbon-like odour to												
	3.0m. - trace to some clay below 3.3m.												
	adde to some day below 0.311.												
2													
			1										
				3	GS	-  							
						1							
3													
Ŭ													
						1							
				4	GS	₽ 1							
ł	Dense, moist, grey CLAY, trace silt.		0.77 3.80										
4													
		V///											
		<i>\///</i>											
		V///											
				5	GS	- ⊕							
			-0.23	5	65	ľ							
	End of TEST PIT.		4.80									T	
5													
5													
			1			Go	1					I	
DE	PTH SCALE					CA	dor						LOGGED: PM/RM
	25						ciat	26					CHECKED: WB/RP

	SOIL PROFILE			SAM	PLES	Organic Vapour Meter				
DEPTH SCALE METRES		5				400 8	00 120	00 1600	Ð	
TH S ETRI	DESCRIPTION		ELEV.	NUMBER	ТҮРЕ	Soil Vapour Content (%				ADDITIONAL LAB TESTING
DEP		RAT.	DEPTH (m)	NUN	É					
		ST				10 2	20 30	) 40		
— o	Ground Surface		5.82 0.00							
-	Loose to compact, dry, red-brown, oxidized SAND and GRAVEL (sub-rounded).		0.00							-
-	(FILL)									-
-				1	GS	<b>₽</b>				-
-										-
-										-
-			5.12							-
-	Stiff, moist, brown SILT, trace sand and occasional clay pockets. - no odour or staining.	TI II	0.70							-
	- no odour or staining.									
L 1										_
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F										-
$\mathbf{F}$										-
-	Refusal in Bedrock at 1.7m.			2	GS 🤅	₽				-
F	End of TEST PIT.	┼╵╵┦	4.12 1.70							
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IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11 T										-
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126										
7 (50										
-004										-
5 1436										
-80										
LOG						Golder				
₽ DE	PTH SCALE					Golder				LOGGED: PM/RM
d1∶	: 25				V	Associates				CHECKED: WB/RP

	SOIL PROFILE			SAM	PLES	Organic Va	pour Meter				•	
DEPTH SCALE METRES		5				40	0 8	00	1200	1600		
ETRI	DESCRIPTION	A PL(	ELEV.	1BER	ТҮРЕ	Soil Vapour			1200			ADDITIONAL LAB TESTING
Δ D E D	DESCRIPTION	STRATA PLOT	DEPTH (m)	NUMBER	Ļ							
		ST	(m)			1	0 2	20	30	40		
— o	Ground Surface		5.53 0.00									
-	Loose to compact, dry, red-brown, SAND and GRAVEL, fine to coarse sand and sub-rounded gravel, some large blast rock		0.00									-
-	sub-rounded gravel, some large blast rock pieces. (FILL)											-
-	(FILL)											-
-				1	GS 🤅	Ð						-
-						-						-
-			1.00									-
-	Loose, moist, red-brown mottled, silty SAND, interbedded, fine angular gravel.		4.83 0.70									-
-	- no odour.											-
-	<ul> <li>large weathered bedrock boulders below</li> <li>1.0m.</li> </ul>			2	GS	Ð						-
- 1	1.011.					-						_
-												-
			4.23									-
Ľ	BEDROCK. - no odour or staining.		1.30	3	~~~	•						-
		$\mathbb{N}$	4.03	3	GS							
L	End of TEST PIT.	$ \top$	1.50									
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IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11 T	1							L				I
L DE	EPTH SCALE					Gol	der					LOGGED: PM/RM
J 1	: 25				V	Asso	ciates					CHECKED: WB/RP

	SOIL PROFILE		SAM	PLES	Organic Va	pour Meter				•	
DEPTH SCALE METRES		10	~		- 40	8 00	00	1200	1600		
TH S TH S	DESCRIPTION		NUMBER	ТҮРЕ		Content (%					ADDITIONAL LAB TESTING
DEP		LOTA PLOT DEPTH (m)	N	ŕ					10		
					1	0 2	20	30	40		
— o	Ground Surface Loose, dry to moist, brown to red-brown, silty	5.42 XXX 0.00									
-	Loose, dry to moist, brown to red-brown, silty SAND, some sub-rounded gravel. (FILL)										-
-	- no odour or staining.										-
-					-						-
-			1	GS	€						-
-											-
											_
-					-						_
-			2	GS	<del>\$</del>						-
- 1					-						-
-											-
-											-
-											-
E		<u>3.92</u> 1.50									-
	Stiff, moist, stained, grey SILT, trace sand. - hydrocarbon-like odour and hydrogen sulphide-like odour.	1.50	3/4	GS	Ð						
-	sulphide-like odour.										-
-											-
-											-
- 2											
-											-
-											-
-											-
		2.92									-
_	Compact, brown and grey, silty SAND, trace to some fine gravel. - trace hydrocarbon-like odour. - less gravel at 3.0m and increasing sand.	2.50	5	GS	⊕						_
_	- trace hydrocarbon-like odour.										_
-											-
-	Refusal in Bedrock at 3.0m.										-
— 3	End of TEST PIT.	2.42	6	GS	•						
-											-
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5 143											
0 0											
L DE	PTH SCALE				Cal	dar					LOGGED: PM/RM
IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11 . T	25			V	Gol	ciates					CHECKED: WB/RP

	SOIL PROFILE			SAM	PLES	Organic Va	pour Meter				•	
DEPTH SCALE METRES		D D		~		- 41	8 00	00	1200	1600		
AETR S	DESCRIPTION	LA PL	ELEV.	NUMBER	ТҮРЕ		r Content (%	1		I		ADDITIONAL LAB TESTING
DEP		STRATA PLOT	DEPTH (m)	NU		1	0 :	20	30	40		
	Cround Surface	S	5.42			'	- '	1				
— 0	Loose to compact, moist, red-brown SAND		0.00									
-	and GRAVEL. (FILL)											-
	- no ódour											
-				1	GS (	₽						-
-						-						-
-			4.70									-
-	Stiff, moist, red-brown, sandy SILT, trace fine		4.72 0.70									-
	Stiff, moist, red-brown, sandy SILT, trace fine to medium sub-rounded gravel. - no odour or staining.			2	GS (	₽						-
Ľ,			4.42 1.00									
- '	Loose, moist, coarse, red-brown, gravelly SAND, sub-rounded.	°.0	1.00	3	GS (	ŧ						-
-	Refusal in Bedrock at 1.3m.	0 ° C										-
F	End of TEST PIT.	<u>.</u> Q:	4.12 1.30	4	GS (	P						
F												-
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08-14; 08-14												_
90	1	1 1				÷.	I	1		I		1
- I	EPTH SCALE					Gol	der					LOGGED: PM/RM
J 1	: 25				V	Asso	ciates					CHECKED: WB/RP

ц I	SOIL PROFILE			SAN	IPLES	Organic Vapour	weter			⊕	
METRES		LOT		Ĥ		400	800	1200	1600		ADDITIONAL
MET	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	ТҮРЕ	Soil Vapour Co	ntent (%LEL)				ADDITIONAL LAB TESTING
7 1		ЗТRА	(m)	NL		10	20	30	40		
	Ground Surface	0)	6.16				1				
0	Loose to compact, dry to moist, brown SAND		0.00								
	and GRAVEL, with some silt below 0.3m. (FILL)			1	GS	<b>€</b>					
				2	GS	<b>♦</b>					
						-					
	Stiff, moist, red-brown to grey mottled SILT,		5.26 0.90	3	GS	♦					
1	Stiff, moist, red-brown to grey mottled SILT, trace to some fine sand. (FILL)					-					
	<ul> <li>occasional medium sub-rounded gravel.</li> <li>clay pockets increasing to some clay below</li> </ul>										
	- citaly pockets increasing to some citaly below 1.4m. - some wood pieces to 1.4m.										
	- some wood pieces to 1.4m.										
				4	GS						
	Dense, moist, mottled brown and red-brown		4.26 1.90								
2	Dense, moist, mottled brown and red-brown and grey, oxidized sandy SILT, trace clay with large blast rock pieces.										
	(FILL) - red brick fragment.			5	GS	- •					
						]					
	Refusal in Bedrock at 2.7m.			6	GS						
	End of TEST PIT.		3.46 2.70	0	60	¥					
3											
3											
4											
5											
					Ē						
	PTH SCALE					Golde	er				LOGGED: PM/RM
1:	25				V	Associa	ates				CHECKED: WB/RP

Under the state         Use it is the state of the state of the state is the state of the state of the state is the state of the	ш	SOIL PROFILE	SAM	PLES	Organic Vap	our Meter							
0         0	SCALI		LOT		£		40	0 80	00	1200	1600	⊕	ADDITIONAL
0         0	PTH 8	DESCRIPTION	TA PI		MBE	YPE	Soil Vapour	Content (%L	LEL)			_	LAB TESTING
0         Except formula, the sensitive         construction         construction           1         Construction         construction         construction         construction           2         Construction         construction         construction         construction           2         Construction         construction         construction         construction           2         Construction         constructio	DEF		TRA		NN	-	10	. 2	0	30	40		
Image: Second	-	Ground Surface	S	6.00				2		1	$\neg$		
	- c	Loose to compact, dry to moist, brown SAND		0.00									
	-	and GRAVEL. (FILL)			1	GS (	₽						-
		- 6" corragated steel drain pipe identified running north-south direction at 0.2m below		5.90									
Bit dy, tow and gy SLT, sorte free           Bit dy, tow and gy SLT, sorte free<	_	grade. - Test Pit extended west of pipe.	1111	0.30									-
	_	Stiff, dry, brown and grey SILT, some fine	Ш	5.70	2	GS	₽						
	-	Refusal in bedrock at 0.5m.	1	0.50									-
	-	End of TEST PIT.											-
	-												-
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	- 3	5											-
DEPTH SCALE LOGGED: PM/RM LOGG	-												-
DEPTH SCALE  LOGGED: PM/RM  CHECKED: WB/RP  LOGGED: PM/RM  CHECKED: WB/RP	Ē												
DEPTH SCALE 1:25 LOGGED: PM/RM LOGGED: PM/R	-												-
DEPTH SCALE 1: 25 LOGGED: PM/RM CHECKED: WB/RP	-												-
DEPTH SCALE LOGGED: PM/RM LOGG	F												-
DEPTH SCALE 1:25 LOGGED: PM/RM CHECKED: WB/RP	F												-
de - 4 de - 4	111												-
DEPTH SCALE 1: 25 LOGGED: PW/RM CHECKED: WB/RP	05/15												_
DEPTH SCALE 1:25 LOGGED: PM/RM CHECKED: WB/RP													
DEPTH SCALE 1 : 25 LOGGED: PM/RM CHECKED: WB/RP	OL.G												
DEPTH SCALE 1 : 25 LOGGED: PM/RM CHECKED: WB/RP													-
DEPTH SCALE 1 : 25 LOGGED: PM/RM CHECKED: WB/RP	TP.6												-
DEPTH SCALE 1 : 25 LOGGED: PM/RM CHECKED: WB/RP	2001)												-
DEPTH SCALE 1 : 25 DEPTH SCALE LOGGED: PM/RM CHECKED: WB/RP	1												
DEPTH SCALE 1 : 25 DEPTH SCALE LOGGED: PM/RM CHECKED: WB/RP	1 (5(												
DEPTH SCALE 1 : 25 DEPTH SCALE LOGGED: PM/RM CHECKED: WB/RP	- 004												-
DEPTH SCALE     LOGGED: PM/RM       1 : 25     CHECKED: WB/RP	143	5											
DEPTH SCALE     LOGGED: PM/RM       1 : 25     CHECKED: WB/RP	0 9												
1 : 25 CHECKED: WB/RP	D PLC	EPTH SCALE					Col	lor					LOGGED: PM/RM
	1						Assoc	iates					

	SOIL PROFILE			SAN	IPLES	Organic Va	pour Meter					⊕	
RES		LOT		Ĥ		4	00	800	120	10 1	600		ADDITIONAL LAB TESTING
METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	ТҮРЕ	Soil Vapou	r Content (	%LEL)					LAB TESTING
		STR4	(m)	N		1	0	20	30		40	_	
	Ground Surface	1	6.60			1							
0	Loose, dry, grey SAND and GRAVEL. (FILL)		0.00										
	(FILL)			1	GS	€							
			6.30			4							
	Firm, moist, brown, with grey pockets/staining SILT, some clay, some sand.		0.30										
	(FILL) - gravel lense, red-brown from 0.6m - 0.7m.												
	- grey at 0.7m. - hydrocarbon-like odour.												
	- some concrete, metal and wood debris.			2	GS	Ð							
1													
	Compact to loose, brown and grey, coarse		5.20 1.40	3	GS	_ €							
	Compact to loose, brown and grey, coarse SAND, some medium sub-rounded gravel. - strong hydrocarbon-like odour. - grey staining from 1.5m - 1.8m.					1							
						1							
	Refusal in Bedrock at 1.8m. End of TEST PIT.		4.80	4	GS			_				2400	)
	LINUUL TEST FIL.		1.00										
2													
2													
3													
4													
5													
DE	PTH SCALE					Gol	der						LOGGED: PM/RM
1.	25						ciate	6					CHECKED: WB/RP

	SOIL PROFILE			SAN	PLES	Organic Va	apour Mete				$\oplus$	
METRES	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ	4 Soil Vapou	00 I r Content (	800 // %LEL)	1200	160		ADDITIONAL LAB TESTING
Σ	DESCRIPTION	TRAT/	DEPTH (m)	NUN	Τ		10	20	30	40		
0	Ground Surface	0)	5.58					Ť			-	
Ŭ	Loose, moist, brown-red SAND, with gravel. (FILL)		0.00									
			5.28	1	GS (	₽						
	Moist, brown to black and grey SILT, trace sand.		0.30			-						
	(FILL)											
	- stained below 0.6m. - metal debris, wire conduits, with product surrounding lines, concrete. - occasional gravel.			2/3	GS	Ð						
	- occasional gravel.		X									
1												
	Soft, wet, black SLUDGE.		4.38									
	(FILL) - product ponding at 1.7m.		THEFT									
			TIPIE	4	GS (	- €						
	Refusal in Bedrock at 1.7m. End of TEST PIT.		- - 3.68 - 1.90	-								
2												
3												
4												
5												
DE	PTH SCALE				Â		الم					LOGGED: PM/RM
	25					Gol	ciato	0				CHECKED: WB/RP

	SOIL PROFILE			SAM	PLES	Organic Vapour Me	ter			⊕	
DEPTH SCALE METRES		DT .		r		400	800	1200	1600	Φ	
AETR	DESCRIPTION	LA PL	ELEV.	NUMBER	ТҮРЕ	Soil Vapour Conter		I			ADDITIONAL LAB TESTING
DEP		STRATA PLOT	DEPTH (m)	NU	⊢	10	20	30	40		
	Ground Surface	S S	5.39								
- 0	Loose, dry to moist, light brown, coarse SAND		0.00								
-	and GRAVEL. (FILL)			1	GS (	€					-
-											-
-	Firm to stiff, moist, green-grey, stained SILT.		4.89 0.50	2	GS	#					-
-	(FILL)			2							-
-	- hydrocarbon-like odour. - some electrical conduits.										-
			4.49	3	GS						
- 1	Dense, moist, wheathered BEDROCK, with some black sludge material. - oily black product seeping from bedrock	$\mathbb{N}$	0.90								_
-	- oily black product seeping from bedrock	Ŵ									-
-	Refusal in Bedrock at 1.3m.	Ŵ		4	GS						-
F	End of TEST PIT.	K//	4.09 1.30								
t											-
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IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11	EPTH SCALE					Golder					LOGGED: PM/RM
101	: 25				V	Associat	es				CHECKED: WB/RP

	SOIL PROFILE			SAM	PLES	Organic Va	pour Meter				•	
DEPTH SCALE METRES		5				- 40	00 8	00	1200	1600		
TH S ETRI	DESCRIPTION		ELEV.	NUMBER	ТҮРЕ		r Content (%					ADDITIONAL LAB TESTING
DEP		TRAT.	EPTH (m)	NUN	É							
		ST				1	0 2	20	30	40		
— o	Ground Surface Loose, moist, brown, coarse SAND and		4.65 0.00									
-	GRAVEL. (FILL)		0.00									
-	(FILL)		ŀ									-
-				1	GS 🤅	Ð						-
-			ŀ			-						-
-												-
-												-
_			3.75			-						
- 1	Firm, moist, brown and grey mottled, sandy SILT.		0.90	2	GS 🤅	₽						_
_	- grey stained lens from 0.9m - 1.1m. - hydrocarbon-like odour throughout.											-
-	,											-
-												-
F												-
F			ŀ	3	GS	•						-
F												
-												-
_ 2												-
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-												-
-												-
-												-
-	Firm, moist, grey SILT, some clay. - strong hydrocarbon-like odour to 3.8m.		2.15 2.50									-
-	- strong hydrocarbon-like odour to 3.8m.											-
-												-
-				4/5		Ð						-
3				4/5	GS	₽						
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IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11 T				6	GS							
1	End of TEST PIT.		0.05 4.60									
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08-1												
90	1								1			1
	EPTH SCALE					Gol	der					LOGGED: PM/RM
<u> </u>	: 25					Asso	ciates					CHECKED: WB/RP

;	SOIL PROFILE	-		SAM	PLES	Organic va	pour Meter				⊕	
METRES		STRATA PLOT		ĥ		40		300	1200	1600		ADDITIONAL
MET	DESCRIPTION	TAP	ELEV. DEPTH	NUMBER	ТҮРЕ	Soil Vapour	Content (%	LEL)				ADDITIONAL LAB TESTING
1		:TRA	(m)	NL	-	1	0	20	30	40		
-+	0	S					-					
0	Ground Surface Compact, moist, red-brown, silty SAND, with	<b>***</b>	4.64									
	organics.											
	(FILL) - wet lense at east end of the Test Pit.											
			1 F									
				1	GS	₽						
ŀ	Dense, moist, mottled brown and grey SILT,	×	4.14 0.50			-						
	trace sand.			2	GS	•						
	trace sand.     - hydrocarbon-like odour.     - occasional peat inclusions to 2.0m.     - trace to some clay, increasing with depth.			_								
	- trace to some clay, increasing with depth.											
1								1				
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			[					1				
				3	GS	₽		1				
								1				
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								1				
				4	GS	⊕						
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				-	00			1				
-  -	End of TEST PIT.	$\mathbb{H}$	0.04	6	GS	€						
								1				
5								1				
	PTH SCALE				Â	Gol	-					
						ar Cal	don					LOGGED: PM/RM

		SOIL PROFILE			SAM	PLES	Organic Va	pour Meter					
	DEPTH SCALE METRES		5				4(	0 90	00 1	200	€ 1600	,	
	H SC		STRATA PLOT	ELEV.	NUMBER	Щ		Content (%L		200	1600		ADDITIONAL LAB TESTING
	EPT ME	DESCRIPTION	ATA	DEPTH	IMU	TYPE	Soli vapoul	Content (%L	-EL)			ן נ	
			STR	(m)	2		1	0 2	0	30	40		
		Ground Surface		4.79									
Ē	- 0	Loose, moist, light brown, coarse SAND and		0.00	1	GS 🤅	Þ						
		GRAVEL. (FILL)											-
													-
F													-
F													-
F				4.19									-
F		Loose, moist to wet, silver GRAVEL.		0.60									-
F		(FILL) - strong hydrocarbon-like odour.			2	GS	Ð						-
F		<ul> <li>strong hydrocarbon-like odour.</li> <li>metal grate like debris.</li> <li>black product on gravel</li> <li>oily product seeping at 0.8m.</li> </ul>											-
F		- oily product seeping at 0.8m.											-
	- 1			3.69									-
╞		Firm to stiff, moist, brown and grey SILT.	IIII	3.69	3	GS	⊕						-
F		<ul> <li>hydrocarbon-like odour.</li> <li>trace to some clay below 4.0m.</li> <li>hydrocarbon-like odour decreasing with</li> </ul>				-							-
┢		- hydrocarbon-like odour decreasing with											-
┢		depth.											-
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ő L	- 4												-
9													-
₽													-
GPJ													-
E. H													-
001				0.19	5	GS 🤅	Ð						-
26_1		End of TEST PIT.		4.60									
(50													-
1047													-
136-0													-
8-14	- 5												
IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11							<u> </u>						
PLC	DE	PTH SCALE					Gol	dor					LOGGED: PM/RM
OLT	1:	25					Asso	ciates					CHECKED: WB/RP
∟								-THEFT					

	SOIL PROFILE	_	,	SAM	IPLES	Organic Vapour M	eter			⊕	
METRES		STRATA PLOT		H		400	800	1200	1600	ADD	ITIONAL TESTING
E E	DESCRIPTION	ATA F	ELEV. DEPTH	NUMBER	ТҮРЕ	Soil Vapour Conte	nt (%LEL)				TESTING
5		STR/	(m)	ž		10	20	30	40		
	Ground Surface	1	4.95								
0	Loose, dry to moist, brown-grey SAND and		0.00								
	GRAVEL. (FILL)			1	GS	€					
	- no ódour.										
			4.45 0.50								
	Loose, moist, red-brown to grey, coarse SAND and GRAVEL, some silt.		0.50	2/3	GS	Ð					
	(FILL) - strong hydrocarbon-like odour.			20							
1	Dense, moist, brown and grey SILT, some		3.95 1.00			-					
	fine sand lenses. - no odour.		1.00	4	GS	€ 1					
	- no odour.										
2											
				5	GS	•					
3											
4											
				6	GS	<b>€</b>					
	End of TEST PIT.	+	0.75 4.20								
5											
DEI	PTH SCALE					Golder				LOGGED: F	M/RM
	25					∎= Golder				CHECKED: V	

	ш	SOIL PROFILE			SAM	PLES	Organic Va	pour Meter			•	
	DEPTH SCALE METRES		-OT		£		40	0 80	0 12	200 10	500	
	METH	DESCRIPTION	TA PI	ELEV.	NUMBER	ТҮРЕ	Soil Vapou	r Content (%L				ADDITIONAL LAB TESTING
			STRATA PLOT	DEPTH (m)	NN		1	0 2	0 :	30 4	40	
-		Ground Surface	0,	5.22								
Ē	- 0	Loose, dry, brown, coarse SAND and GRAVEL.		0.00								
_		(FILL) - orange staining below 0.5m.			1	GS 🤅	Ð					-
-							-					-
-												-
-												-
												-
_					2	GS (	₽					-
-							-					-
-	- 1	Stiff, moist, red-brown with grey SILT, trace sand, occasional rootlets.		4.22 1.00								-
		sand, occasional rootlets.			3	GS	Ð					-
							-					
-												-
-												-
-												-
-												-
-	- 2				4/5	GS (	€					-
-					-							-
_												-
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_												-
-	- 3											_
-												-
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-												-
-												-
9/11												
05/1	- 4											_
-GDT												-
												-
GP.												-
01)TF		Dense, moist, brown SILT, no organics, trace		0.72								-
6_20		clay.		0.52	6	GS (	₽					-
(502		End of TEST PIT.		4.70								
-0047												-
1436	- 5											-
-80 5							<u> </u>					
P LOC	DE	PTH SCALE				Â		dan				LOGGED: PM/RM
IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11	1:						Gol	ciates				CHECKED: WB/RP

j ŀ	SOIL PROFILE	1.		SAM	PLES	Organic Vap	our meter			$\oplus$	
METRES		STRATA PLOT	ELEV.	ËR	щ	400			200 1	600	ADDITIONAL LAB TESTING
Ξ	DESCRIPTION	ATA	DEPTH	NUMBER	TYPE	Soil Vapour (	Content (%L	_EL)			LAD LESTING
נ		STR	(m)	2		10	2	:0	30	40	
0	Ground Surface		5.22								
Ŭ	Loose, moist, red-brown SAND and GRAVEL. (FILL)		0.00								
	<ul> <li>- no odour.</li> <li>- 4" wrapped pipe and metal wire debris below surface.</li> </ul>			1	GS	€					
	below surface.					-					
			4.32								
1	Compact, moist, dark brown to black, with a thin grey lense sandy SILT, some organics musty odour.	TI	0.90								
'	- musty odour.			2	GS	€					
			4.02								
	Stiff, moist, brown and grey SILT, trace clay below 4.5m, fissured. - no odour.		1.20								
	- no odour.										
2											
4											
				-							
				3	GS	€					
3											
				4	GS	€					
4											
			0.52	5	GS	•					
	End of TEST PIT.		4.70								
5											
	PTH SCALE				Â	Gold					
DC-					<u>₹</u> _	EC.L	1				LOGGED: PM/RM

۲ <u>۲</u>	SOIL PROFILE	L	-	SAN	IPLES	Organic Vapour	victor			$\oplus$	
METRES		STRATA PLOT	ELEV.	3ER	ш	400	80		200 10	500	ADDITIONAL LAB TESTING
ΞΞ	DESCRIPTION	ATA	DEPTH	NUMBER	TYPE	Soil Vapour Con	ent (%L	EL)			LABTESTING
		STR	(m)	2		10	2	0 :	30 4	10	
0	Ground Surface		4.81								
Ĭ	Loose, moist, brown to grey stained SAND and GRAVEL, coarse sand pockets.		0.00								
	(FILL) - strong hydrocarbon-like odour.		X	1/2	GS					0	
-			4.51 0.30								
	Soft, moist, black, organic SILT. - hydrocarbon-like odour and musty.		0.00	3	GS					⊕	
ŀ	Loose, moist, green-grey, silty fine SAND,		4.21 0.60								
	Loose, moist, green-grey, silty fine SAND, with organic seams, mottled black organics. - hydrocarbon-like odour.										
1											
ʻ			·]	4	GS					⊕	
			ļ								
				5	GS					Ð	
			3.01								
Γ	Dense, grey, moist SILT. - strong hydrocarbon-like odour	ТП	1.80								
2											
				6/7	GS					•	
				0/1	00					Ū.	
3											
4											
				8	GS					Ð	
			0.01								
	End of TEST PIT.		4.80								
5											
		•				Golde					
	PTH SCALE					Calda	-				LOGGED: PM/RM

	SOIL PROFILE			SAM	PLES	Organic Vapo	ur Meter			Đ	
DEPTH SCALE METRES		OT		~		400	80	00 12	200 16	500 000	
AETR	DESCRIPTION	A PL	ELEV.	NUMBER	ТҮРЕ	Soil Vapour C			1	1	ADDITIONAL LAB TESTING
DEP		STRATA PLOT	DEPTH (m)	NUN	ŕ	10					
		LS				10	2	0 3	30 4	10	
— o	Ground Surface Loose, brown to silver grey, GRAVEL, trace		4.72 0.00								
-	sand.										-
-	(FILL) - strong hydrocarbon-like odour.										-
-	<ul> <li>strong hydrocarbon-like odour.</li> <li>strong hydrocarbon-like sheen.</li> <li>metal debris at the north end of Test Pit.</li> </ul>			1	GS						-
-	- water seepage at 0.8m.										-
-											-
-											-
-											-
-											-
											-
- 1				2	GS	•					_
			3.52								
	Soft to stiff, moist, brown and grey mottled SILT, occasional clay pockets, peat - like	$\ \Pi\ $	1.20	3	GS	•					
L	inclusions. - strong hydrocarbon-like odour										
L											-
-											-
-											-
-											-
-											-
- 2	Stiff, moist, brown-grey SILT, trace clay below		2.72 2.00								-
-	4.0m. - trace to no hydrocarbon-like odour.			4	GS (						-
-				•							-
-											-
-											-
-											-
											-
											-
- 3											_
-				5	GS	₽					-
-											-
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DL.GL											
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Ъ.											-
E -											-
20(	End of TEST PIT.	╢╢╢	0.12	6	GS (	€					
5026											-
1 (											-
											-
5 - 143											
IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11		1									
J DE	EPTH SCALE					Gold	0				LOGGED: PM/RM
L し 1	: 25						er iates				CHECKED: WB/RP
<i>≍</i> ∟						110000					

	SOIL PROFILE			SAM	PLES	Organic Va	pour Meter				•	
DEPTH SCALE METRES		ОТ		~		4	00 8	00	1200	1600	⊕	
TH S IETRI	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ		r Content (%l	1				ADDITIONAL LAB TESTING
DEP	DESCRIPTION	RAT	DEPTH (m)	NUN	É							
		ST				1	0 2	20	30	40		
— o	Ground Surface		4.42						_			
-	Loose, moist, black, sandy SILT, some bedrock/blast rock, pipes, concrete footings and plywood debris below surface.											-
-												-
-	<ul> <li>product seeping from south side of Test Pit.</li> <li>strong hydrocarbon-like odour.</li> </ul>											-
-												-
-												-
				1	GS	$\oplus$						
			3.62									_
-	Loose, moist to wet, stained black, gravelly SAND , with fine rock, product covered.		0.80									-
- 1	(FILL) End of TEST PIT.	<b>XXX</b>	3.42 1.00	2/3	GS	Ð			_			
-	Refusal in Bedrock at 1.0m		1.00									-
-												-
F												-
F												-
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E												
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IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11						 ■						
L DE	PTH SCALE					Gol	der					LOGGED: PM/RM
1 :	: 25				V	Asso	<u>ciates</u>					CHECKED: WB/RP

: L	SOIL PROFILE			SAN	IPLES	Organic va	pour Meter				$\oplus$	
METRES	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ	40 Soil Vapour		800 / 6LEL)	1200	1600		ADDITIONAL LAB TESTING
2	DESCRIPTION	TRAT	DEPTH (m)	NUN	L L	1		20	30	40		
0	Ground Surface	0	4.32					Ť				
	Loose, moist, grey GRAVEL. (FILL)		0.00									
				1	GS	_ ⊕						
			X									
	Loose, wet, black stained SAND and GRAVEL, some silt, some wood debris.		3.72 0.60	2	GS	Ð						
	(FILL)											
	- strong hydrocarbon-like odour. - seepage from all walls at 0.8m.		X									
1												
	Loose, moist, green-grey SILT.		3.02 1.30									
	<ul> <li>heavy black organic inclinations.</li> <li>strong hydrocarbon-like odour.</li> </ul>			3/4	GS	<b>⊕</b>						
2												
				5	GS	⊕						
3												
				6	GS	-  ⊕ -						
			0.42	7	GS	- ₽						
4	End of TEST PIT. Refusal in Bedrock at 3.9m		3.90									
5												
э												
		-							I	I		
υEł	PTH SCALE					Gol	der					LOGGED: PM/RM

	SOIL PROFILE			SAM	PLES	Organic Va	ipour Mete	r			$\oplus$	
METRES		STRATA PLOT	ELEV.	<b>ER</b>	ш		00	800	1200	) 16	00	ADDITIONAL LAB TESTING
.≝	DESCRIPTION	ATA	DEPTH	NUMBER	ТҮРЕ	Soil Vapou	r Content	(%LEL)				LABTESTING
נ		STR	(m)	2		1	0	20	30	4	0	
0	Ground Surface		4.25					_				
	Loose, moist, grey GRAVEL. (FILL)		0.00									
				4	GS (	€⊕						
				1	65 (							
			3.75									
ľ	Loose, wet, heavily black stained, gravelly SAND, some fine gravel.		0.50									
	(FILL)											
	<ul> <li>asphalt pieces near 0.5m.</li> <li>hydrocarbon-like odour and sheen.</li> <li>water seepage at 0.8m, heavy</li> <li>hydrocarbon-like sheen and product seepage.</li> </ul>											
	hydrocarbon-like sheen and product seepage.											
1												
				2	GS (	•						
	Soft to stiff, moist, brown and grey mottled	×	2.65									
	SILT. - strong hydrocarbon-like odour.		1.00									
	- heavy staining (green-grey to 2.3m).											
2				3	GS (	•						
3												
				4	GS	- €						
						1						
4												
ł	End of TEST PIT.		-0.15 4.40	5	GS	€		_				
5												
רבי					Â	Gol						
υEł	PTH SCALE					F Gol	der					LOGGED: PM/RM

5 L	SOIL PROFILE			SAM	IPLES	Organic Vapour M	elei		(	⊕
METRES		LOT		н.		400	800	1200	1600	ADDITIONAL
METI	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ	Soil Vapour Conte	nt (%LEL)			ADDITIONAL LAB TESTING
		TRA'	DEPTH (m)	NN		10	20	30	40	
_		ò					20	30		
0	Ground Surface 2 layers of ASPHALT.		4.30 0.00							
ŀ	Loose to compact, moist, red brown SAND		3.90 0.40	1	GS					
	and GRAVEL.					T I				
	- grey stained and hydrocarbon-like odour									
	- grey stained and hydrocarbon-like odour below 1.4m. - wet caving sands with heavy sheen (product) at 1.6m.									
	(product) at 1.6m.									
1										
			2.70							
Γ	Soft to firm, moist, grey-brown mottled SILT. - hydrocarbon-like odour to 3.0m. - stiff below 3.0m.		1.60							
	- stiff below 3.0m.									
2										
-				2	GS	Ð				
3										
				3/4	GS	- ₽				
						1				
4										
				-						
╞	End of TEST PIT.	+	-0.30 4.60	5	GS	€				
5										
	PTH SCALE					Golder				
<b>DC</b>										LOGGED: PM/RM

	SOIL PROFILE		SAM	PLES	Organic Va	pour Meter				Φ		
DEPTH SCALE METRES	<u> </u>	10				- 40	00 8	00	1200	1600	Ð	
TH S ETRI	DESCRIPTION	APL	ELEV.	NUMBER	ТҮРЕ		Content (%I					ADDITIONAL LAB TESTING
S DE D DE D DE D DE		STRATA PLOT	DEPTH (m)	NUN	É			0	20	10		
		S				1	0 2	0	30	40		
— O	Ground Surface Compact to loose, moist, grey, fine GRAVEL.		4.14 0.00						_			
F	(FILL) - 4" dia. vertical pipe at east end of Test Pit.											-
-												-
				1	GS	•						
-												-
-	Soft. moist. dark brown, organic SILT.		3.54 0.60	2	GS	-					4	-
-	Soft, moist, dark brown, organic SILT. - strong hydrocarbon-like odour. - concrete footing debris approximately 6" thick at 0.7m (northwest corner of Test Pit).			2	00	1						-
-	thick at 0.7m (northwest corner of Test Pit).											-
_ '			3.04									-
-	Soft, moist, green, grey and black mottled SILT, trace to some sand, organic inclusions. - strong hydrocarbon-like odour.		1.10									-
-	- strong hydrocarbon-like odour.			3	GS	Ð						-
F												-
F			2.54									-
Ľ	Stiff to firm, moist, green-grey CLAY. - slight hydrocarbon-like odour.		1.60									-
_												-
-												-
- 2				4	GS	⊕						-
-				4								-
-												-
												-
_	Defined in Dedaeds at 2 Cm											-
-	Refusal in Bedrock at 2.6m. End of TEST PIT.	14	1.54 2.60		GS				<b>—</b>			
-												-
-												-
- 3												-
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IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11												-
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436-0												-
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8	I									I		I
T DE	PTH SCALE					Gol	der					LOGGED: PM/RM
<u>ا</u>	: 25				V	Asso	ciates					CHECKED: WB/RP

	SOIL PROFILE	_		SAM	PLES	Organic Va	pour Meter				<b>⊕</b>
METRES		STRATA PLOT		ĸ				800	1200	1600	ADDITIONAL
MET	DESCRIPTION	TAP	ELEV.	NUMBER	ТҮРЕ	Soil Vapou	r Content (%	LEL)	•		LAB TESTING
-		TRA.	DEPTH (m)	NN	-	1	0 2	20	30	40	
		ò				'		20	30	+0	
0	Ground Surface Dense to compact, moist, grey GRAVEL.		4.14								
	(FILL)										
			3.84 0.30								
	Moist, black, fine gravelly SAND, concrete, metal, wood and ground wire debris.		0.30								
	(FILL) - hydrocarbon-like odour and staining.										
	- product seepage from wall at 1.2m.					_					
				1	GS	⊕					
1											
' I											
			2.94								
	Soft to firm, moist, brown-grey SILT, product on surface and in seams.	TIII	1.20	2/3	GS (	• ₽					
	- strong hydrocarbon-like odour.					1					
2	Stiff to firm, moist, brown-grey with red	////	2.14 2.00								
	Stiff to firm, moist, brown-grey with red organic inclusions CLAY, trace sand. - hydrocarbon-like odour.										
	,	V///									
		////		4	GS (	.  €					
						-					
		V///									
		V///									
		V///									
3											
		<i>\///</i>									
						-					
				5	GS (	<b>•</b>					
		V///		5	33 1	Ť					
						-					
		<i>\///</i>									
4		V///									
		////									
		<i>\///</i>									
				6	~ ~	_ €					
	End of TEST PIT.	<i>\////</i>	-0.46 4.60	6	GS (	Ť					
5											
						Gol			•		
DEI	PTH SCALE					Gol	der				LOGGED: PM/RM
	25					Acco	ciates				CHECKED: WB/RP

		SOIL PROFILE		SAM	PLES	Organic Va	pour Meter			Đ		
DEPTH SCALE	2		5				4(	10 80	00 1	200 1	600	
S E	Ξ Ξ	DESCRIPTION	A PLO	ELEV.	IBER	ТҮРЕ		r Content (%L		1		ADDITIONAL LAB TESTING
DEP	Σ	DESCRIPTION	STRATA PLOT	DEPTH	NUMBER	Ť						
	$\downarrow$		ST	(m)			1	0 2	0	30	40	
-	0	Ground Surface Loose to compact, moist GRAVEL.		4.27 0.00								
-		(FILL)		0.00								
-												
-	ŀ	Loose, moist, black SAND, some gravel.		3.97 0.30								-
-		(FILL) - strong hyrocarbon-like odour.										-
-												-
E					1	GS	⊕					
_												-
_	1											
-												-
-												-
$\vdash$	ł	Soft, moist, grey SILT, trace to some fine	<b>F</b>	2.97 1.30								
╞		sand. - strong hydrocarbon-like odour.										-
F					2	GS	₽					-
Ľ							1					-
_												_
_												-
_	2											
-												-
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_												
-												-
-												-
-	3	Stiff to firm, moist, brown and grey CLAY.		1.27 3.00								-
-		Stiff to firm, moist, brown and grey CLAY. - strong hydrocarbon-like odour. - red organic inclusions to 3.5m.			3	GS (	₽					-
-												-
_												
-												-
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<del>-</del> -												-
5/19/												-
0 5	4											-
L.G												
2												
Ъ.												-
101)T					4/5	GS €	•					-
1-1-	ł	End of TEST PIT.	////	-0.33 4.60	-10	00 0	r			+		
(502												
0047												
436-	5											_
08-1												
IOL TP LOG 08-1436-0047 (5026_2001)TP:GPJ IOL.GDT 05/19/11						Â	Gol				_	
LTP		PTH SCALE					Gol	der				LOGGED: PM/RM
⊆	1 :	20					<u> ASSO</u>	<u>ciates</u>				CHECKED: WB/RP

	SOIL PROFILE		SAM	PLES	Organic Va	pour Meter			•		
DEPTH SCALE METRES		OT.		r		- 41	00 80	00 1	200 16	500	
PTH S	DESCRIPTION	LA PL	ELEV.	NUMBER	ТҮРЕ		r Content (%L		1		ADDITIONAL LAB TESTING
DEP		STRATA PLOT	DEPTH (m)	NU		1	0 2	0	30 4	10	
	Ground Surface	S									
— c	Loose, dry to moist, brown SAND and	<b>***</b>	4.18 0.00								
-	GRAVEL. (FILL)										-
-	- concrete wood electical conduits and metal										-
	debris. - at 0.3m red staining and oily product seeping from sidewalls. - product on ponding water.					_					
_	- product on ponding water.			1	GS	Ð					-
-	Moist to wet, grey, fine to medium SAND,		3.58 0.60								-
-	some fine gravel. - strong hydrocarbon-like odour.										-
-	- strong hydrocarborplike ododi.										-
-											-
1											-
Ĺ	Refusal in Bedrock at 1.2m.		2.98	2	GS				•		
_	End of TEST PIT.		1.20								
+											-
F											-
F											-
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— 2											_
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J.G.											
E F											
- 20(											-
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436-0											_
08-1											
LOG					Â	Gol					
⊢	EPTH SCALE					Gol	der				LOGGED: PM/RM
₫ <u>1</u>	: 25				V	Asso	<u>ciates</u>				CHECKED: WB/RP

	SOIL PROFILE		SAM	PLES	Organic Vapour Meter		Φ	
DEPTH SCALE METRES		10			400 800	1200	⊕ 1600	
ETRE	DECODIDITION	LUTA PLOT ELEV. (m)	NUMBER	TYPE	Soil Vapour Content (%LEL)			ADDITIONAL LAB TESTING
DEP	DESCRIPTION	DEPTH	NUN	Ţ				
		ш Б м (m)			10 20	30	40	
— o	Ground Surface Loose, moist, grey SAND and GRAVEL.	4.29 XXX 0.00						
-	(FILL)		1	GS (	₽			-
-								-
-	Soft, moist, dark brown, organic SILT,	3.99						-
-	Soft, moist, dark brown, organic SILT. - musty, organic-like odour.							-
-								-
-			2	GS (	₽			-
F		3.49						-
-	Soft, moist to wet, red-brown SILT. - no odour.	0.80						-
Ľ,		3.29	3	GS 🤅				-
_ '	End of TEST PIT.	1.00						_
-	Refusal in Bedrock at 1.0m.							-
-								-
F								-
$\vdash$								-
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$\vdash$								-
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4								-
GDI								-
₫								-
GPJ								-
, TP.								-
2001								-
1								
7 (5(								-
-004								-
1436								_
-80								
IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11					Golder			
	PTH SCALE				Golder			LOGGED: PM/RM
d1∶	: 25			V	Associates			CHECKED: WB/RP

	SOIL PROFILE		SAM	IPLES	Organic Vapour Meter		•	
DEPTH SCALE METRES		10	~		400 80	0 1200	1600	
TH S TH S	DESCRIPTION			түре	Soil Vapour Content (%L			ADDITIONAL LAB TESTING
DEP		CTRATA PLOT (m) (m)		Γ É	10 00			
					10 20	30	40	
— o	Ground Surface Loose, moist, dark brown SILT, some gravel, some red staining, some tiles and concrete	4.5	2 1	GS (	<b>⊕</b>			
-	some red staining, some tiles and concrete	0.1	1					-
F	debris. (FILL)							-
-	Soft, moist, dark brown, organic SILT, some large boulders.							-
_								_
-		3.8	2					-
-	Soft, moist, red-brown, some grey mottling SILT.	0.7						
-			3	GS	- ⊕			-
- 1				03 1				-
-								-
F		3.2	2					
Ľ	Soft, moist, grey and brown mottled SILT. - no odour or staining.	1.3	0					
E		3.0	2 4/5	GS (	₽ 			
F	End of TEST PIT.	1.5	U					
-								-
-								-
-								-
- 2								-
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-								-
-								-
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-								-
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Ľ			1					
L			1					
19/11								
4 02/1			1					-
GDT			1					
GPJ			1					
TP.								· · ·
2001			1					
1			1					
47 (5								
			1					
5 - 143								-
IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11								
T DE	EPTH SCALE				Golder			LOGGED: PM/RM
<u> </u>	: 25			V	Associates			CHECKED: WB/RP

# RECORD OF BOREHOLE: BH09-03

				SAMPLES		Soil Va	apour Co	ntent (p	om)				
ALE	SOIL PROFILE				SAMPLES		-				$\oplus$	NG	
DEPTH SCALE METRES		STRATA PLOT	ELEV.	NUMBER	Щ	RECOVERY %		50 1 I apour Co			200	ADDITIONAL LAB TESTING	PIEZOMETER OR
DEPT	DESCRIPTION	ATA	DEPTH	MUM	ТҮРЕ	COV	3011 V	apour co	interit (70			ADD LAB	STANDPIPE INSTALLATION
		STF	(m)			RE	2	20 4	10 	60	80		
— o	Ground Surface SAND, coarse, trace subrounded gravel,		0.00										
_	compact to loose, moist, brown		0.00	1	GRAB		⊕						
-													
-	Sandy SILT, stiff, dry to moist, brown, no odour, no staining		0.51	2	GRAB		⊕					METALS	
- 1													
-	Coarse SAND with subrounded GRAVEL, occasional large cobbles, compact, moist to		1.07	3	GRAB		⊕					BTEX VPH/EPH	
-	wet, brown	×	1.22 1.37										
-	BEDROCK	ΊΙΙ											
-													
2													-
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DE	PTH SCALE					GG	lde	r	2535 Calg	- 3rd Av ary, Alb Ida T2A	/enue S.I erta	Ξ.	LOGGED: PM
1 :	50	ALE								ida T2A	7W5	CHE	CKED: WB/RP

													1	
щ	SOIL PROFILE				SAMPLES	3	Soil Va	apour Co	ntent (pp	om)	$\oplus$			
DEPTH SCALE METRES		OT		~		%,	- ۱	i0 1	00 1	50 2	:00	ADDITIONAL LAB TESTING	PIEZOMETER	
TH S ETRE	DECODIDATION /	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %		apour Co			1	TES	OR	
MEPT	DESCRIPTION	<b>ATA</b>	DEPTH		1	l S			interit (70			ADD AB	STANDPIPE INSTALLATION	
		STF	(m)			L H	2	20 4	0	50 8	80			П
	Ground Surface		4.48										<ul> <li>Stickup</li> <li>= 0.96 m</li> </ul>	
- 0	SAND and GRAVEL, loose to compact, moist to wet, brown to grey	o. Viii											Sand	
-	CLAY, blocky, trace silt, dense, moist, brown and grey, mottled		0.15	1	GRAB		-		⊕				Bentonite	
-	and grey, mottled	$\langle / / /$											Sand	
-														
-							4					BTEX EPH	26-Aug-09 ☑	日
- 1				2	GRAB							EPH VPH VOC		
-							1					VOC	Slotted Section	
-														
_														
-				3	GRAB		1	€	9			METALS		E
- 2														目
-	Heavy end hydrocarbon odour from 0 m to 2.1 m												Sand	
-				4	AS		1		Ð			BTEX EPH VPH		
-		V//		4	AS		-		9			VPH PAH		
- - - 3		V//												
- 3														
_							4							
_				5	AS			€	e					
_							1							
- 4														
_ `													Bentonite	
-				6	AS		1	•						
-							-							
F														
- 5														
-	Soft from 5.2 m to 6.1 m													
-														
-				7	AS		]	•				BTEX EPH VPH		
E							-					VPH		
- 6			-1.62											-
F	End of MONITORING WELL.		6.10											
-														
_														
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- 7														-
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- 9														-
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-														
- 10														
	PTH SCALE				Â	A G			2535	- 3rd Av	venue S.	E.	LOGGED: PM	
1 .	50					<b>F</b> G	olde	t toc	Calga Cana	ary, Albe da T2A	erta 7W5	CUI	ECKED: WB/RP	
						ASS	ucia	162				CHI		

	SOIL PROFILE				SAMPLES		Soil Va	pour Co	ntent (p	om)	Ð	AG		
METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	Soil Va	ıpour Co	ntent (%	LEL)	200 	ADDITIONAL LAB TESTING	PIEZOME OR STANDE INSTALLA	PIPE
	Ground Surface	0)	5.12							1			Stickup = 0.85 m	
0	SAND, loose, subrounded gravel, loose to compact, dry to moist, reddish brown to grey		0.00	1	GRAB		•					BTEX	Sand	
1	Silty SAND, fine, subrounded gravel, stiff, dry to moist, mottled, brown and grey Black staining, odour from 0.9 m to 1.8 m		4.36	2,3	GRAB		-					VPH PAH EPH VOC METALS		
2			· · ·	4	GRAB			₽				BTEX VPH EPH		
-	SILTY CLAY, some rocks, firm, moist, light		2.68									LIII		
3	brown			5	AS				⊕				Bentonite	
													26-/	Aug-09 ⊻
4				6	AS			Ð				BTEX VPH EPH		Ā
5														
				7	AS		-	⊕						
6													Sand	
	CLAY, very soft, moist, grey		-1.58 6.71	8	AS		-	⊕					Slotted Section	
7			-2.50											
8	End of MONITORING WELL.		7.62											
9														
10														
	PTH SCALE				Â	C	older	<b>P</b>	2535 Calg	- 3rd A ary, Alb ida T2A	venue S.E	E.	LOGGED: PM	

SHEET 1 OF 1

	SOIL PROFILE				SAMPLES	;	Soil Va	apour Co	ontent (pp	om)			1	
DEPTH SCALE METRES		Ц	1		GAIVIP'LES	%	-				<b>(</b> )	NAL		
ETRE		STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY			100 1 		200	ADDITIONAL LAB TESTING	PIEZOMETER	
DEPI	DESCRIPTION	RAT/	DEPTH (m)	NNN	1							ADD	STANDPIPE INSTALLATION	
		ST	(11)			R	2	20	40 6	60 i	B0		- Stickup	Π
— o	Ground Surface Coarse gravelly SAND, loose, moist, grey, no		4.75										= 0.98 m Sand	
E	odour, no staining			1	GRAB		∎						Bentonite	
F													Sand	
F			3.99										26-Aug-09	同じ
- 1	Gravelly SAND, some subrounded GRAVEL, loose, wet, grey, hydrocarbon like odour, hydrocarbon like sheen on surface of ponding		0.76	2	GRAB		⊕					METALS	-	
-	hydrocarbon like sheen on surface of ponding water at 1.4 m						1							
-													Slotted Section	
E														
-			2.77	3	GRAB		-		•			BTEX EPH VPH		
- 2	Sandy SILT, dense, wet, grey, hydrocarbon like odour		1.98									PAH		
_			2.32										Sand	
-	SILTY CLAY, occasional fine angular gravel, stiff to firm, brown to grey		2.44											
E	Hydrocarbon like odour from 2.4 m to			4	AS		-  							
- 3	4.3 m Moist from 3 m to to 2.8 m						-							
-														
E														
F				5	AS		⊕					BTEX EPH		
- 4							-					VPH		
E														
F														
-				6	AS		∎							
- 5							-							
-														
-													Bentonite	
													Bentonite	
-	CLAY, soft, wet, grey, no odour, no staining		-1.04 5.79	7	AS		-  							
- 6							ſ							
E														
F														
-				8	AS		-							
- 7							-							
-														
E														
E														
- 8	CLAY, with weathered bedrock pieces, dense,		-3.17 7.92	9	AS		- -					BTEX VPH		
	wet, grey, no odour, no staining			9	AS		-					EPH		
190			-3.78											
	BEDROCK End of MONITORING WELL.		8.69				-							
9														-
2-														
- 10														
9 9 1 1 1 1 1 1 9 1 1 1 1 1 1 1 1 1 1 1	l					Ş.			2525	_ 3rd A.	venue S.	<b>F</b>		
DE	PTH SCALE					G	older ocia	ŗ	Calga	ary, Albo da T2A	erta		LOGGED: PM	
<u>j</u> 1 :	: 50				V	Ass	<u>ocia</u>	tes	Gana	JULI 12A		CHE	ECKED: WB/RP	

	SOIL PROFILE				SAMPLES		Soil Vap	oour Co	ntent (pp	m)				
DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %		oour Co	ntent (%L	L _EL)	⊕ 2000 □	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		ST	(11)			R	20	) 4	0 6	i0 i	80		Stickup	Π
— o	Ground Surface Coarse SAND, some subrounded GRAVEL,		5.39 0.00										= 1.07 m Sand	
_	compact to loose, moist, brown, no odour, no staining	0.0	5.09	1	GRAB		•						Bentonite	
_	SANDY SILT, frim, moist to wet, greenish, grey with black staining, hydrocarbon like		0.30									BTEX		
-	grey with black staining, hydrocarbon like odour and staining		4.50	2,3	GRAB							EPH	Sand	
F	Blast ROCK, with sludge, dense, wet, black, hydrocarbon like odour and staining		4.58 0.81				1					BTEX VOC EPH PAH METALS VPH		
- 1	hydrocarbon like odour and staining	$\otimes$											Slotted Section 26-Aug-09	
_				4	AS		∎						Į ⊻	
-			3.72	5	AS		Ð						Slough	
-	End of MONITORING WELL.		1.68											
- 2														_
_														
E														
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1436-														
IOL MW LOG         08-1436-0047.5026.GPJ         10L.GDT         05/19/11           I <td></td>														
					Â	R.			2535 -	· 3rd Av	venue S.I	Ε.		
≦  DE	EPTH SCALE					G	older		Calga	ry, Albo da T2A	erta		LOGGED: PM	
<u>o</u>	: 50				V	ASS	uciat	es				CHE	CKED: WB/RP	

					0.41.15: -		Soil Va		ntent (pp	m)				
ш	SOIL PROFILE	1. 1			SAMPLES		3011 Va	apour co	interit (pp	111)	$\oplus$	19		
SCA RES		LOT		E H		۲۶ %	5	i0 1	00 1	50 2	00	STIN	PIEZOMETER	
DEPTH SCALE METRES	DESCRIPTION		EV. PTH	NUMBER	ТҮРЕ	OVEF	Soil Va	apour Co	ntent (%l	_EL)		ADDITIONAL LAB TESTING	OR STANDPIPE	
DE			m)	l z		RECOVERY %	2	20 4	10 6	30 O	10	LAR	INSTALLATION	
		S S				<u> </u>	-						Stickup = 1.16 m	
- 0	Ground Surface Coarse SAND and subrounded GRAVEL,	0.2	4.21										Sand	
_	loose to compact, dry, brown, hydrocarbon like odour		0.15	1	GRAB		Ð						Pontonito	
E	Sandy SILT, stiff, moist, greenish grey with			· · ·	0.010		ľ						Sand 26-Aug-09	-
E	Sandy SILT, stiff, moist, greenish grey with black staining, hydrocarbon like odour, hydrocarbon like sheen on ponding water, asphalt like patches to 0.6 m													
-	asphalt like patches to 0.6 m													
- 1				2	GRAB		⊕					METALS		日1
-														
-													Slotted Section	
-												BTEX		目目
F.				3	GRAB				⊕			BTEX VOC EPH		日日
- 2	Wet and ponding water at 2.0 m											VPH		日丁
E			1.77											
_	CLAY, trace silt, stiff, moist, brown, grey		2.44									BTEX	Sand	 
_	mottled Occasional fine subrounded gravel from			4,5	AS					<b>⊕</b>		EPH PAH		_
- 3	2.6 m to 8.8 m						1					VPH		-
Ē														-
E	Hydrocarbon like odour to 3.4 m													
_														
F				6	AS		<b>e</b>							-
- 4														-
-														-
-														-
-							-					BTEX		-
-				7	AS		⊕					VPH EPH		-
- 5														-
E														-
E														-
L													Bentonite	-
-													Dentornite	-
- 6				8	AS		Ð							-
_														-
F														
F														-
-				9	AS		∳							-
- 7							1							-
-														-
F														-
E														-
- 8														-
17														-
5/19														
														-
			-4.63											-
<u></u>	Coarse SAND, compact, wet, grey, hydrocarbon like odour		8.84	10	AS		⊕						Slough	
- GP	Clay lens at 9.1 m on bedrock		-4.94 9.14										F F	
5026	End of MONITORING WELL.													-
047.														-
36-0														-
IOL MW LOG         08-1436-0047.5026.GPJ         IOL.GDT         05/19/11           1 <td></td> <td></td> <td></td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td> </td> <td>1</td> <td>I</td> <td>I</td> <td><u> </u></td> <td></td>				1	1	1	1	1		1	I	I	<u> </u>	
	1								2525	Quel A				
≩ DE	EPTH SCALE					GG	older	r	Zo35 Calga	- 3rd Av iry, Albe da T2A '	enue S.I erta	<b>L</b> .	LOGGED: PM	
J 1	: 50					Ass	ocia	tes	Canad	da T2A	(W5	CHE	CKED: WB/RP	

								0			>			1	—
L	9	SOIL PROFILE				SAMPLES		Soil Va	apour Co	ntent (p	pm)	$\oplus$	Qب		
	METRES		OT		<u>م</u>		% λ	5	0 1	00 î	150 2	00	ADDITIONAL LAB TESTING	PIEZOMETER	
I I		DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ	RECOVERY %	Soil Va	apour Co	ntent (%	LEL)		DITIO TES	OR	
			RAT	DEPTH (m)	N N	Ĺ Ĺ							ADI	STANDPIPE	_
			ST	(11)			R.	2	20 4	10 	60	80		Stickup	
L	0	Ground Surface		4.57										= 1.13 m	_
E		Coarse SAND and subrounded GRAVEL, compact to loose, moist, brown, 0.1 m	0.0	0.00	1	GRAB		⊕						Sand 🔅 k	-  -
E		diameter pipe identified at 0.6 m below grade, hydrocarbon like odour	2	1	-	GIVAD								Bentonite	-
F			0											Sand	1
È		SANDY SLIT, occasionally subrounded	1A	3.87 0.70											3-
E	1	gravel, stiff, moist, brown, greenish grey, mottled, hydrocarbon like odour and staining,											BTEX		4
E		water ponding at 2 m with hydrocarbon sheen			2	GRAB		∳					BTEX VOC EPH		-  -
F													PAH VPH	26-Aug-09	)-  -
-				8										26-Aug-09 Slotted Section ♀	<u>.</u> -
F													BTEX VPH EPH		3
F	2				3	GRAB		Ð					EPH METALS		1
F													ME IAEO		4-
F				2.13											-
F		CLAY, trace subrounded gravel, stiff, moist, brown and grey, no odour, no staining		2.44				-						Sand 🔅 🔆	<u>_</u>
F					4	AS		₽							-
F	3							1							╟
F															-
F															-
E													DIEV		
E					5	AS		∳					BTEX VPH EPH		-
F	4	Firm start from 4.0 m						1					Litti		
E															-
F															_
-					6	AS									_
F								-						Dontonito	-
-	5													Bentonite	-
F		Soft, wet, grey from 5.2 m													-
F															-
F															-
E	6				7	AS		₽							
E	Ŭ							1							-
E															
E															
F															-
F	7				8	AS		₽							ŀ
F															-
F															
F															
F															
F	8														
9/11														Slough	
05/1															
Ц															
OL.C								{							
	9			-4.57	9	AS		₽							
26.G		End of MONITORING WELL.		9.14											-
7.50			1												-
-004															-
1436-	10														_
IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11	10														
POG							\$-			2525	- 3rd Av	venue S.	E		_
MM	DE	PTH SCALE					GG	olde	r	Calg	ary, Albo da T2A	erta		LOGGED: PM	
	1 :	50				V	Ass	ocia	tes	Jaila		, 115	CHE	CKED: WB/RP	

SHEET 1 OF 1

;	SOIL PROFILE				SAMPLES		Soil Va	pour Cor	ntent (ppn	n)	Ð	5 L		
METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	5 Soil Va	pour Cor	00 15 Intent (%L)	EL)		ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
0	Ground Surface Fine to medium SAND and subrounded GRAVEL, loose to compact, moist, brown, no	, ç	4.27 0.00 4.06 0.20										Stickup = 0.95 m Sand	
	\odour, no staining/ Medium to coarse SAND and subrounded GRAVEL, loose to compact, wet, grey, hydrocarbon like odour, water ponding with hydrocarbon like sheen		3.66 0.61	1	GRAB							METALS BTEX VPH EPH	Bentonite Sand 26-Aug-09	
1	Sandy SILT, some organic pockets, occasional subrounded gravel, soft to stiff, wet, brown and grey, with black staining, hydrocarbon like odour and sheen (possible free product)			2,3	GRAB							EPH PAH	26-Aug-09 ∑ Slotted Section	
2	CLAY, some coarse sand, stiff, wet, brown, grey, hydrocarbon like odour to 5.8 m		<u>2.44</u> 1.83	4	GRAB		•					BTEX VPH EPH		
													Sand	
3				5	AS		•							
				6	AS		Ð						Bentonite	
4														
5	weathered bedrock pieces from 4.9 m to 5.8 m Soft from 4.9 m to 5.8 m						_					BTEX		
	BEDROCK		-1.37	7	AS		-					VPH EPH	Slough	
6	End of MONITORING WELL.		5.79											
7														
8														
9														
10														
DEI	PTH SCALE				Â		older	•	2535 - Calgar		enue S.E. erta		LOGGED: PM	

	SOIL PROFILE			SAMPLES		Soil Va	pour Cor	ntent (pp	om)			
DEPTH SCALE METRES		5			%					<b>(</b> )	ADDITIONAL LAB TESTING	
H SO		LOT PLOT DEPTH (m) (m)	NUMBER	щ	RECOVERY %	50				00	TION	PIEZOMETER OR
ME	DESCRIPTION	E DEPTH	INM	ТҮРЕ	SOVE	Soli va	pour Coi	ntent (%	LEL)			STANDPIPE
		LS (m)			REC	20	0 4	0 6	50 8	80		
	Ground Surface	4.21										Stickup = 0.81 m
- 0	Gravel, dense to compact, moist, grey (FILL)	0.00										Sand 🔆 🔆 -
_	Fine gravelly SAND concrete metal wood	3.90	-									Bentonite
-	Fine gravelly SAND, concrete, metal, wood and ground wire debris, moist, black (FILL), hydrocarbon like odour and staining											Sand
E	nydrocarbon like odour and staining											
- 1												26-Aug-09
_ '	Product seepage from wall at 1.2 m	2.99										
E	SILT, porduct on surface and in seams, soft to firm, moist, brown and grey	1.22										Slotted Section
-	firm, moist, brown and grey											
_												
- 2		2.19										
-	Red organic inclusions CLAY, trace sand, stiff to firm, moist, brown and grey, hydrocarbon	2.13							-			<u>                                     </u>
F	Like odour											
F	End of MONITORING WELL.											
-												
- 3												-
E												
E												
L												
E												
- 4												-
-												:
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- 5												-
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OL.(												:
- 9 - 9												
26.G												:
7.50												:
-004												.
1436												
IOL MW LOG 08-1436-0047.6026.GPJ 10L.GDT 05/19/11												
					r.			2535	- 3rd Av	enue S.I	Ξ.	
≨ DE	PTH SCALE				Go Ass	older		Calga	ary, Albe da T2A	erta		LOGGED: PM
<u>d</u> 1 :	: 50				Asse	ociat	tes	Jana			CHE	CKED: WB/RP

	SOIL PROFILE				SAMPLES		Soil Va	pour Cor	ntent (pp	om)	$\oplus$	<u>ں</u> ب	
METRES	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ	RECOVERY %		0 10 pour Cor			00	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE
		STRA	(m)	N		REC	2	0 4	0 6	50 8	30	<b>∀</b>	INSTALLATION
_	Ground Surface		4.11										- Stickup = 1.0 m
0	Coarse SAND and subrounded GRAVEL, loose to compact, dry to moist, no odour, no	0.0	0.00										Sand
	staining	°.U		1	GRAB		•						Bentonite
		0.0	1										Sand 26-Aug-09
	Coarse SAND and subrounded GRAVEL,	0.0	. <u>3.41</u> 0.70	2	GRAB		-	Ð				BTEX VPH EPH	¥
1	some large cobbles, loose, wet, grey, hydrocarbon like odour, ponding water at 1.5	0.0		2	GIVID		1	Ŷ				EPH PAH	
	m, hydrocarbon like sheen	p O											
		0.0											Slotted Section
		00											
	Sandy SILT, stiff, wet, brown, no odour, no		2.29	3	GRAB		l b					BTEX VPH	
2	staining						1					EPH	
	CLAY, stiff, moist, brown and grey, no odour,		1.83 2.29										Sand
	no staining												
							-						
3				4	AS		<b>₽</b>					METALS	
							-					BTEX	
				5	AS		⊕					BTEX VPH EPH	
4													
													Bentonite
5													
							1						
				6	AS		● 						
6	Soft and grey from 6.1 m												
				7	AS		⊕						
							1						
7													
			-3.20										
	Coarse SAND with clay, and weathered bedrock pieces, no odour, no staining		-3.51	8	AS		⊕						Slough
	End of MONITORING WELL.		7.62										
8													
J													
9													
10													
					Â	F.			2535	- 3rd Av	enue S.E		
	PTH SCALE					G	older ocia	•	Calga Canad	ary, Albe da T2A	erta 7W5		LOGGED: PM
1.1	50					<u>' ASS</u>	<u>ocia</u>	tes		-		CF	IECKED: WB/RP

ц	Ţ	SOIL PROFILE				SAMPLES		Soil Va	pour Co	ntent (pp	m)	Ð			
	METRES		ОТ		č		%)	1 5	0 1	00 1	50 20	00	ADDITIONAL LAB TESTING	PIEZOMETER	
נו	ETR.	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ	RECOVERY %			ntent (%l			TES	OR	
	.Σ	DESCRIPTION	RAT/	DEPTH	NUN	1	CO				,		ADE	STANDPIPE INSTALLATION	
	-		STI	(m)			RE	2	:0 4	ю 6	8 0i	0		Stickup	
F	0	Ground Surface		3.78										= 0.9 m	
F		ASPHALT Medium to coarse SAND and subrounded		0.05	1	GRAB		⊕					METALS	Sand and Concrete	x x-
F		GRAVEL, some angular cobbles, loose to compact, moist, brown to grey below 5.8 m,		-1 -1				1						Bentonite	-
F		no odour, no staining	, Q											Sand	
E			• C	Ś	2	GRAB		•					BTEX VPH EPH		[]目]
F	1		0					1					EPH		目出
E			o f	S											
F			0											26-Aug-09 	
F			°, Ö											<u> </u>	
F		SILTY CLAY, occasional fine subrounded	Ŵ	1.95										Slotted Section	
-	2	gravel, firm, moist to wet, brown ang grey, no odour, no staining			3	GRAB		⊕					DTEV		
F		odoui, no staining			4	AS		•					BTEX VPH EPH		
F								1					EPH PAH		11
F				1.04											[::F::f
F		Silty SAND, some fine angular gravel below 3 m, loose to compact, moist, brown, no odour,		2.74	5	AS		•							
F	3	no staining		0.58				1						Claush	
F		BEDROCK	Ŵ		6	AS		⊕						Slough	
E		End of MONITORING WELL.		3.35											-
E															-
F	4														_
F															-
F															-
F															-
F															-
E	5														_
E															-
F															-
E															-
F															-
F	6														_
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GP.															-
5026															-
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36-0															-
IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11	10		I	1		1	1	I	I			I		<u> </u>	
LOG							÷.			2535	- 3rd Δv	enue S.I	<b>.</b>		
MM		PTH SCALE					GG	older	r	Calga	ry, Albe da T2A	rta		LOGGED: PM	
	1:	50					Ass	ocia	tes	Jand	ua 12A		CHE	CKED: WB/RP	

		SOIL PROFILE				SAMPLES	;	Soil Va	pour Co	ntent (pp	om)				
DEPTH SCALE METRES		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	Soil Va	pour Coi	ntent (%	LEL)	⊕ 2000 □ 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	+		S								1				
- ( - - - - -	Ĩ	Ground Surface ASPHALT SAND and GRAVEL, loose, moist, black, debris (wood boards, 2 diameter pipe) between 0.3 m to 0.35 m, hydrocarbon like odour and sheen		3.66 0.05 2.83	1	GRAB		-	0					Flushmounted Casing Sand Bentonite Sand	
	1	Fine to medium SAND, loose, moist, grey, hydrocarbon like odour		0.82	2	GRAB		•					BTEX VPH EPH		
-				4.00	3	GRAB		⊕					METALS	Slotted Section	
- - - - -	K	Fine to medium SAND, loose to compact, wet, black, hydrocarbon like odour BEDROCK	×	2.13	4,5	GRAB			0				BTEX/VPH EPH/PAH/VOC	Sand	
		End of MONITORING WELL.													
	4														
	5														
- - - - - - -	6														
- 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7 - 7	7														
L.GDT 05/19/11	в														
08-1436-0047.5026.GPJ IOL.GDT 05/19/11															
7 – 10 80															
D MW LOG	)EP' : {	TH SCALE 50				Ø	GG	older	tes	2535 Calga Cana	- 3rd Av ary, Alb Ida T2A	venue S.I erta 7W5		LOGGED: PM CKED: WB/RP	

1	SOIL PROFILE	1.			SAMPLES		Soil Va	pour Co	ntent (pp	m)	⊕	2 Q	
METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	Soil Va	pour Co	ntent (%l	EL)	0	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Ground Surface		3.57										
ľ	CONCRETE	P. 4	0.09				-						Flushmounted Casing Concrete Sand
1	Medium to coarse gravelly SAND, loose, moist, brown, no odour, no staining			2	GRAB		•					BTEX VPH EPH METALS	Sand Sand
2	Coarse gravelly SAND, loose, wet, black		2.12										
	Hydrocarbon like odour from 2.7 m			3,4	AS							BTEX VPH EPH PAH VOC	26-Aug-09 Slotted Section
3							-						Sand
	Free product at 4.0 m		-0.40	5	AS							BTEX VPH EPH	
4	BEDROCK End of MONITORING WELL.	Ŵ	4.11										Sand
5 6 7													
8													
10													
	PTH SCALE 50				Ø	GG	older	tes	Calga	- 3rd Av ry, Albe da T2A	enue S.E rta 7W5		LOGGED: PM CKED: WB/RP

	SOIL PROFILE				SAMPLES		Soil Va	pour Cor	itent (ppm	ר)	$\oplus$	ЪĞ	
METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	Soil Va	pour Cor	itent (%LE	EL)		ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
_	Ground Surface	ω.	4.39			Ľ		, 4		0 0	0		_
0	CONCRETE	P 4											Flushmounted Casing L. Concrete
Ī	Fine to medium SAND and subrounded		0.18	1	GRAB		•					METALS	Sand
	GRAVEL, compact, moist, reddish brown mottled, hydrocarbon like odour Coarse SAND, some subround GRAVEL,	0	3.75 0.64		GIVAD								Bentonite Sand
	loose, moist to wet, grey, hydrocarbon like odour	0.0	2	2	GRAB		] ⊕					BTEX VPH EPH	26-Aug-09 ∖ ∑
1	Water ponding at 1 m with hydrocarbon like sheen	0°0°	- - -									Lin	
	Sandy SILT, frim, moist, greenish grey with	111	2.87 1.52									BTEX VPH	Slotted Section
	black staining, hydrocarbon like odour			3	AS		•					BTEX VPH EPH PAH VOC	Slotted Section
2													
	CLAY, some fine sand seams, stiff, moist, brown, grey, no odour, no staining		1.95 2.44									DIEY	
	steam, groy, no ouour, no stallilling			4	AS		⊕					BTEX VPH EPH	
3													
													Slough
4				5	AS		●						
	End of MONITORING WELL.		-0.18 4.57										
5													
Ĵ													
6													
7													
8													
9													
10					· · · ·								·
	PTH SCALE				Â		1 1		2535 - 3	3rd Ave	enue S.E.		LOGGED: PM
20	50					E G	older ociat	•	Calgar Canada	y, Albe	rta		LUGGLD. FIVI

	SOIL PROFILE			SAMPLES	;	Soil Vap	our Con	tent (ppm)	•		
DEPTH SCALE METRES	DESCRIPTION	(m (m) (m) (m) (m) (m) (m) (m) (m) (m) (	TH S	ТҮРЕ	RECOVERY %	50 Soil Vap	our Con	tent (%LEL)	200	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
- 0	Ground Surface										
	ASPHALT Fine SAND, compact, moist, black, no odour, no staining		1	GRAB		Ð					Sand
- 1	Medium to coarse SAND and subrounded GRAVEL, some silt, loose, moist to wet, reddish, brown, no odour, no staining		2	GRAB		Ð				BTEX VPH EPH PAH METALS	Bentonite
- 2	CLAY, trace subrounded gravel, dense, moist to wet, grey, no odour, no staining Water ponding at 2.0 m End of MONITORING WELL.	1	83 3	GRAB						BTEX VPH EPH	
- 3											
- 4											
5											
- 6											
. 7											
/											
8											
9											
10											
9 9 0 0 0 0 10 1 1	PTH SCALE 50			Ø	G	older	es	2535 - 3rc Calgary, / Canada T	d Avenue S. Alberta '2A 7W5		LOGGED: PM ECKED: WB/RP

LOCATION: 337 Victoria View Road CONTRACTOR: Beck Drilling and Environmental Services Ltd. EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck OVM TYPE: RKI Eagle BORING DATE: May 17, 2010

# RECORD OF BOREHOLE: MW10-01

Ц	SOIL PROFILE				SAMPLES		Soil Va (ppmv)	pour Co	ncentrati	on	Ф	
DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	5 Soil Va (%LEL) 2	pour Coi	ncentrati	on	00   30	ADDITIONAL LAB TESTING
0	Ground Surface											
	CONCRETE (CORED) SAND and GRAVEL (FILL), large cobbles, debris (brick and concrete), compact, moist to wet, black staining		0.08									
- 1	Standing water, sheen at 0.8 m											
	SILT, stiff, wet, brown, hydrocarbon odour		1.22									
2	NO RECOVERY		1.68									
2	SILT, stiff, moist, grey to brown		2.13	1			⊕					METALS
3	Very stiff, some clay at 3.1 m and below			2			•					BTEX EPH
- 4	Some subrounded gravel at 4.4 m			3			Φ					PAH VPH
6	SILTY CLAY, trace subrounded gravel, moist, brown with grey mottles		5.49	4			Ð					
. 7	SILTY CLAY, trace fine gravel, soft, moist, grey		6.40	5								BTEX EPH PAH VPH
	SILTY SAND, trace gravel, fine, compact, moist to wet, grey, Hard drilling at 7.5 m		7.32	6			Ð					BTEX EPH VPH
8	Pulverized BEDROCK, angular pieces Rock at 7.9 m End of BOREHOLE. Upon completion of drilling, the borehole was backfilled with bentonite from the bottom of hole to	×	7.92									
9	0.3 m below ground surface. The last 0.3 m was backfilled with sand.											
					Â	- -			2535	- 3rd Av	venue S.I	
	PTH SCALE 50				(J	Go	oldei	tes	Calga	ry, Albe da T2A	erta	LOGGED: AEK/PM CHECKED: WB/RP

LOCATION: 337 Victoria View Road CONTRACTOR: Beck Drilling and Environmental Services Ltd. EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck OVM TYPE: RKI Eagle BORING DATE: June 02, 2010 DATUM: Geodetic

щ	SOIL PROFILE				SAMPLES		Soil Va (ppmv)	pour Co	ncentrat	ion	$\oplus$	ں ب	
DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	5 Soil Va (%LEL	pour Co )	ncentrat	ion	200 □ 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface	0	4.54								1		-
— 0 ·	ASPHALT (CORED) SAND and GRAVEL (FILL), cobbles, with debris (brick and concrete), compact, moist to wet, black stained, faint odour		0.08	1,2			•					METALS	Flushmount Roadbox
- 1				3			_ _ ⊕						28 July 2010
- 2	SILT, firm, wet, dark brown to black Grey and black, stiff, hydrocarbon at 1.7 m Pooling water, hydrocarbon sheen and \odour at 1.8 m SILT, stiff, moist, brown and grey		3.02 1.52 2.71 1.83	4								BTEX EPH VPH	28 July 2010 又
- 3	Very stiff at 3.1 m and below SILTY CLAY, firm, moist, brown and grey		1.34 3.20										Bentonite
- 4	CLAY, soft, wet, grey, some brown oxidation		-0.34 4.88										
- 6	Fine to medium grained SILTY SAND, some embedded subrounded fine gravel, brown to grey		<u>-1.40</u> 5.94										
- 7	Weathered BEDROCK, silty sand, grey Hard drilling (reported by drillers) at 7.0 m Bedrock 76.2 mm long pieces Refusal at 7.5 m		-2.32 6.86										Sand Slotted Section Sand
- 8	End of MONITORING WELL.		-3.23 7.77										Sand
- 9													
- 10													
10		_											
DEI 1 :	PTH SCALE 50				Ø	G	older ocia	tes	Calg	- 3rd Av ary, Albo ida T2A	venue S. erta 7W5	LO	GGED: AEK/PM ECKED: WB/RP

LOCATION: 337 Victoria View Road CONTRACTOR: Beck Drilling and Environmental Services Ltd. EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck OVM TYPE: RKI Eagle BORING DATE: May 18 and June 2, 2010 DATUM: Geodetic

щ	SOIL PROFILE				SAMPLES		Soil Va (ppmv)	pour Co	ncentrati	on	Ð	٩Ľ		
DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	5 Soil Va (%LEL)	pour Co	ncentrati	on	00	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	Ground Surface	0,	5.04										-	
- 0	ASPHALT (CORED)	***	0.08										Flushmount Roadbox	
	SAND and GRAVEL (FILL), subrounded, moist, grey to brown			1			_ ⊕ _					METALS		
- 1	Standing water at 0.96 m			2			 					BTEX EPH PAH VPH	6 July 2010	
- 2	SILT, some sand, firm, moist to wet, grey to brown, hydrocarbon like odour		3.52 1.52	3			- 0 1						Bentonite	
	SILT, trace clay, stiff, dry to moist, brown and grey		2.81 2.23				<b>⊕</b>							
- 3	Wet, fractured, more clay, occasional coarse sand lens, mainly brown with grey seams below 3.1 m			5,6			_ ⊕ _					BTEX EPH VPH	Sand	
- 4	Gravel at 3.9 m (only 50.8 mm recovery from 3.1 m to 4.6 m) Cobble lens, subrounded, flat, green, white to black, ranging from 0.35 m to 0.38 m length at 3.9 m													
- 5				7			- ⊕ -					EPH VOC VPH	Slotted Section	
				8,9			•					BTEX EPH VPH		
- 6												viii	- - - - - - - 	UTUTUT
				10,11			•							
. 7			-1.97										Sand	
	End of MONITORING WELL.		7.01											
- 8														
. 9														
10														
DEF 1 :	PTH SCALE				Â	G	older ociat	•	Calga	- 3rd Av ary, Albe da T2A		LOC	GGED: AEK/PM ECKED: WB/RP	

LOCATION: 337 Victoria View Road CONTRACTOR: Beck Drilling and Environmental Services Ltd. EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck OVM TYPE: RKI Eagle BORING DATE: May 18 and June 1, 2010

SHEET 1 OF 2

s	SOIL PROFILE	<b>⊢</b>	-	+		SAMPLES	%	Soil Vapour C (ppmv)			Ð	ING	
METRES	DESCRIPTION	STRATA PLOT	ELE DEP	тн	NUMBER	ТҮРЕ	RECOVERY %	Soil Vapour C (%LEL)	oncentra	ition		ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface	ST		, 1.83			R	20	40	60	30		6 July 2010
0	SILTY SAND, some gravel, compact, moist, dark brown, hydrocarbon like odour			0.00									Flushmount Roadbox
					1							METALS	
	SILT, trace sand, firm, moist, grey and brown,			1.07 ).76									
1	slight hydrocarbon like odour Some fine sand, strong hydrocarbon like			╞	2			-		⊕		BTEX EPH METALS VPH	
	odour at 1.1 m											VPH	
												BTEX	
2	SILT, some clay, firm, wet, brown with grey			2.70	3,4							BTEX EPH PAH VPH	
				-	5			<b>⊕</b>					
3													
Ĵ	Red oxidation below 3.1 m Large subrounded gravel at 3.2 m. Some fine gravel, becoming stiff, no odours below												
	fine gravel, becoming stiff, no odours below 3.2 m											BTEX EPH METALS	
4				-	6			<b>⊕</b>				METALS PAH VPH	
	SILTY CLAY, trace gravel (fine subround			).26 I.57									
5	below 6.2 m), soft to very soft			┢	7,8			_   ⊕					Dentenite
				┢									Bentonite
6													
	Wet puddles at 6.1 m				9			₽					
	No odours, break on core run at 3.1 m												
7													
				╞	10			<b>⊕</b> -					
8													
9	Some silt pockets (becomes firm) from 8.8 m to 9.1 m			╞	11			- ⊕					
				F									
	Personal and to firm below 0.7												
10	Becoming soft to firm below 9.7 m				12			0					
	CONTINUED NEXT PAGE						+		252	5 - 3rd A	0000 8 5		
DE	PTH SCALE						G	older ociates	Calg	jary, Albo ada T2A	erta	LO	GGED: AEK/PM

LOCATION: 337 Victoria View Road CONTRACTOR: Beck Drilling and Environmental Services Ltd. EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck OVM TYPE: RKI Eagle BORING DATE: May 18 and June 1, 2010 DATUM: Geodetic

RECORD OF MONITORING WELL: M	N10-03
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	ш	SOIL PROFILE				SAMPLES		Soil Va (ppmv)		ncentratio	on	Ð	. (5)	
	DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	5	0 1 pour Coi )	ncentratio	n		ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	- 10	SILTY CLAY, trace gravel (fine subround below 6.2 m), soft to very soft (continued)		-5.84										
	- 11	SILTY SAND, medium to coarse grained, loose, wet, grey, no odour or staining		10.67	13,14			Ð						Bentonite
	- 12	SANDY SILT, fine grained, firm to soft, wet, grey		-6.90 11.73 -7.36	15			Ð					BTEX EPH VPH	
		SAND, some silt, medium to coarse grained, wet, grey Coarse sand lens with some coarse gravel from 12.6 to 12.7		12.19	16,17			Ð						
	- 13	SILTY SAND, with weathered bedrock pieces (50.8 mm thick at 13.2 m and 76.2 mm at 13.5 m), flat, subangular, wet		<u>-7.97</u> 12.80										Sand
-		Large BEDROCK pieces with silt, green to grey, no odour		-8.89 13.72	18 19,20			⊕ ⊕					BTEX EPH PAH	Slotted Section
-	- 14	76.2 mm flat, very dense     Hard drilling, possible bedrock     End of MONITORING WELL.		<u>-9.54</u> 14.37									VPH	Sand
	- 15 - 16													
PJ IOL.GDT 05/19/11	- 17 - 18													
IOL MW LOG 08-1436-0047-5026-2006 MW LOGS.GPJ IOL.GDT 05/19/11	- 19 - 20 -													
IOF MW LOG 0	DEI 1 :	PTH SCALE 50				Î	Go	older	tes	Calga	- 3rd Av ry, Albe da T2A 7	enue S.I rta 7W5	LOG	GED: AEK/PM CKED: WB/RP

T	SOIL PROFILE				SAMPLES	3	Soil Vapour C (ppmv)	Concentration	Ð	1()	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	Soil Vapour C (%LEL)	100 150 Concentration	200	ADDITIONAL LAB TESTING	PIEZOMETEF OR STANDPIPE INSTALLATIO
╞	Ground Surface SAND and GRAVEL (FILL), subrounded,		4.47				•			BTEX	Stickup = 0.78 m
	compact, moist, black and grey to brown, strong hydrocarbon like odour		3.96							EPH METALS PAH VPH	
	SILT, trace sand, firm, moist, grey to brown, slight hydrocarbon like odour		0.51				•			METALS	6 July 20
	Metal debris, orange to brown mottling at 0.9 m										
	Ponded water, hydrocarbon sheen at			3			•			BTEX EPH VPH	
	1.5 m									VPH	
			1.88	4	SS		•			BTEX EPH METALS PAH	
ľ	Hydrocarbon like odour, grey staining, trace gravel at 2.6 m SILTY CLAY, stiff, some orange roots and fine		2.59		SS		- €			VPH	
	grained sand lenses to 2.7 m, wet, brown with grey striations, no odour		1.25	5							
	SILT, fine grained sand lens, dense, wet, hydrocarbon odour Fine sand lenses and orange stained seam from 3.3 m to 3.4 m and from 3.6 m to 3.7 m		3.22	6	SS		-				
	Water in spoon has fine grained sand Becoming loose below 4.2 m										
	Red fine grain sand lenses (1 mm), to 4.2 m Wet, grey with orange mottling below			7	SS						
	4.2 m Clay pockets at 4.5 m CLAY, firm, moist to wet, brown and grey		-0.10 4.57	D	ss					BTEX EPH	
	Fine sand lens or seam, wet to 4.7 m Becoming soft and grey below 4.9 m									VPH	Bentonite
	Some fine sand below 4.5 m Hydrocarbon odour from 5.1 m to 5.3 m Very soft with some fine sand from 5.6 m			9	SS		•				
	to 6.2 m			10,11	SS		•				
	Firm below 6.6 m			12	SS		⊕ 				
	Very soft at 7.0 m										
				13	SS						
				14	ss						
	SAND, medium subrounded gravel, some clay, medium coarse grained, loose, wet		-4.45		SS		- +				
	Flat rock pieces, less clay below 9.6 m			16	SS		⊕			EPH VOC VPH	

CC EQ May	CATION: 337 Victoria View Road NTRACTOR: Beck Drilling and Environmental Ser UIPMENT USED : Sonic Truck Percussion Rig / V MMPPE: RKI Eagle			and Track	mounted	- Hollow /	Auger with Sp	lit Spoon an	nd ODEX	/ELL	: MW10-0	SHEET 2 OF 2	
	RING DATE: May 18 and June 15, 2010 TUM: Geodetic												
DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	SAMPLES	RECOVERY %	Soil Vapour (ppmv) 50 Soil Vapour (%LEL) 20	100 1 Concentrati	50 200		ADDITIONAL LAB TESTING	PIEZOMETE OR STANDPIP INSTALLATI(	E
- 10 - - -	SILTY SAND, with some medium subrounded gravel, fine to medium grained, loose, wet, grey		18:88										
- - - - - - - - - - -	Course sand lens from 10.51 m to 10.53 m Embedded fine gravel, wet below 10.7 m			17,18	SS		+ + + + + + + + + + + + + + + + + + +					Bentonite	- - - - - - - - - - - - - -
- - - - - - -	Saturated from 11.4 m to 11.7 m		<u>-7.49</u> 11.96								BTEY	Sand	
- - -	Weathered BEDROCK, some silty fine sand, dense, moist, grey		-8.15	20	SS		⊕ 				BTEX EPH VPH	Slotted Section	
- - - 13 -	BEDROCK Cave at 12.8 m Bedrock depth confirmed with tape		12.62									Sand	
-	End of MONITORING WELL.		-8.94 13.41										
- 14 - - - -													
- - - 15 - -													-
- - - - - - - - - - - - - - -													-
- - - - - - - - -													-
-  -													-
													-
- - - - - - - - - - - - - - - - - - -													-
- - 20													
	PTH SCALE 50				Ø	G	older ociates	2535 Calga Cana	- 3rd Ave ary, Alber da T2A 7	ta	LO	GGED: AEK/PM ECKED: WB/RP	

CO EQ ଏହା BO	CATION: 337 Victoria View Road INTRACTOR: Beck Drilling and Environmental S UIPMENT USED : Sonic Truck Percussion Rig / MTPPPE: RKI Eagle IRING DATE: May 18 and June 16, 2010 TUM: Geodetic											.: MW10-0	SHEET 1 OF 2
SCALE RES	SOIL PROFILE	LOT		с,	SAMPLES	۲% %	Soil Vapo (ppmv) 50		ncentration		⊕ 10	ONAL	PIEZOMETER
DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY	Soil Vapo (%LEL) 20		ncentration		0	ADDITIONAL LAB TESTING	OR STANDPIPE INSTALLATION
— o	Ground Surface		5.15										Stickup = 0.83 m
	SAND and GRAVEL (FILL), trace metal debris, subrounded, compact, grey to brown			1			_ ⊕ _					METALS	
	SILT, trace to some fine grained sand, firm, moist, grey and brown with black pockets Moderate hydrocarbon like odour, wood debris at 0.9 m		<u>4.24</u> 0.91				€	₽				BTEX EPH PAH VPH	
- - - - -	Ponded water, hydrocarbon sheen at 1.8 m No hydrocarbon odour and no black pockets, firm to stiff, moist from 1.9 m to 3.4 m			3			•					BTEX EPH VPH	28 July 2010 <u> </u>
	Mainly brown with grey vertical striations from 1.9 m to 3.4 m			4			⊕						
- 3 - 3							-						
-	∖ Wet gravel lens to 3.4 m		1.77	5	SS		<b>⊕</b>						
-	SILTY CLAY, stiff, moist, brown, black to reddish brown (dark) spots between 3.7 m to 3.9 m and 4.1 m to 4.2 m, no odour		3.36	6	SS		_ ⊕						
	CLAY, stiff, moist, brown		0.12 5.03		SS		Đ						Bentonite
	Grey and firm below 5.9 m												
-	Some silt, brown from 6.1 m to 6.6 m			8	SS		•						
- - - -	Brown and grey mottled and soft to firm below 6.6 m Wet below 7.0 m			9,10	SS		<b>⊕</b>						
- 7 - - - -	Soft below 7.0 m			11	SS		- - -						
8				12	ss		<b>→</b>					BTEX EPH	
- - - - - 9 -	Occasional subrounded gravel between 8.5 m to 8.6 m											PAH VPH	
- - - - - - - - -				13	SS								
10	CONTINUED NEXT PAGE												
	PTH SCALE 50				Î	G	older ociate	es	2535 - 3 Calgar Canada	y, Albe	enue S.E rta W5	LO	GGED: AEK/PM ECKED: WB/RP

ш	SOIL PROFILE				SAMPLES		Soil Va		centration	Ð	. (1)		
DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	5 Soil Va (%LEL	i0 10	Icentration	200	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
— 10 - -	CLAY, stiff, moist, brown <i>(continued)</i> Silt band 50.8 mm thick at 10.2 m			14	SS		•						
- - - - - - - -	Fine grained sand lens, 10 mm thick, wet at 10.7 m												
- - - - - -	SANDY SILT, some fine subangular gravel, some clay, firm, wet, grey Musty odour from 11.9 m to 12.2 m Gravel increasing below 12.2 m		<u>-6.81</u> 11.96	15,16	SS		•						
- - 13 -	SILTY SAND, fine to medium grained gravel, compact, moist, grey Fine sand lenses layered with silt lenses		-7.88 13.03	17	ss		•				EPH VOC VPH	Bentonite	
-	between 13.1 to 13.3 m Some fine subangular gravel and increasing at 13.5 m			18	SS		•						
- 14 - - -				19	SS		•						
- - - - 15 -	Coarse sand lens 50.8 mm thick with large subangular cobble (green bedrock-like) between 14.7 m to 14.8 m Course grained SAND, with fine to medium subangular gravel, some silt, compact to		-9.86 15.01	20	SS		- ⊕						
- - -	dense, grey Saturated from 15.2 m to 15.6 m SILTY SAND, fine to medium grained, some fine subrounded gravel, compact, wet, grey		-10.47 15.62	21	SS		•				BTEX EPH VPH	01	
— 16 - -	BEDROCK (green to black)		-11.00 16.15								VPH	Sand Slotted Section	
- - - - - 17	End of MONITORING WELL.		<u>-11.61</u> 16.76									Sand	
- - - -													
- - - 18 -													
-													
- 19 - -													
-													

LOCATION: 337 Victoria View Road CONTRACTOR: Beck Drilling and Environmental Services Ltd. EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck OVM TYPE: RKI Eagle BORING DATE: June 2 and 3, 2010 DATUM: Geodetic

#### **RECORD OF MONITORING WELL: MW10-06**

L	SOIL PROFILE		,		SAMPLES		Soil Va (ppmv)	pou. 00.		•	μĻ	
METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	Soil Va (%LEL	pour Cor )	00 150 ncentration		ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface	0,	4.70				-					-
0	CONCRETE (CORED)		0.08									Flushmount Roadbox
	SAND (FILL), some gravel, medium sand, loose, moist, grey to brown		0.07	1			₽					
ŀ	Coarse sand, wet at 0.6 m SAND and GRAVEL, some silt pockets,		3.97 0.73	2			₽ 1					
1	coarse grained with medium subrounded gravel, wet, black stained, hydrocarbon odour	o C										6 July 201
	Very loose, with gravel at 0.9 m		· 3.48	3			<b>+</b>				METALS	
	SILTY CLAY, firm, moist to wet, grey to black stained, hydrocarbon odour		3.18	4			-	e		<b>₽</b>	BTEX,EPH	
F	SILT, dry to moist, compact	TIT.	1.52	3,0			1		ľ I		PAH,VPH	
	Becomes brown and grey, still hydrocarbon											
2	odour at 1.7 m			7			•					
	Becomes very stiff below 2.3 m											
				-			-					
				8			-  "	Ð				
3	Riverbed gravel lens (subrounded) from						1					
	3.1 m to 3.7 m											
	Conorally gray at 2.7 m						1					
┝	Generally grey at 3.7 m CLAYEY SILT, some embedded fine to	╢╢	1.04 3.66									
	medium grained subrounded gravel, beige paint or metal chips below gravel lens, dense	W	3.00				1				ЕРН	
4	paint or metal chips below gravel lens, dense		1	9,10			1	⊕			EPH METALS PAH	
		KII.		3,10			4	Ψ			VOC VPH	Bentonite
		W	0.40				1				vr0	
┢	CLAY, firm to soft, moist, brown with grey		0.13									
	inclusions, no odour	V///					1					
5							1					
		<i>\///</i>					-					
		V///		11			•					
		V///					1					
		<i>\///</i>										
6		V///					1					
-		<i>\///</i>										
							1					
				12				Ð				
							1					
7		V///					1					
		V///					1					
		V///					1					
							4					
	Grey, wet below 7.6 m	V///		13,14			1	Φ				
8		V///					1					
							1					
	Trace bedrock fragments below 8.2 m	<i>\///</i>		15	7			⊕			BTEX EPH VPH	Sand
┝	BEDROCK, dense, dry	$\mathbb{H}$	-3.83 8.53				-				VPH	Slotted Section
	······································	Ŵ					1					Sand
9		Ķ//	-4.29				ļ					Sand
Ĭ	End of MONITORING WELL.		8.99				1					
							1					
							1					
10		•										
									0.000			
DEF	PTH SCALE					E C	older ocia	•		3rd Avenue S. /, Alberta	<b>E.</b>	OGGED: AEK/PM
										a T2A 7W5		

LOCATION: 337 Victoria View Road CONTRACTOR: Beck Drilling and Environmental Services Ltd. EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck OVM TYPE: RKI Eagle BORING DATE: June 2 and 3, 2010 DATUM: Geodetic

# RECORD OF MONITORING WELL: MW10-06A(Nest)

ц	ц	SOIL PROFILE				SAMPLES		Soil Va (ppmv)	pour Co	ncentrat	ion	Ð	. (1)	
	METRES		-OT		ĸ		% ≻			00 1	50 2	00	ADDITIONAL LAB TESTING	PIEZOMETER
	METH	DESCRIPTION	TA PI	ELEV.	NUMBER	ТҮРЕ	VER	Soil Va (%LEL	pour Co	ncentrati	ion		B TEG	OR STANDPIPE
			STRATA PLOT	DEPTH (m)	NN		RECOVERY %	2		0 0	50 E	0	LAC	INSTALLATION
		Ground Surface	0,	4.66										
F	0	ASPHALT		0.08										Flushmount Roadbox
E		SAND (FILL), medium to coarse grained, some gravel, loose, wet (flowing Saturated), brown and grey, hydrocarbon odour												
F		brown and grey, hydrocarbon odour												-
F														Bentonite 6 July 2010
E	1													Bentonite 6 July 2010
F														
F				3.14 1.52										Sand
E		SILT, trace gravel to 0.9 m, firm to stiff, black stained to 2.1 m with hydrocarbon odour, then		1.52										
F	2	brown to grey												
F														Slotted Section
E														
F														
-	2													1 N N N N
E	3													Sand
F		CLAY, very stiff, brown to grey, some reddish		1.31 3.35										-
F		oxidation												-
E														Bentonite
F	4													-
E														
F		End of MONITORING WELL.		0.09										
E														-
F	5													-
F														-
E														-
F														-
E	6													-
F														-
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S.GP														-
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MM-														-
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1 1														-
36-0(														
IOL MW LOG 08-1436-0047-5026-2006 MW LOGS.GPJ IOL.GDT 05/19/11	10			1		1		I		1	1	I	<u>I</u>	I
LOG							₩.			2535	- 3rd Av	enue e	F	
MM		PTH SCALE					GG	oldeı	•	Calga	ary, Albe da T2A	rta		LOGGED: PM
	1 :	50				U	Ass	<u>ocia</u>	tes	Jana			CHE	CKED: WB/RP

SHEET 1 OF 1

LOCATION: 337 Victoria View Road CONTRACTOR: Beck Drilling and Environmental Services Ltd. EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck OVM TYPE: RKI Eagle BORING DATE: June 10, 17 and 18, 2010 DATUM: Geodetic

### **RECORD OF MONITORING WELL: MW10-07**

	SOIL PROFILE				SAMPLES		Soil Va (ppmv)	ipour Con	centratio	n	⊕	5 Č	
METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	Soil Va (%LEL		icentratio	n		ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		S				Ľ.	2	0 40	0 6	9 8	0		Stickup = 0.94 m
0 -	Ground Surface Coarse SAND and subrounded GRAVEL, loose to compact, dry to moist, no odour, no staining		4.18	0									
1	Sand and gravel, compact, moist, brown, hydrocarbon odour from 0 to 1.5 m Coarse SAND and subrounded GRAVEL, some large cobbles, loose, wet, grey, hydrocarbon like odour, pounding water at 1.5 m, hydrocarbon like sheen     Silt, stiff, light brown, wet from 1.5 m to		0.70										
2	3.1 m Sandy SILT, stiff, wet, brown, no odour, no staining	0	2.3	3									
-	CLAY, stiff, moist, brown and grey, no odour, no staining		2.29										28 July 2010 
3	Brown, dense, wet, clay at 3.1 m												
5													Bentonite
6	Soft and grey from 6.1 m		-1.92										
	CLAY, firm, moist, brown and grey		6.10										
	Fine sand seams 10 mm thick between 6.48 m and 6.58 m Some gravel (subrounded) below 6.6 m			1	SS		•					BTEX EPH VPH	
7	SAND, coarse grained, some fine to medium subangular gravel, some silt, compact, moist		-2.75 6.90	2			⊕						
			· · ·				-						
8	Wet from 7.6 m to 8.0 m		•	3			Ð						
	Gravel is finer below 8.2 m												
9	Coarse sand lens from 8.61 m to 8.64 m and 9.47 m to 9.54 m SILTY SAND, fine to medium grained, trace to some medium subrounded gravel, dense,		-4.66				•						
	moist			5,6	SS		Ð					BTEX EPH VPH	
10	CONTINUED NEXT PAGE	<u>E</u> LF	1		<u> </u>	<u> </u>	1						
DEF	PTH SCALE				Â	G	older	r	2535 - Calga	3rd Av ry, Albe la T2A 3	enue S.E erta	E.	LOGGED: PM

LOCATION: 337 Victoria View Road CONTRACTOR: Beck Drilling and Environmental Services Ltd. EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck OVM TYPE: RKI Eagle BORING DATE: June 10, 17 and 18, 2010 DATUM: Geodetic

## RECORD OF MONITORING WELL: MW10-07

	SOIL PROFILE			SAMPLES	3	Soil Va	pour Co	ncentrati	on	•		
DEPTH SCALE METRES	DESCRIPTION	(m) (m) (m)	_ <	ТҮРЕ	RECOVERY %	(ppmv) 5 Soil Va (%LEL)	0 1	00 1 I ncentrati	1		ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE
DE		(m)	z z		RECO	2				B0	AI	INSTALLATION
- 10 	SILTY SAND, fine to medium grained, trace to some medium subrounded gravel, dense, moist ( <i>continued</i> ) Finer gravel and sand, increasing density below 10.4 m											
	SAND, coarse grained, with some gravel, wet, some flat subangular gravel, grey		.89	SS		•						Bentonite
- - - - - - - -	Coarse gravel lens, wet, fine from 11.68 m to 11.73 m SILTY SAND, fine grained, some fine gravel, compact, wet SAND, medium grained, some fine gravel, compact, wet, grey		.63 8 .81 .04 .22 .9	SS		● ● ● ●					BTEX EPH VPH	
- - - - - - - - - - - -	BEDROCK		.90 10								VPH	Sand Slotted Section
- - - - - - - - - - -	End of MONITORING WELL.	-9	.26									Slotted Section
- - - - - - - - - - - - - - - - - - -												
- - - - - - - - - - - - - - - - - - -												
DE	EPTH SCALE 50			Ø	G	older ociat	tes	Calga	- 3rd Av iry, Alb da T2A	venue S. erta 7W5		Logged: PM CKED: WB/RP

LOCATION: 337 Victoria View Road CONTRACTOR: Beck Drilling and Environmental Services Ltd. EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck OVM TYPE: RKI Eagle BORING DATE: June 28, 2010

# RECORD OF BOREHOLE: MW10-08

SHEET 1 OF 1

	TUM: Geodetic SOIL PROFILE				SAMPLES		Soil Vap	our Co	ncentratio	on	-	
CALE		5				%	(ppmv)		00 15		⊕ 00	
DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY	(%LEL)	Soil Vapour Concentration			ADDITIONAL LAB TESTING	
- 0	Ground Surface											
	SAND and GRAVEL, angular gravel, some roots, fine to medium gravel, dense, dry, brown, organic to musty odour		0.00		GRAB		•					BTEX,EPH METALS,VPH
-	Coarse grained SAND and GRAVEL, finer gravel, compact, moist, orange staining below	0.0	0.56	2	GRAB		⊕					METALS
-	0.4 m, reddish brown Some orange (slag-line pieces and metal)		0.00									
- 1	at 0.5 m End of BOREHOLE.											
-	Upon completion of drilling, the borehole was backfilled with bentonite from the bottom of hole to 0.3 m below ground surface. The last 0.3 m was backfilled with sand.											
- - - 2	last 0.3 m was dackfilled with sand.											
-												
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-												
- 9 - -												
_												
- - - 10												
10												
DE 1 :	PTH SCALE 50				Ĝ	G	older ociat	es	2535 - Calga Canad	· 3rd Av ry, Albe la T2A '	enue S.E erta 7W5	LOGGED: PM CHECKED: WB/RP

LOCATION: 337 Victoria View Road CONTRACTOR: EQUIPMENT USED : Hand Dug with Clam Digger OVM TYPE: RKI Eagle BORING DATE: June 28, 2010 DATUM: Geodetic

	SOIL PROFILE				SAMPLES		Soil Va (ppmv)	pour Co	ncentrati	on	•	1 (7)		
DEPTH SCALE METRES	DESCRIPTION		ELEV. DEPTH (m)	NUMBER	ТҮРЕ	RECOVERY %	5	0 1) pour Coi	00 1 I ncentrati	50 20 0n		ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
0	Ground Surface	S	5.15			E							Stickup = 0.54 m	
-	HAND AUGER		0.00										Bentonite	
- - - 1 -													Sand	
- 2	HOLLOW STEM AUGER		<u>3.63</u> 1.52										Slotted Section	
-													Sand	
-	End of MONITORING WELL.		2.41 2.74											
— 3 —	Monitoring well was dry on July 28, 2010													
	Please refer to borehole log for MW10-05 for detailed soil description results													-
- 4														-
-														
-														
- 5														
-														
														-
- 6														-
-														
-														
- 7														_
-														
05/16														
8 L-GDI														_
0.65.0														
J 9														
6-2006														-
47-502														
1 1 1														
71 - 10					1					1			I	
≥	EPTH SCALE : 50				Î	GG	older	tes	Calga	- 3rd Av ary, Albe da T2A 1	rta	l	.ogged: Aek Cked: WB/RP	

C E O B	OCATION: 337 Victoria View Road CONTRACTOR: Beck Drilling and Environmental S EQUIPMENT USED : R-53 (Track Rig) Hollow Ster DVM TYPE: RKI Eagle 3ORING DATE: June 28, 2010 DATUM: Geodetic				L: MW10-1	SHEET 1 OF 1
	SOIL PROFILE		SAMPLES	Soil Vapour Concentration		
DEPTH SCALE METRES	DESCRIPTION	(m) STRATA PLOT (m) (m)	NUMBER TYPE RECOVERY %	(ppmv) ⊕ 50 100 150 200 Soil Vapour Concentration (%LEL) □ 20 40 60 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface	4.72				-
	ASPHALT     HAND AUGER	0.15				Flushmount Roadbox Bentonite
- 1 - 1   	1 HOLLOW STEM AUGER	<u>3.35</u> 1.37				6 July 2010
- - - - - -	2	1.98				Sand
	End of MONITORING WELL.	2.74				
- - - - - - -	4					
	5					
- - - - - - -	6					
F	7					
	8					
	9					
D	DEPTH SCALE		GAS	2535 - 3rd Avenue S. Calgary, Alberta Canada T2A 7W5		Logged: Aek Ecked: WB/RP

CC EC O\ BC	DCATION: 337 Victoria View Road DNTRACTOR: Beck Drilling and Environmental So QUIPMENT USED : R-53 (Track Rig) Hollow Stem /M TYPE: RKI Eagle DRING DATE: June 28, 2010 ATUM: Geodetic			ord of		ORING	WELL	: MW10-1	SHEET 1 OF 1	
	SOIL PROFILE		SAN	IPLES	Soil Vapour C	oncentration	•			
DEPTH SCALE METRES	DESCRIPTION	STRATA PLOT (m) (m) (m)	~	TYPE RECOVERY %	Soil Vapour C (%LEL)		⊕ 200 □ 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
0 	Ground Surface HOLLOW STEM AUGER	4.16							Stickup = 0.92 m	
- - - - - - - - - - - - - - - - - - -	HOLLOW STEM AUGER	2.64							28 July 2010 ⊻	
	HOLLOW STEM AUGER	1.11 3.05							Bentonite	
- 4 	HOLLOW STEM AUGER	-0.41 4.57								
- 6 - 6 - 7	HOLLOW STEM AUGER	-1.94 6.10								
-5026-2006 MW LUGS: GPJ 10L. GD1 1071911	HOLLOW STEM AUGER	-3.46 7.62							1 6	
08-1436-0047-5026-2006 MW LOGS.	soil description results	4.37 8.53								<u>285 (v) [</u>             
	EPTH SCALE : 50		(	<b>P</b> Ass	older ociates	2535 - 3rd A Calgary, All Canada T2A	Avenue S.E. perta A 7W5		LOGGED: AEK :CKED: WB/RP	

	CATION: 337 Victoria View Road NTRACTOR: Beck Drilling and Environmental Se	rvices	Ltd.										SHEET 1 OF 1	
EQ OV	UIPMENT USED : R-53 (Track Rig) Hollow Stem /M TYPE: RKI Eagle /RING DATE: June 28, 2010	Auger	/ Hand A		COR	D OF	MO	ΝΙΤΟ	ORIN	IG W	/ELI	.: MW10-12	2	
DA	TUM: Geodetic						Soil Va	pour Cor	ncentratio	'n			1	
DEPTH SCALE METRES	SOIL PROFILE	5			SAMPLES	%	(ppmv)				⊕ 10	TING	PIEZOMETER	
PTH S METRI	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ	RECOVERY		pour Cor	ncentratio			ADDITIONAL LAB TESTING	OR STANDPIPE	
DE		STRA	DEPTH (m)	NN		RECO	2		0 6	0 8		LAC	INSTALLATION	
— o	Ground Surface HAND AUGER		4.44										Stickup = 0.98 m	
-	HAND AUGEN		0.00										July 28 2010	-
-														
-														
- 1														
F			2.92											
-	HOLLOW STEM AUGER		1.52											-
- 2													Bentonite	-
-														-
-														
-														-
- 3	HOLLOW STEM AUGER		1.39 3.05											
-														-
														-
- 4													Sand 6 July 2010 ⊻	
- *													Slotted Section	
-														
-			-0.44										Sand	
- 5	End of MONITORING WELL.		4.88											
-	Please refer to MW10-04 for detailed soil description results.													-
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5														
	PTH SCALE				Â	F.			2535 -	3rd Ave	enue S.I			
	50				E	<b>G</b> Ass	older ociat	tes	Calgar Canad	ry, Albe la T2A 7	rta W5		Logged: Aek :Cked: WB/RP	

	CO EQ OV BO	CATION: 337 Victoria View Road NTRACTOR: Beck Drilling and Environmental Se JIPMENT USED : R-53 (Track Rig) Hollow Stem M TYPE: RKI Eagle RING DATE: June 28, 2010					D OF	MON	ΙΙΤΟ	RING	G WEL	.L: MW10	SHEET 1 OF 1
-		TUM: Geodetic SOIL PROFILE				SAMPLES		Soil Vapo	our Conc	entration			
DEPTH SCALE	METRES	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER		RECOVERY %	(ppmv) 50 Soil Vapc (%LEL) 20	100	entration	€ 200 1 80	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	0	Ground Surface	0)	3.55					Ť	Ť			
	1	CONCRETE (previously cored) SAND (FILL), some fine gravel, compact, moist, grey to brown, odour (mildew/organic like) Medium sand, trace subrounded gravel (fine)		0.12									Flushmount Roadbox Bentonite Sand
					1		60	_ ⊕ _					Slotted Section
-	2	Refusal, potential bedrock at 2.3 m		0.96	2,3		50	•				BTEX EPH METALS PAH VOC VPH	Sand
-		End of MONITORING WELL.		2.59									
	3 4 5	Well was dry on July 7, 2010.											
	6 7												
	8												
	9												
	DE 1 :	PTH SCALE 50				Ø	1	older ociate	es	Calgary,	rd Avenue S , Alberta T2A 7W5		LOGGED: AEK CHECKED: WB/RP

CO	CATION: 337 Victoria View Road NTRACTOR: Beck Drilling and Environmental Se			tom Aug	or.								SHEET 1 OF 1
OV BO	UIPMENT USED : R-53 (Track Rig) Hollow Stem M TYPE: RKI Eagle RING DATE: June 28, 2010 TUM: Geodetic	Auger	7 5010 5			D OF	MO	NITO	ORIN	IG W	/ELL	.: MW10-1	4
	SOIL PROFILE				SAMPLES		Soil Va (ppmv)	pour Co	ncentratio	on	Ð		
DEPTH SCALE METRES		OT		~		% >	(ppinv) 5		00 15	50 20		ADDITIONAL LAB TESTING	PIEZOMETER
AETR	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ	RECOVERY	Soil Va	pour Co	ncentratio			DITIO 3 TES	OR
DEP		IRAT	DEPTH (m)	ΝΩ	⊢	ECO	(%LEL)					AD	STANDPIPE INSTALLATION
		S				Ľ	2	0 4	0 6	0 8	)		-
— 0	Ground Surface		5.01										Flushmount Roadbox
E	HAND AUGER	1	0.08										Bentonite
E													Sand
E													
- 1													
E													Slotted Section
-			3.49										6 July 2010 ☐ 
-	HOLLOW STEM AUGER		1.52										
-													
- 2			2.88										Sand
-	End of MONITORING WELL.		2.13										
F													
-	Please refer to MW10-02 for detailed soil description results												:
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	PTH SCALE				Â	۲.				3rd Ave			
						GG	older	•	Calga Canad	ry, Albe la T2A 7	rta W5		LOGGED: AEK
<u> </u>	50				V	ASS	ocial	tes			· ·	CHE	ECKED: WB/RP

LOCATION: 337 Victoria View Road CONTRACTOR: Beck Drilling and Environmental Services Ltd. EQUIPMENT USED : Track Mounted R53 ODEX Drilling Rig OVM TYPE: RKI Eagle BORING DATE: October 05, 2010 DATUM: Geodetic

<b>RECORD OF MONITORING WELL: I</b>	MW10-15
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ш	i	SOIL PROFILE				SAMPLES		Soil Va (ppmv)	pour Co	ncentrat	ion	Ð	()	
PTH SCAL	METRES	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	ТҮРЕ	RECOVERY %	5	i0 1			200	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE
DE	7 1		STRA	(m)	N		RECO			10	60	80	Ar	INSTALLATION
-	0	Ground Surface SAND and GRAVEL (FILL), loose		5.77 0.00										Stickup = 0.82 m
	1	SAND (FILL), medium grained, some rounded gravel, loose, moist, brown CLAYEY SILT, some sand, firm, grey, moist		5.31 0.46 5.08 0.69		AS	80	Ð						
	2	BEDROCK Fracture zone, hydrocarbon-like odour from 1.83 m to 1.98 m		4.55		AS	80 6							Bentonite 22 Nov 2010 ♀
	3	Soft rock, easy drilling from 3.05 m to 3.35 m Competant bedrock from 3.35 m to 3.81 m												
	4	Fracture zone from 4.57 m to 4.67 m												Sand
	6	Competant bedrock from 5.33 m to 6.25 m												Slotted Section
-		End of MONITORING WELL.	K	-0.63 6.40										Sand
15/19/11	7			0.40										
OGS.GPJ IOL.GDT (	8													
IOL MW LOG 08-1436-0047-5026-2006 MW LOGS.GPJ IOL.GDT 05/19/11	9													
3-1436	10													
IOL MW LOG 0	DEI 1 :	PTH SCALE 50				Ø	Go	older	r tes	Calg	- 3rd A ary, All da T24	venue S. perta A 7W5		Logged: AA CKED: WB/RP

LOCATION: 337 Victoria View Road CONTRACTOR: Beck Drilling and Environmental Services Ltd. EQUIPMENT USED : Track Mounted R53 ODEX Drilling Rig OVM TYPE: RKI Eagle BORING DATE: October 05, 2010 DATUM: Geodetic

<b>RECORD OF</b>	MONITORING WELL:	MW10-16
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	ш	SOIL PROFILE				SAMPLES		Soil Va (ppmv)	pour Co	ncentrati	on	•	. (1)	
	DEPTH SCALE METRES		PLOT			5	0 1			00	ADDITIONAL LAB TESTING	PIEZOMETER		
	MET	DESCRIPTION	STRATA PLOT	ELEV. DEPTH	NUMBER	ТҮРЕ	COVEI	Soil Va (%LEL	pour Co )	ncentrati	on		ADDIT AB TE	OR STANDPIPE INSTALLATION
_			STR	(m)	~		RE	2	0 4	ο e	60 8	30 		
-	0	Ground Surface SAND (FILL), medium grained, some rounded		5.67 0.00										Stickup = 0.93 m
E		gravel, loose, moist, grey-brown												
F														Bentonite
-		CLAYEY SILT, some sand, firm, grey, moist		4.91 0.76										
E	• 1													
E			K)											Sand
F			$\ $	3.84										22 Nov 2010 21 0 ⊻ ; ⊟ : -
Ē	- 2	BEDROCK, fractured, hydrocarbon-like odour	K	1.83										
-														Slotted Section
Ē														
E			$\bigotimes$											
E	3		K											Sond Sond
F		Water in hole at 3.20 m End of MONITORING WELL.	1	2.32 3.35										Sand
F														-
Ē	· 4													-
Ē														
E														
-														-
-	• 5													-
F														-
F														-
-	- 6													-
E														
E														-
-	• 7													
9/11														-
- 05/1														-
L.GD	. 8													-
GS.G														-
- LC														=
2006 N	. 9													
5026-2														-
0047-{														
1436-(	· 10													
G 08-	-													
IOL MW LOG 08-1436-0047-5026-2006 MW LOGS.GPJ IOL.GDT 05/19/11	DE	PTH SCALE				Â		Jda-	•		- 3rd Av ry, Albe	enue S.I erta	E.	LOGGED: AA
	1:	50				V	GG	ocia	tes	Cana	da T2A	7W5	CHE	CKED: WB/RP

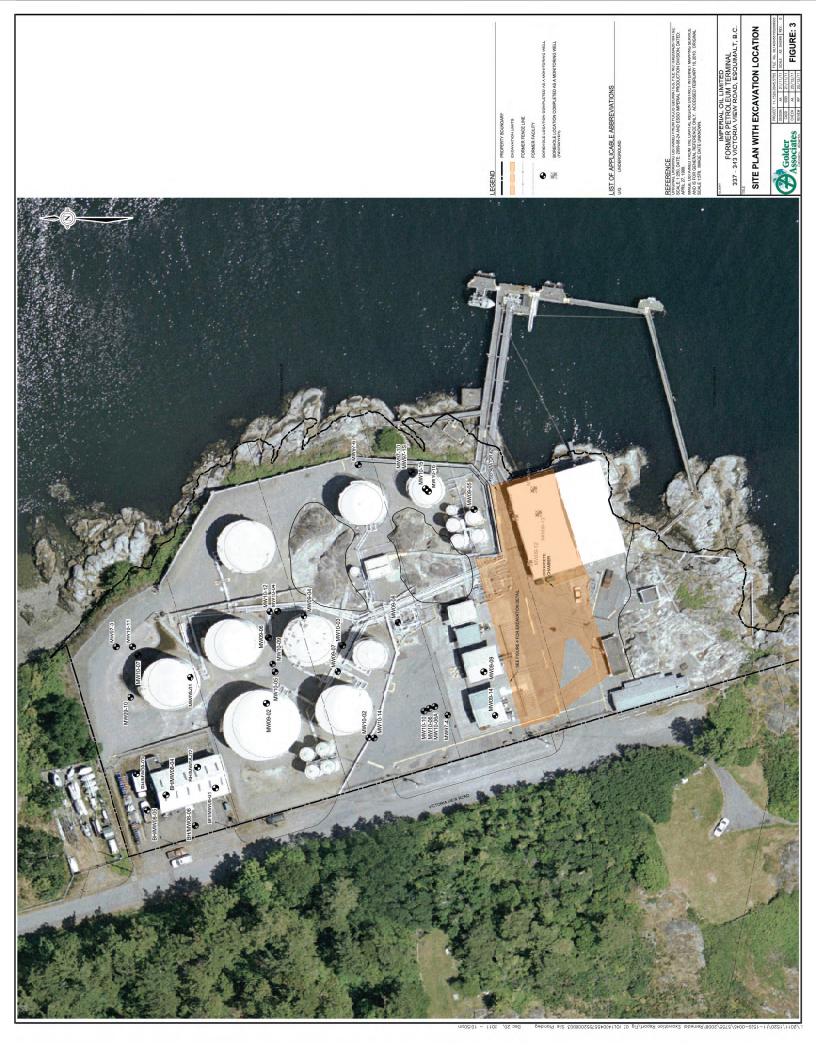
Core Area Wastewater Treatment Program Final

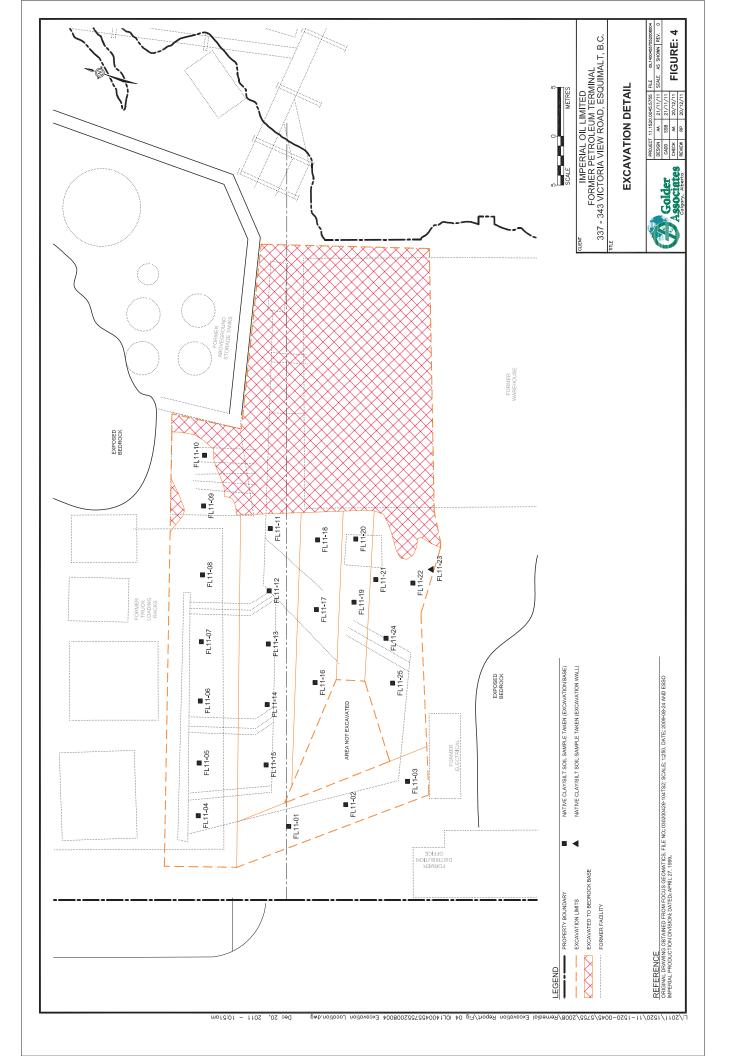
# **APPENDIX G**

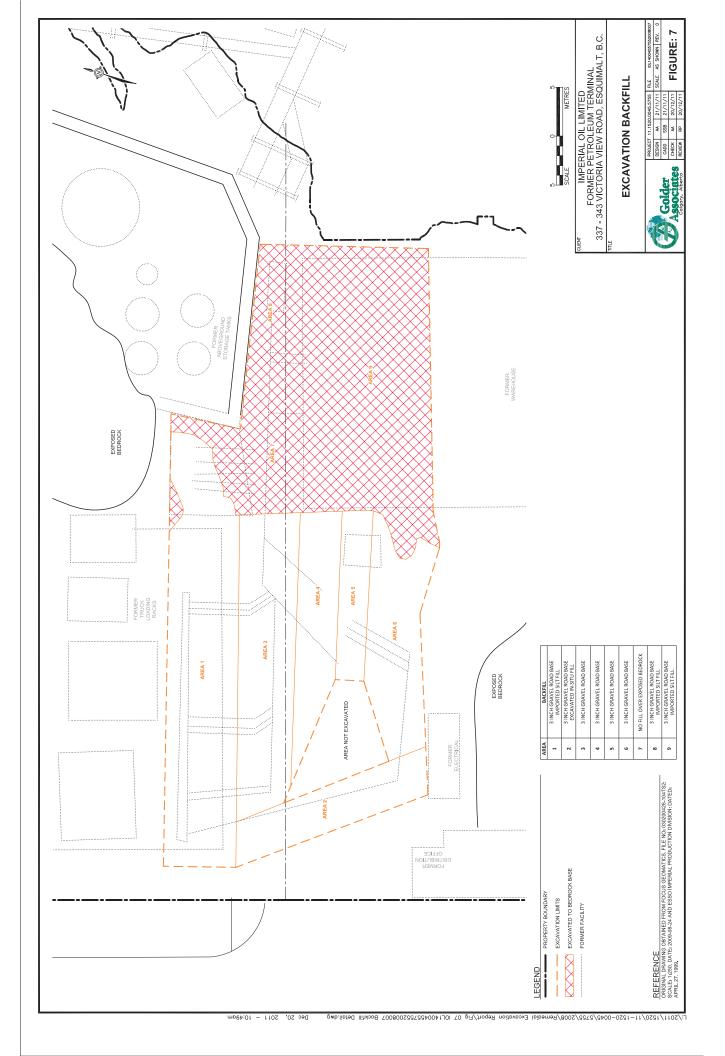
Remedial Site Works Drawings by Golder Associates

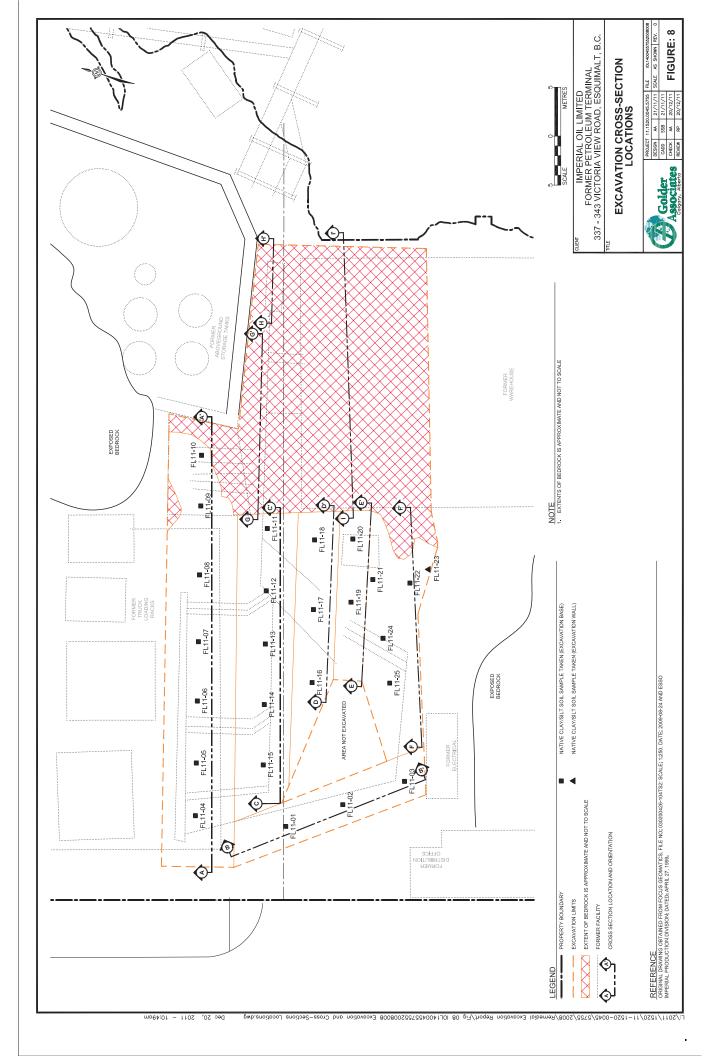


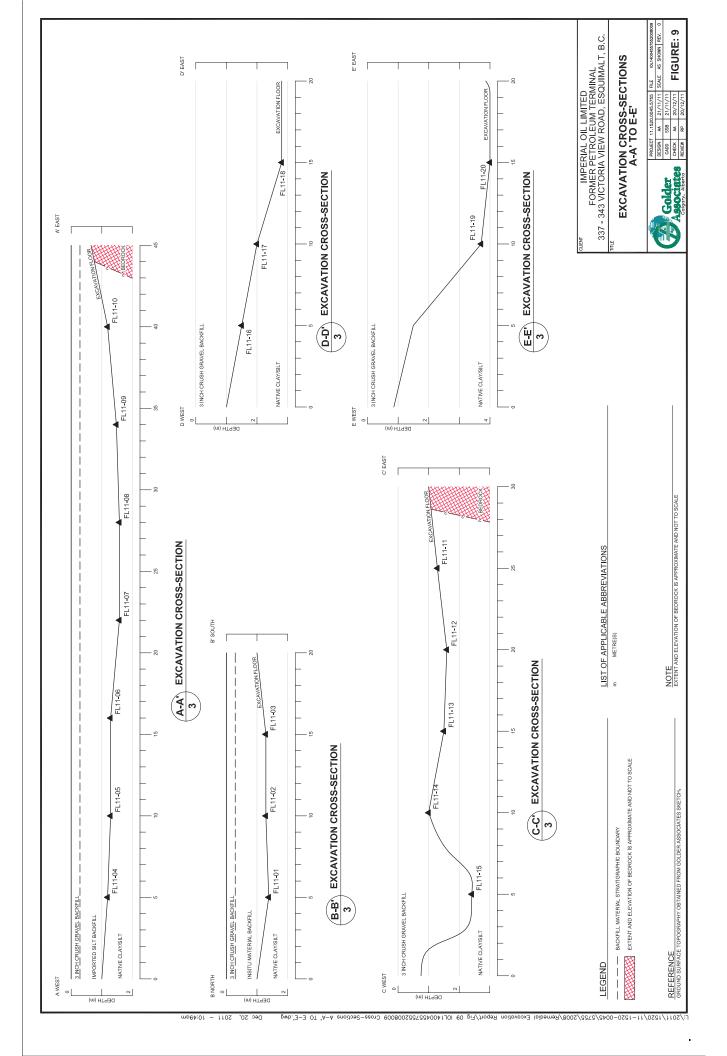
One Team. Infinite Solutions.

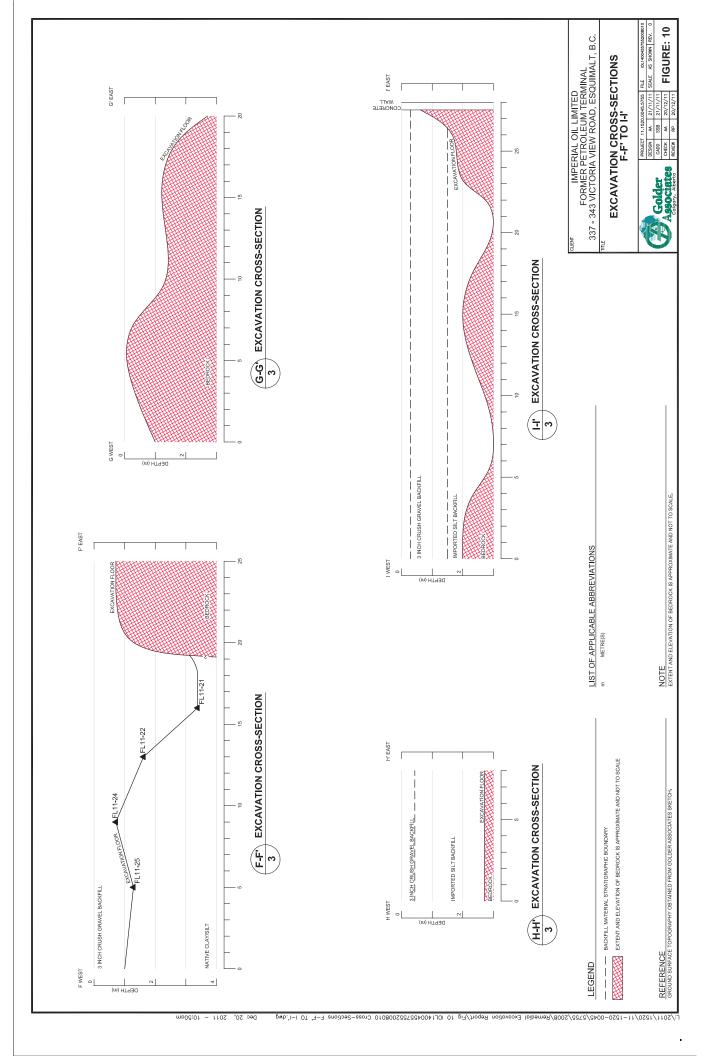


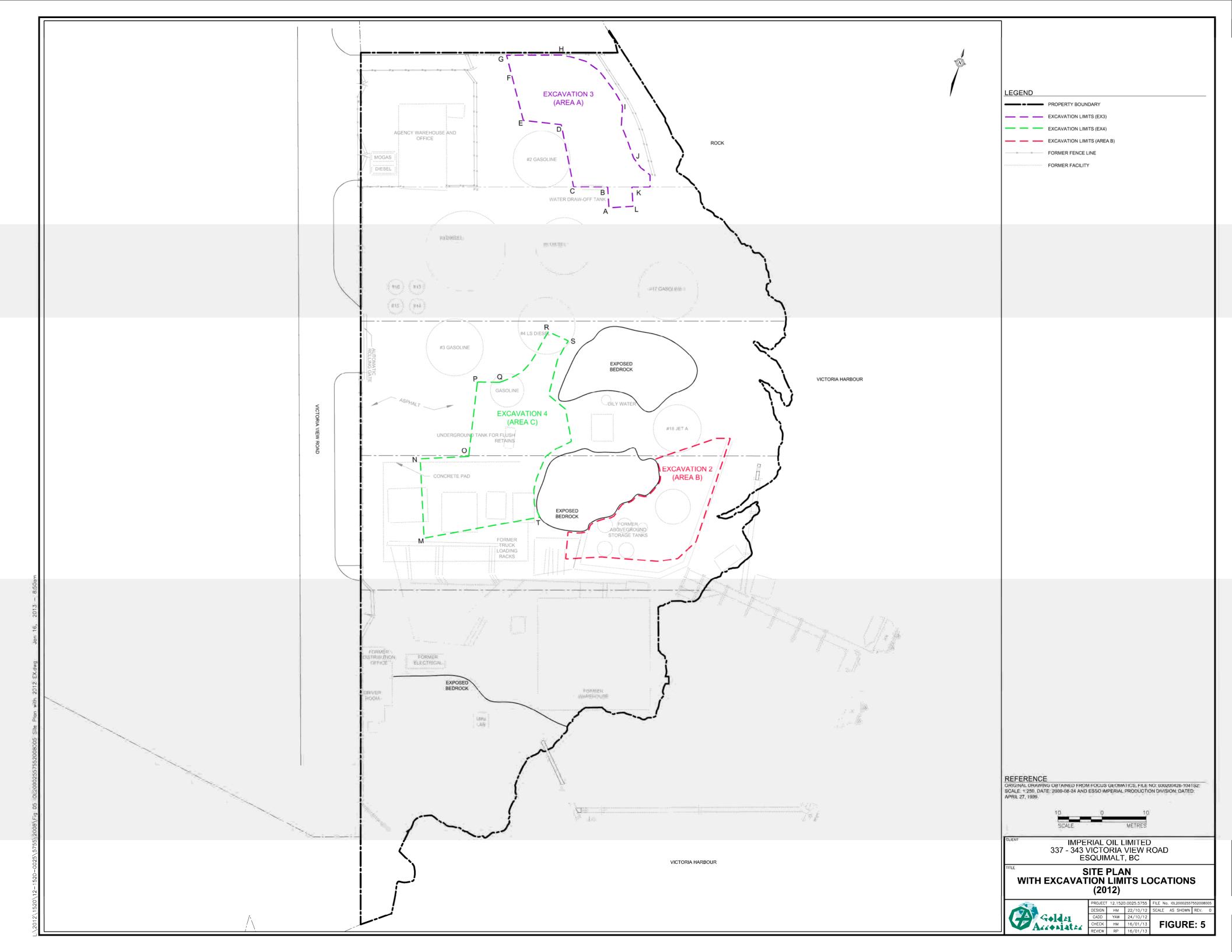


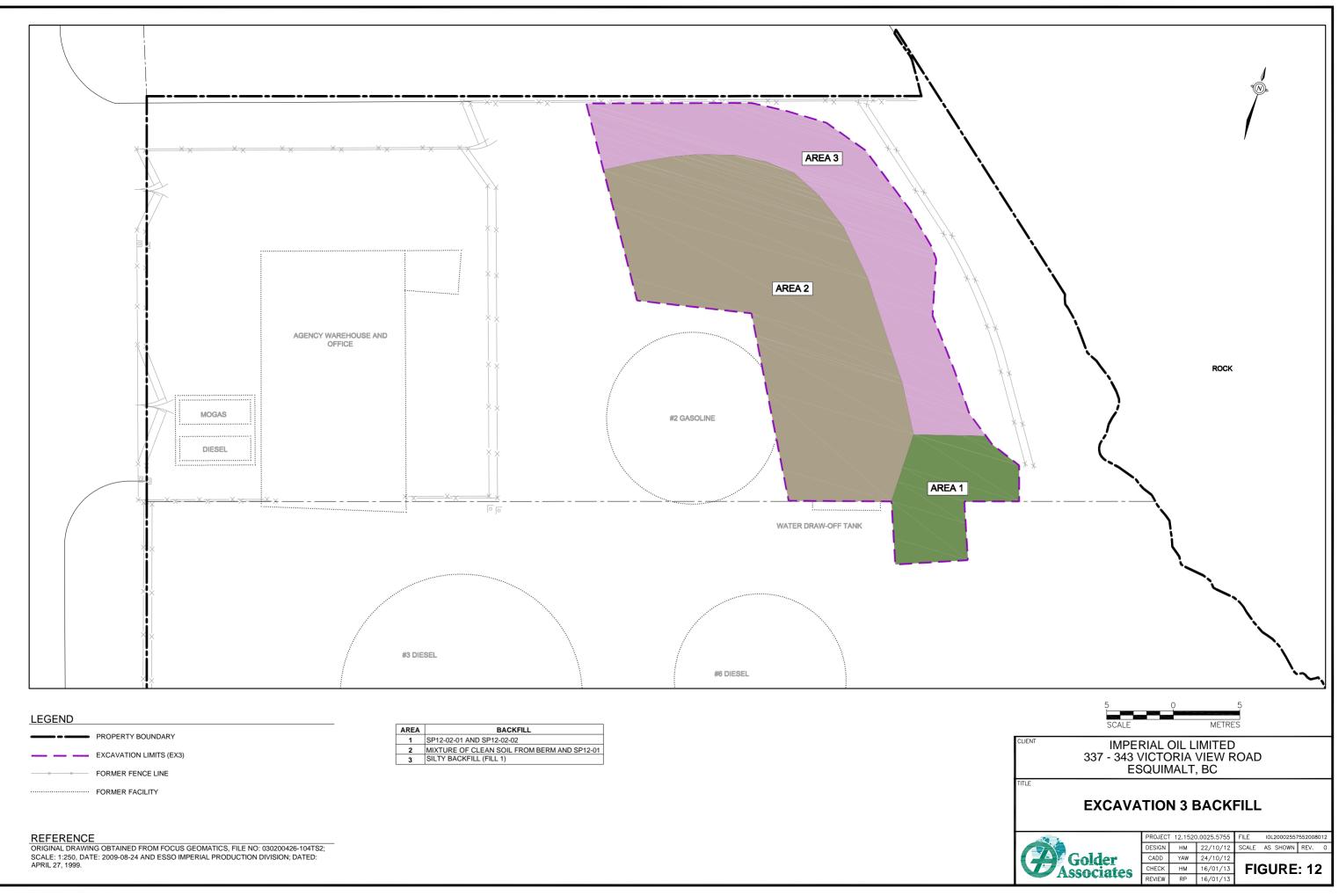






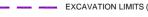






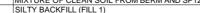








AREA	BACKFILL
1	SP12-02-01 AND SP12-02-02
2	MIXTURE OF CLEAN SOIL FROM BERM AND SP12-01



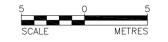


AREA	BACKFILL					
1	SP12-02-03, SP12-02-04, SP12-02-05 AND SP12-02-06 ON BEDROCK					
2	BLAST ROCK FROM AREA B, COVERED WITH SP12-02-03, SP12-02-04, SP12-02-05 AND SP12-02-06					
3	SP12-03-01 AND SP12-03-02					
4	3" MINUS (FILL 3)					
	LAYERED	3" MINUS (FILL 3)				
5		FINE SAND (FILL 4)				
		3" - 6" CLEAR				
6		SP12-05				
7		SILTY BACKFILL (FILL 1)				

#### LEGEND

PROPERTY BOUNDARY
 EXCAVATION LIMITS (EX4)
 EXCAVATION LIMITS (AREA B)
 FORMER FACILITY

REFERENCE ORIGINAL DRAWING OBTAINED FROM FOCUS GEOMATICS, FILE NO: 030200426-104TS2; SCALE: 1:250, DATE: 2009-08-24 AND ESSO IMPERIAL PRODUCTION DIVISION; DATED: APRIL 27, 1999.



LIEN



TITLE

### **EXCAVATION 4 BACKFILL**

Golder	PROJECT 12.1520.0025.5755			FILE I0L20002557552008019			019
	DESIGN	нм	22/10/12	SCALE	AS SHOWN	REV.	0
	CADD	YAW	24/10/12				
	CHECK	нм	16/01/13	FIC	GURE	: 19	)
Associates	REVIEW	RP	16/01/13				

Geotechnical Data Report

Core Area Wastewater Treatment Program Final

# **APPENDIX H**

Frontier Geoscience Report



One Team. Infinite Solutions.

#### STANTEC

#### **REPORT ON**

### **BATHYMETRIC AND ACOUSTIC**

#### SUB-BOTTOM SURVEY

#### VICTORIA AND ESQUIMALT

#### **PIPELINE PROJECT**

### VICTORIA, B.C.

by

Pierre Foicik, M.Sc.

Cliff Candy, P.Geo.

September, 2010

**PROJECT FGI-1154** 

Frontier Geosciences Inc. 237 St. Georges Avenue, North Vancouver, B.C., Canada V7L 4T4 Tel: 604.987.3037 Fax: 604.984.3074

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2.2 Survey	Procedure and Positioning	3
	TTOM ACOUSTIC PROFILING SURVEY	4
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3.2 Data Pr	rocessing and Interpretation Procedure	4
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Dwg ESQ-BED	Esquimalt - Interpreted Bedrock Depth Contour Plan	Appendix
Dwg ESQ-SED	Esquimalt - Interpreted Sediment Thickness Contour Plan	Appendix
	Esquimalt - Dredge Alignment Depth Section	Appendix
	Esquimalt - Tunnel Alignment Option 1 Depth Section	Appendix
	Esquimalt - Tunnel Alignment Option 2 Depth Section	Appendix
	Equimalt Saismia Donth Soction Example	Annondiv

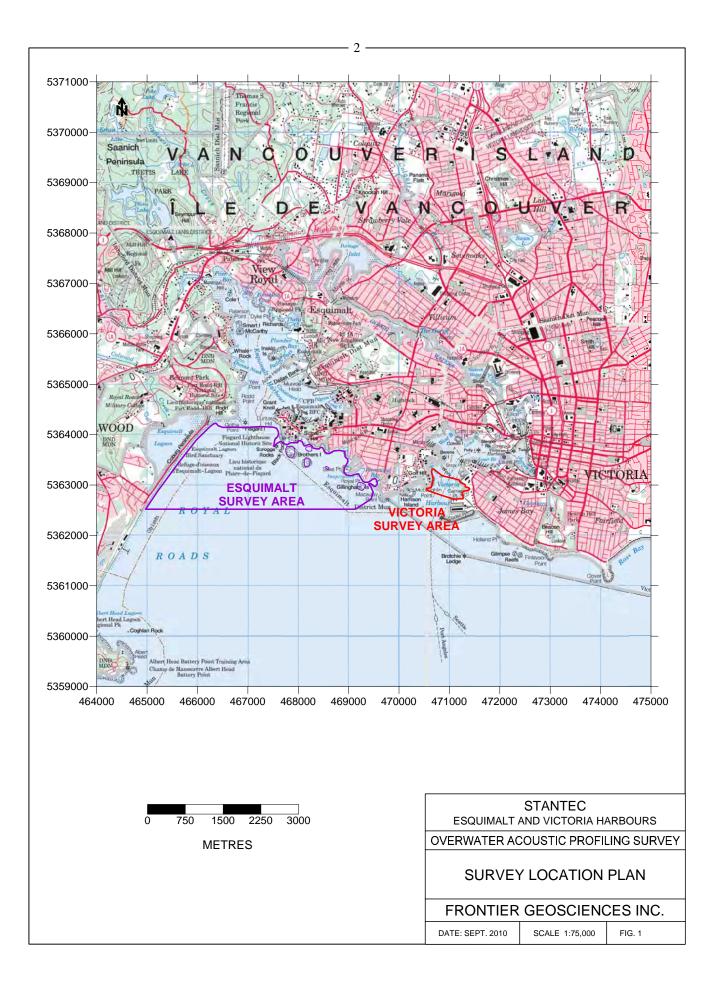
Dwg ESQ-EXEsquimalt - Seismic Depth Section ExampleAppendixDwg VIC-BATVictoria - Bathymetric Contour PlanAppendixDwg VIC-BEDVictoria - Interpreted Bedrock Depth Contour PlanAppendixDwg VIC-SEDVictoria - Interpreted Sediment Thickness Contour PlanAppendixDwg VIC-DSVictoria - Alignment Options A and B Depth SectionsAppendix

# 1. INTRODUCTION

In the period Sept. 8 to Sept. 24, 2010, Frontier Geosciences Inc. carried out an overwater geophysical survey for Stantec at the entrance to Victoria harbour and at Royal Roads near the entrance to Esquimalt harbour. The purpose of the survey was to determine ocean bottom contours, thicknesses of overburden materials and the depths to and configuration of the bedrock surface. This information will aid in planning the route of proposed pipelines and assist in deciding the appropriate emplacement technology.

The survey work at Royal Roads extends from Fleming Bay on the east to the south end of the Coburg Peninsula on the west and covers an area of approximately 3600 metres by 1600 metres. The Victoria harbour overwater survey encompassed an area at the entrance to Victoria harbour of approximately 650 metres by 300 metres.

A Survey Location Plan of the survey areas is illustrated at a scale of 1: 75,000 in Figure 1.



# 2. THE OVERWATER BATHYMETRY SURVEY

# 2.1 Equipment

The overwater bathymetric survey was completed with a Marinetek, PCS-200 Sounder. The system was calibrated with respect to water temperature and water salinity and used a broadband output with a 200 kHz centre frequency. Power for the field computer and Marinetek Sounder was provided by the survey vessel through an inverter. The work was carried out from a 31 foot Camano Trawler survey vessel.

# 2.2 Survey Procedure and Positioning

The bathymetric transducer was placed in the water at a depth of 0.30 metres at the stern of the vessel. The transducer location was carefully determined to facilitate the best operating environment for the transmission and reception of sound pulses. In operation, the source transducer pulsed twice every second with a sounding frequency of 200 kHz. The pulses emitted from the transducer were reflected by the ocean bottom and then digitally recorded and visually reviewed in real time on the high resolution display of a notebook computer. The digital record of the reflected signal was stored in the notebook hard drive and played back to interpret the water depth.

Data collected on the Marinetek PCS-200 Sounder was correlated with a differential Ray Marine GPS so that each pulse position could be contoured for final data presentation and interpretation. The positioning accuracy of the differential GPS was 0.5 metres to 1 metre. The positioning datum of NAD83 in UTM grid coordinates was used on all plans.

As some parts of survey were carried out in high traffic areas, all operations were co-ordinated with the Harbourmaster, for the Victoria site, and with the Fleet Manager, for the Esquimalt Naval Base. The survey was carried out in good conditions, and the continuity and quality of the data was excellent.

## 3. THE SUB-BOTTOM ACOUSTIC PROFILING SURVEY

## 3.1 Equipment

The overwater acoustic profiling was completed with an electric pulser source. The pulser system was used with a multi-element hydrophone receiver array. The system was calibrated in milliseconds and has a broad band output with a 250 Hz centre frequency. Reflected signals were amplified for viewing and recorded in a field computer. The field computer recorded a seismogram of 200 milliseconds two-way time duration approximately twice per second. Power for the seismic system was also provided from the power inverter.

The pulser source was placed in the water, 5 metres astern of the vessel with the midpoint of the receiver hydrophone "eel," 15 metres behind the source. In operation, pulses from the source were reflected from the bottom and sub-bottom objects or horizons and were summed in the eel hydrophone elements and transferred to the recording amplifiers.

## **3.2 Data Processing and Interpretation Procedure**

The sub-bottom acoustic profiling data was processed into SEG-2 format and imported into the Seismic Unix reflection processing package. The positioning information was processed to account for the lay-back of the source and receiver from the GPS transducer. The data was then converted to SEG-Y format and together with the GPS position information, was imported into the Seismic Micro Technologies (SMT) 2D/3D seismic interpretation package. This software is a comprehensive 2D/3D seismic interpretation program that provides interpretive and horizon picking tools integrated into a map and section database, data management and display system. As well, the bathymetry data was imported as a horizon into the SMT package for interpretation and to allow full handling of the time to depth conversion.

The first stage in the analysis was the use of the horizon picking tools to identify the bedrock reflector and reflectors present within the sediment column. The software shows time markers at the intersection of lines and tie-lines, facilitating the picking of a consistent event throughout the map area. The data was then converted to depth, and the surfaces were plotted in colour contour format.

## 4. GEOPHYSICAL RESULTS

## 4.1 General

The results of the overwater bathymetry survey are displayed in map and profile format in the Appendix. These include contour plans of the bathymetry, interpreted bedrock depth, isopachs of the sediment thickness, and depth sections along the proposed alignments. The Esquimalt data is displayed at a scale of 1:12,500 and the Victoria data is displayed at a scale of a 1:2500. The depths shown on the bathymetric plan were referenced to the Canadian Hydrographic Survey Tide and Chart Datum.

An example of acoustic profiling data illustrating key sub-bottom reflectors is illustrated in Dwg. ESQ-EX. The interpreted bedrock reflector is shown in green. The shallow, yellow line is the sea floor reflector, which is consistent with bathymetric depths acquired from the sounder system.

## 4.2 Discussion

# 4.2.1 Esquimalt Harbour Area

The bathymetric survey for the Royal Roads area is displayed in Dwg. ESQ-BAT. The eastern shores are predominantly rock controlled, consistent with the numerous islands in the area. In the east-central segment of the coverage area, a series of terraced depressions are evident at depths ranging from 28 to 40 metres. These features are described by Mosher and Hewitt (Ref. 1) as either primary depositional features, or possibly post-depositional structures produced from a rotational slide failure.

The central and western shores area of the survey coverage show very uniform variations in water depths, extending to a maximum of approximately 22 metres at the southwestern survey boundary.

The eastern shoreline of the bedrock depth map Dwg. ESQ-BED shows numerous bedrock highs and troughs between Gillingham Islands and Scroggs Rocks. The central area of the survey coverage shows two depressions in bedrock that are approximately 140 metres deep. A very prominent feature in the bedrock topography is present in the western area of the survey, near the Coburg Peninsula. This north-northwesterly trending bedrock ridge rises to approximately 30 metres depth at its shallowest point. East of this ridge, bedrock depths of

up to 90 metres are extant, indicating thick sediment cover shoreward into the Esquimalt Lagoon area.

An interpreted sediment isopach plan was prepared by contouring the thicknesses of sediments overlying bedrock. This plot displayed on Dwg. ESQ-SED, is particularly pertinent in the area of the eastern shoreline, where it clearly shows the areas of thinner sediment cover over the complex bedrock surface.

Stantec determined three possible alignments for the pipeline routes to Colwood. These routes were used to interrogate the bathymetry and interpreted bedrock surfaces, and profiles were derived to plot the depths of these surfaces along the chosen alignment. Displayed on Dwg, ESQ-DR-DR, ESQ-DR-01, and ESQ-DS-02, these plots show the proposed dredge emplacement alignment, and tunnel alignments Options 1 and 2, respectively. These profiles employ a 10 to 1 vertical scale exaggeration.

The seismic data show a number of reflectors within the overall sediment column. Mosher and Hewitt indicate that three main lithologic units overlie bedrock in the region (from the top down): modern (Holocene) sediment, glacial-marine sediment, and a glacial diamict. Three main horizons were also interpreted from the seismic data. These horizons are referred to as the first, second and third intermediate sediment layer on Dwg. ESQ-DR-01; the section exhibiting the thickest sediment. While correlation of the second and third horizon with lithology would have to be determined by drilling, some information is available within the survey area to provide correlation for the first interpreted horizon.

Mosher and Hewitt describe sea floor drilling that was carried out south of Brothers Island. This work showed the presence of post-glacial (Holocene) sediments consisting of fine Sand to coarse Sand/Pebbles in the materials overlying the first intermediate sediment horizon. Below this horizon, the boreholes showed the presence of Silty-Clays that are interpreted by Mosher and Hewitt to be glacial-marine sediment.

## 4.2.2 Victoria Harbour Area

The bathymetric depth contours in Dwg, VIC-BAT display the ocean bottom configuration in the survey area. The western area of the bathymetric plan shows a steeper gradient and is fairly irregular, as the shoreline is controlled by complex, shallow bedrock. The more central channel area is a uniform sediment surface varying between 6 and 14 metres depth. The eastern area, near Ogden Point, is shallow and irregular, indicative of the thinner sediment cover over bedrock.

The bedrock surface shown on Dwg. VIC-BED is dominated by a north-northwest trending, steep-walled trough with the greatest depths of approximately 70 metres at the southern survey boundary. A second bedrock low is observed east of this main feature that is present at a depth of approximately 50 metres. A number complex of bedrock troughs and ridges are evident in the eastern survey area. The variations in sediment thickness are illustrated in Dwg. VIC-SED.

Two proposed pipeline alignments were provided by Stantec. The profile information associated with these alignments is displayed on Dwg. VIC-DS. As was the case with the profiles for the Esquimalt area, a distinct reflector is present approximately 15 metres below the sea floor in the central part of the channel. No drillholes are present within the survey area, but the depth and character of the reflector strongly suggests that it corresponds to the boundary between the post-glacial (Holocene) sediments and the glacial-marine sediment.

#### 5. LIMITATIONS

The depths to subsurface boundaries derived from overwater seismic acoustic profiling surveys are generally accepted as accurate to within ten percent of the true depths to the boundaries. In practice, the seismic velocity of sub-bottom materials is not determined in the course of an overwater acoustic profiling investigation. Errors may arise from application of an assumed velocity for saturated materials to determine the depths to sub-surface horizons when only the travel time to the horizon is known. An underestimate of the velocity function would produce depths that are too shallow, and the reverse occurring with an overestimate of velocity. True depths may be established by carrying out overwater seismic refraction surveying or by determining velocities with known borehole intersections. Small errors may also occur in data gridding. In this survey, a compressional wave velocity of 1442 m/s was utilized for conversion of travel times for the water column into depth. The sediment column was converted using a estimated velocity of 1560 m/s.

In addition, the nature and composition of sub-bottom objects and layers identified in acoustic profiling surveys cannot be determined by inspection of the data. Several indicators such as reflector strength, diffraction patterns, lack of internal reflectors, multiple thin-bed reflectors, depth position, smoothness of reflectors and reflector relief may provide insight into subsurface features. The geology of horizons identified in an overwater acoustic profiling investigation would have to be established by borehole intersections.

The information in this report is based upon acoustic measurements and field procedures and our interpretation of the data. The geological information is based upon our estimate of subsurface conditions considering the acoustic data and all other information available to us. The results are interpretive in nature and are considered to be a reasonably accurate presentation of existing lake bottom and subsurface conditions within the limitations of the acoustic profiling method.

For: Frontier Geosciences Inc.

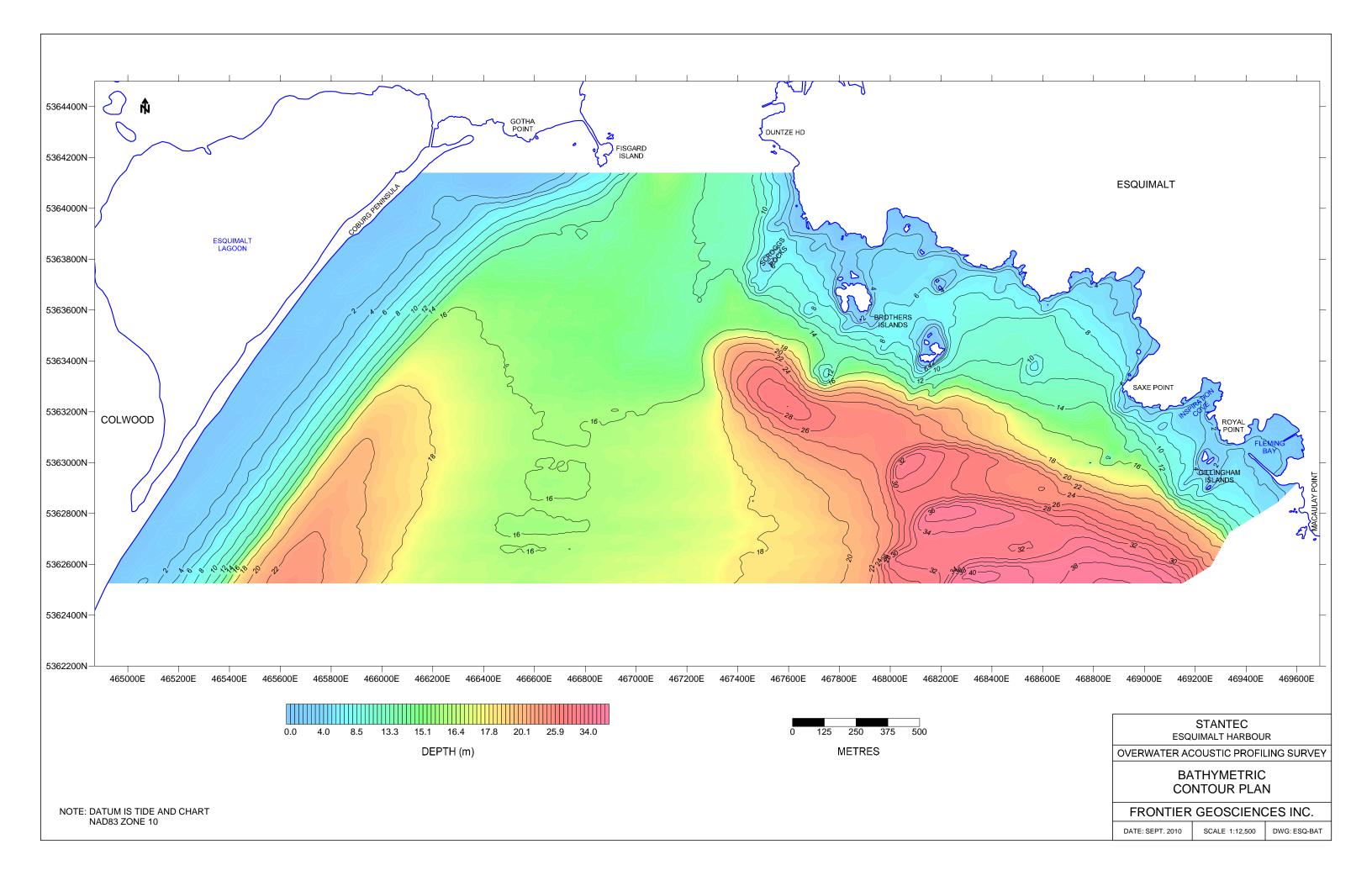
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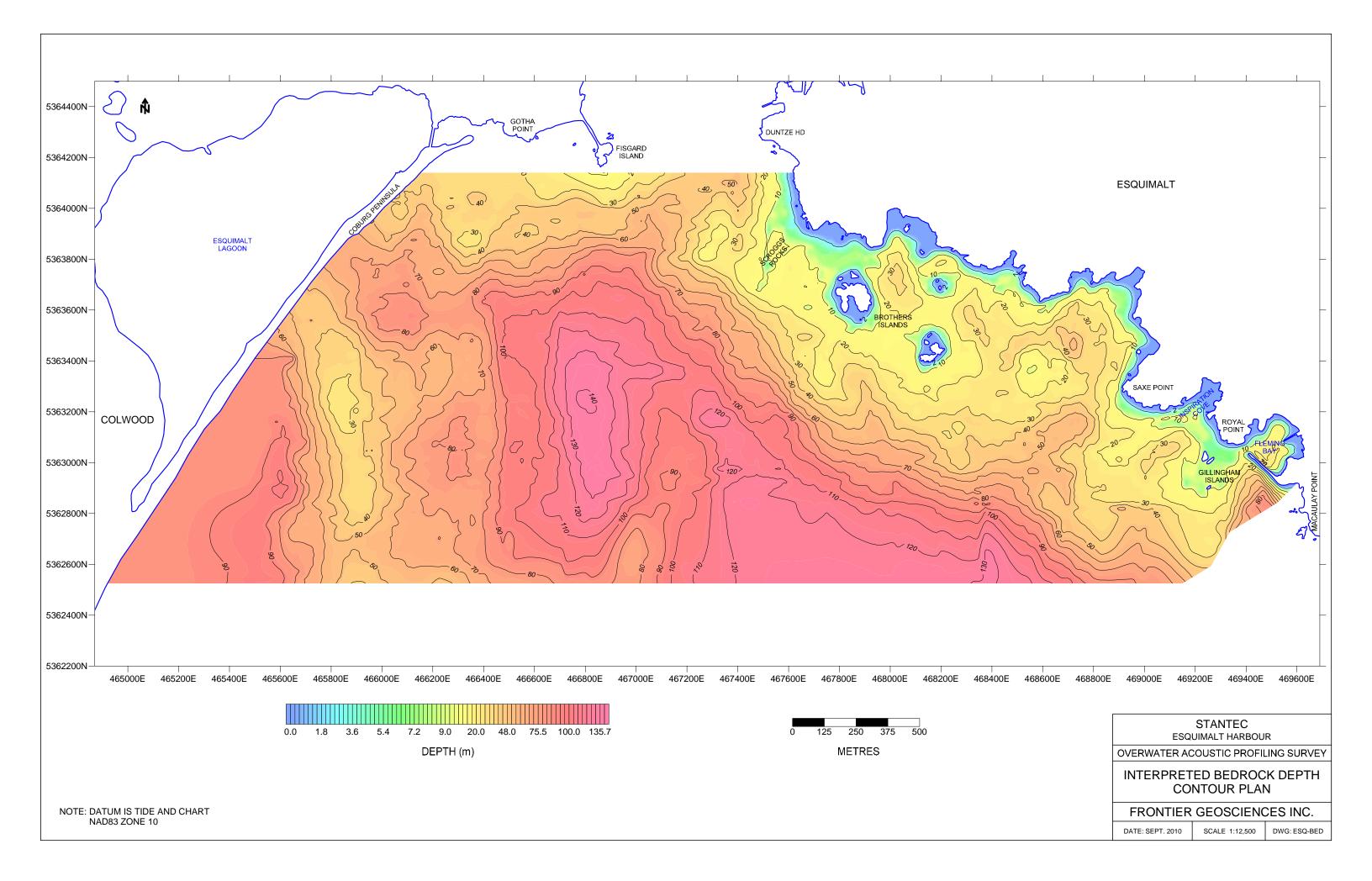
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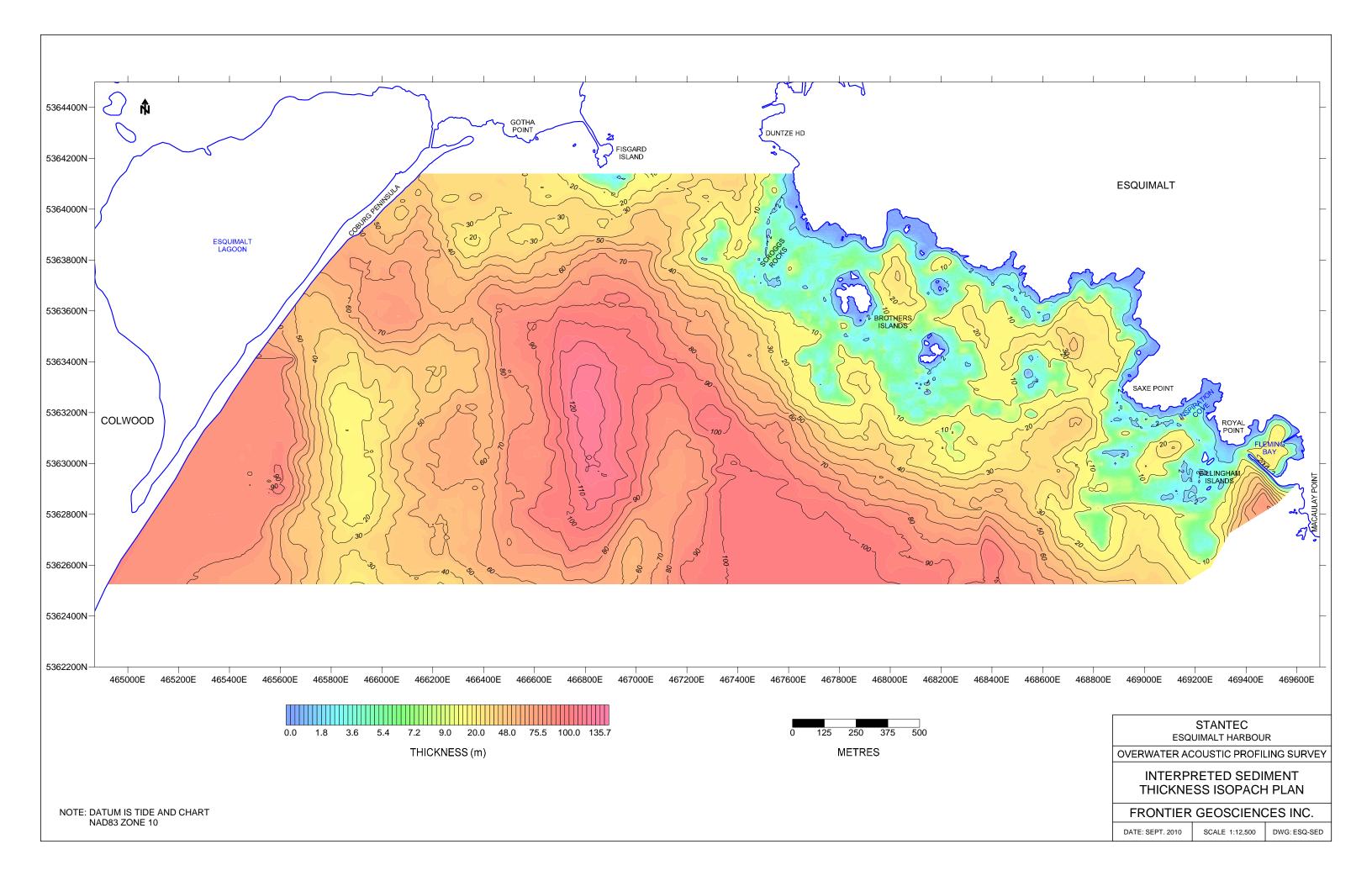
#### 6. **REFERENCES**

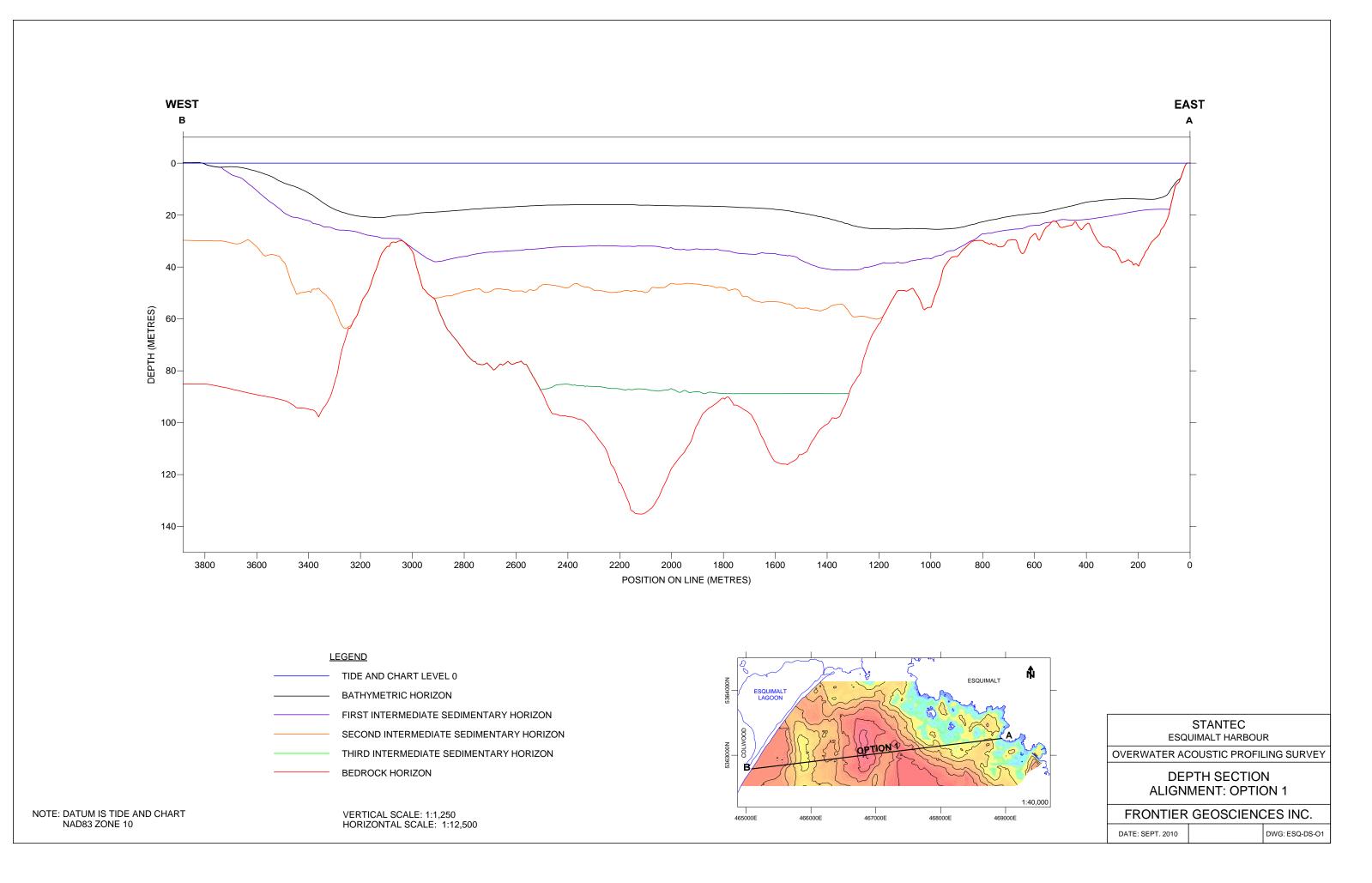
Ref 1: Late Quaternary deglaciation and sea-level history of eastern Juan de Fuca Strait, Cascadia, David C. Moshera, Antony T. Hewitt, Quaternary International 121 (2004) 23–39

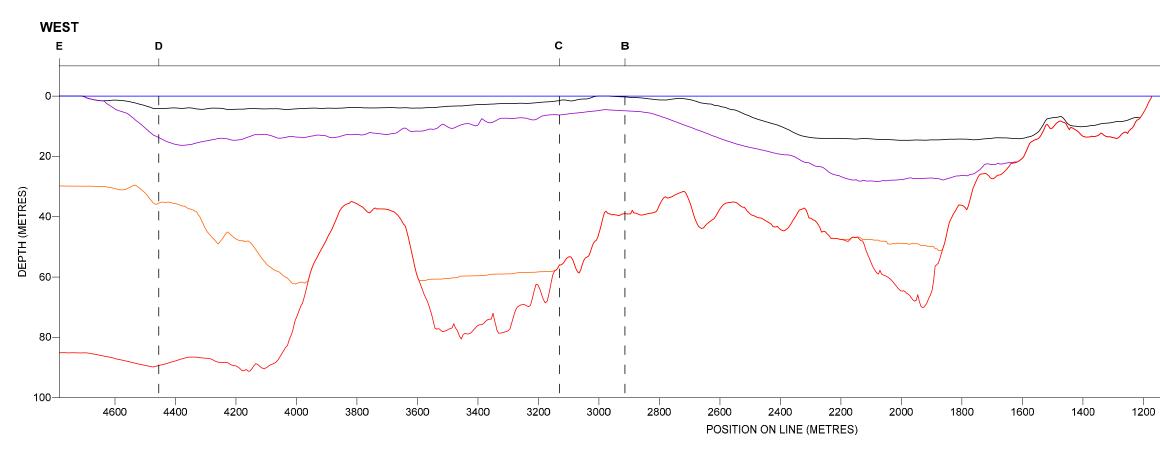
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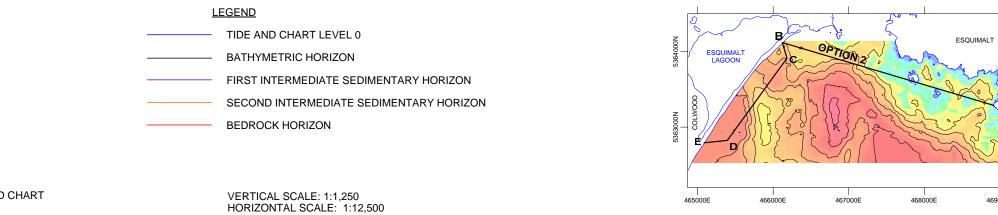




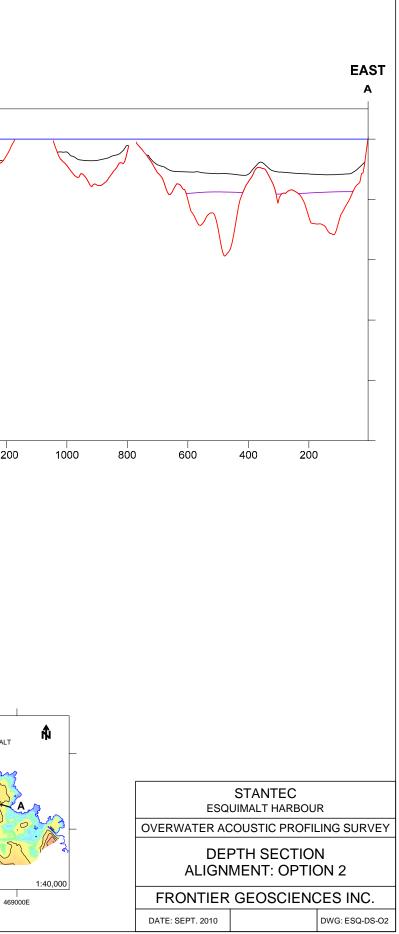


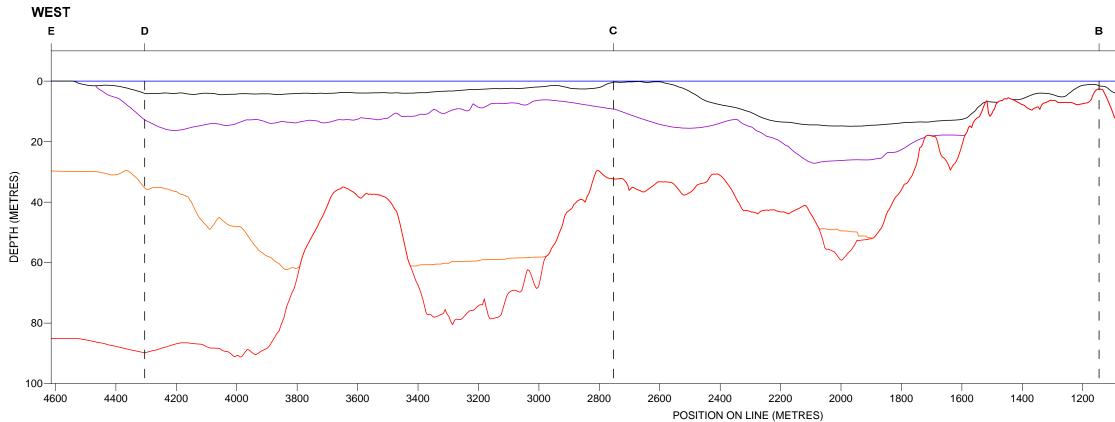






NOTE: DATUM IS TIDE AND CHART NAD83 ZONE 10







NOTE: DATUM IS TIDE AND CHART NAD83 ZONE 10

VERTICAL SCALE: 1:1,250 HORIZONTAL SCALE: 1:12,500

