## 2.3 Options to be used in the AERMOD Model

The options that were used in the AERMOD model are summarized in Table B3-4 below.

**Table B3-4: Options Used in the AERMOD Model**

| Modelling Parameter | Description | Used in the Assessment? |
|---|---|---|
| DFAULT | Specifies that regulatory default options will be used. | Yes |
| CONC | Specifies that concentration values will be calculated. | Yes |
| EMISFACT HROFDY | Specifies that variable emissions are in use for variable emissions type “Hour-of-day” | Yes (see table B3-5) |
| OLM | Specifies that the non-default Ozone Limiting Method (OLM) for $NO_2$ conversion will be used. | No – $NO_2$ is converted during post processing as described in section 2.5 below. |
| DDPLETE | Specifies that dry deposition will be calculated. | No |
| WDPLETE | Specifies that wet deposition will be calculated. | No |
| FLAT | Specifies that the non-default option of assuming flat terrain will be used. | No, the model will use elevated terrain as detailed in the AERMAP output. |
| NOSTD | Specifies that the non-default option of no stack-tip downwash will be used. | No |
| AVERTIME | Time averaging periods calculated. | 1-hr, 8-hr, 24-hr, Annual |
| URBANOPT | Allows the model to incorporate the effects of increased surface heating from an urban area on pollutant dispersion under stable atmospheric conditions. | No |
| URBANROUGHNESS | Specifies the urban roughness length (m). | No, site specific roughness values were incorporated into the AERMET processing. |

The variable emissions by hour of day option in AERMOD was applied for road segments where the volume of vehicle traffic on road segments varies significantly over the course of the day. Table B3-5 lists the road segments and scaling factor applied to emissions.

**Table B3-5: Variable Emissions Scaling Factors**

| Sources | Hour of Day | Scaling Factor |
|---|---|---|
| EXISTROAD, FILL, EXPANROAD, FILL_EXP | 0:00-8:00 | 0 |
| | 8:00-9:00 | 1 |
| | 9:00-10:00 | 1 |
| | 10:00-11:00 | 1 |
| | 11:00-12:00 | 1 |
| | 12:00-13:00 | 1 |
| | 13:00-14:00 | 1 |
| | 14:00-15:00 | 1 |
| | 15:00-16:00 | 1 |
| | 16:00-17:00 | 1 |
| | 17:00-0:00 | 0 |

## 2.4 Time Average Conversions

The smallest time scale that AERMOD predicts is a 1-hour average value. There are instances when criteria are based on shorter averaging times, and in these cases a conversion factor, recommended by the MECP, for conversion from a 1-hour averaging period to the applicable averaging period less than 1-hour was used (MECP, 2017).

An example is given below for converting from a 1-hour averaging period to a 10-minute averaging period, which is required for odour modelling:

$$F = \left(\frac{t_1}{t_0}\right)^n$$

$$= \left(\frac{60}{10}\right)^{0.28}$$

$$= 1.65$$

Where:
F = the factor to convert from the averaging period $t_1$ output from the model (MECP assumes AERMOD predicts true 60 minute averages) to the desired averaging period $t_0$ (assumed to be 10-minutes in the example above).
n = the exponent variable; in this case the MECP value of n = 0.28 is used for conversion.

For averaging periods greater than 1-hour, the AERMOD output was used directly.

## 2.5 NOx to $NO_2$ Conversion

Emissions of oxides of nitrogen ($NO_X$) were used as inputs to the AERMOD model. The modelled predictions of $NO_X$ were then used to calculate the nitrogen dioxide ($NO_2$) concentration, one of the indicator compounds, using the Ozone Limiting Method (OLM) suggested by Cole and Summerhays (Cole et al. 1979). The 1-hour and 24-hour $NO_2$ concentrations were calculated using the background ozone conservatively determined as the 90$^{th}$ percentile of the 1-hour measured ground-level ozone concentration (see Appendix A for baseline).

The OLM (Cole et al. 1979) assumes that 10% of the NOx emissions are in the form of $NO_2$, and the remaining 90% in the form of NO. Some or all of the NO will be converted to $NO_2$ by reaction with ozone ($O_3$). If the $NO_X$ concentration in ppm is multiplied by 0.9 and this value is less than the ozone concentration in ppm, then the $NO_2$ concentration is equal to the $NO_X$ concentration. However, if the $NO_X$ concentration in ppm is multiplied by 0.9 and the value is equal to or greater than the ozone concentration in ppm, then the $NO_2$ concentration is given by the following equations:

$$NO_2(ppm) = O_3(ppm) + 0.1 * NO_X(ppm)$$

For example, the maximum 24-hr modelled concentration of $NO_X$ was 41.79 µg/m³. This can be translated into a concentration in ppm using the equation below at standard temperature and pressure.

$$1ppm = \frac{V_m}{M}\frac{1\mu g}{1Lair}$$

Using a molar volume of 22.414 L ($V_m$) at standard temperature and pressure and the molecular weight of $NO_2$ (M) at ambient temperature, the equation for the $NO_X$ concentration becomes

$$NO_X(ppm) = 41.79\frac{\mu g}{m^3}\left(\frac{1m^3}{1000L}\right)\left(\frac{22.414L}{(14.0067 + 2 * 15.9994)}\right)\left(\frac{273.15 + 25}{273.15}\right)$$

$$NO_X = 0.022\ ppm$$

Since this value multiplied by 0.9 is 0.022 ppm which is less than the ozone concentration of 0.043 ppm, the $NO_2$ concentration is equal to the NOx concentration.

This method is widely accepted as being a reasonable approach that recognizes the most important mechanism for $NO_X$ conversion, namely reactions with ozone.

## 3.0 REFERENCES

Cole, H.S. and J.E. Summerhays. 1979. A review of techniques available for estimating short-term NO2 concentrations. Journal of Air Pollution Control Association. pp. 812-817.

MECP (Ministry of the Environment, Conservation and Parks). 2017. *Air Dispersion Modelling Guideline for Ontario, Version 3.0*. PIBS: 5165e03, Toronto, Ontario

MECP (Ministry of the Environment, Conservation and Parks). 2016. *Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines under O.Reg. 419/05*. Technical Bulletin.

United States Environmental Protection Agency (U.S. EPA). 2004. *Users Guide for the AERMOD Terrain Preprocessor (AERMAP).* EPA-454/B-03-003. Office of Air Quality Planning and Standards. Emissions, Monitoring, and Analysis Division. Research Triangle Park, North Carolina.

United States Environmental Protection Agency (U.S. EPA). 2012. *Haul Road Workgroup Final Report.* Office of Air Quality Planning and Standards. Research Triangle Park, North Carolina.

# Appendix B-4 Estimation of Landfill Gas Generation (LandGEM)

**May 2022**

# Volume 2
# Appendix B-4

# Estimation of Landfill Gas Generation (LandGEM)

GOLDER
MEMBER OF WSP

TOWNSHIP OF
North Dundas

# Table of Contents



## TABLES



## FIGURES

# 1.0 ESTIMATION OF LANDFILL GAS PRODUCTION

## 1.1 Methodology

For purposes of the EA, a model was prepared to estimate the potential landfill gas (LFG) generation rates at the Boyne Road Landfill site in the Township of North Dundas using LandGEM v.3.03 (June 2020) developed by the United States Environmental Protection Agency (US EPA, 1991). The LandGEM model is based on a first-order decay model of landfill gas generation. The key input parameters for the model are the historical and projected annual tonnages of waste disposed of in the landfill footprint, the LFG production potential and the LFG generation rate factor. The waste inputs for the LandGEM model have been provided in Table B4-2, located at the end of this Appendix. The model incorporated available or assumed historical, current and projected waste quantities disposed at the landfill over the operational lifespan of the landfill.

## 1.2 Ultimate Methane Yield and Methane Generation Rate Constant

The LFG production potential ($L_o$) is a measure of the ultimate methane yield in cubic metres of methane per tonne of waste ($m^3$/tonne), and LFG generation rate factor (k) is the methane generation rate constant in $year^{-1}$. Both $L_o$ and k are highly influenced by moisture content, as well as waste composition, temperature, pH, particle size and availability of nutrients. The inputs for $L_o$ and k were the standard Ministry accepted values of 125 cubic metres of methane per tonne of waste and 0.040 $years^{-1}$, respectively (MECP, 1992).

## 1.3 Waste Tonnage and Waste Composition

LFG generation rates were estimated for the Boyne Road Landfill based on the estimated historical and projected waste tonnages landfilled, assuming an operational lifespan of 84 years (i.e., 1964 to 2048). The assumptions used to estimate the historical waste tonnages are provided below. Daily cover and soil fill materials were excluded from the waste tonnages.

The compiled estimated historical and projected waste tonnages were input directly to the model. In the absence of site-specific data, LFG generated at the landfill site was assumed to be comprised of approximately 50% methane ($CH_4$) by volume, based on the published data on typical LFG composition.

The LandGEM model assumes a waste composition similar to typical historical MSW in estimating LFG generation rates.

The Boyne Road landfill does not have a weigh scale; as such, there is no annual waste tonnage information available. There have been annual surveys of airspace consumed for a number of years; using a compacted waste density of 0.7 tonnes/cubic metre and a 4:1 waste: cover ratio, these volumes were converted to tonnage to estimate the projected tonnage of waste during the expansion period from 2023 through 2048.

To estimate the landfilled tonnage from 1965 to 2023, the following describes the methodology used to derive the annual waste tonnage estimates, which are presented in the attachment:

- The calculated total volume of landfilled airspace used for waste and daily cover between 1965 and 2020 is 555,700 $m^3$.
- The volume of airspace used in each of 2009 to 2020 was calculated based on annual topographic surveys, with the calculated airspace consumed at the end of 2008 of 375,077 $m^3$.
- Prior to 2009, there are only vehicle counts available to indicate waste received at the site. The estimation of annual fill rate from 1996 to 2008 was based on the average annual fill rate for 2009 – 2011 and corrected for population growth in five year increments. During this period, approximately 12,500 $m^3$ of airspace was consumed annually.
- For 1966 to 1995, it was assumed that there were progressive step changes to the annual fill rate, starting at 5000 $m^3$ /year for 1966 to 1985, 6,500 $m^3$/year for 1976 to 1985 and 9,500 $m^3$/year for 1986 to 1995.
- The volumes were then converted to waste tonnage using a 4:1 waste: cover ratio and a waste density of 0.7 $Mg/m^3$.

This approach is considered both reasonable and conservative in terms of estimating LFG generation since it results in more waste being placed in more recent years and over the years since the site has been operational (reflecting a gradually increasing larger population and an increase in waste generation per capita).

## 1.4 Landfill Gas Generation Estimates

The resulting theoretical maximum total LFG and methane generation rate estimates obtained from the LandGEM model are illustrated in Figure B4-1. Table B4-1 presents a summary of the estimated LFG and methane theoretical maximum generation. Estimated annual waste input tonnages are presented in the attachment.

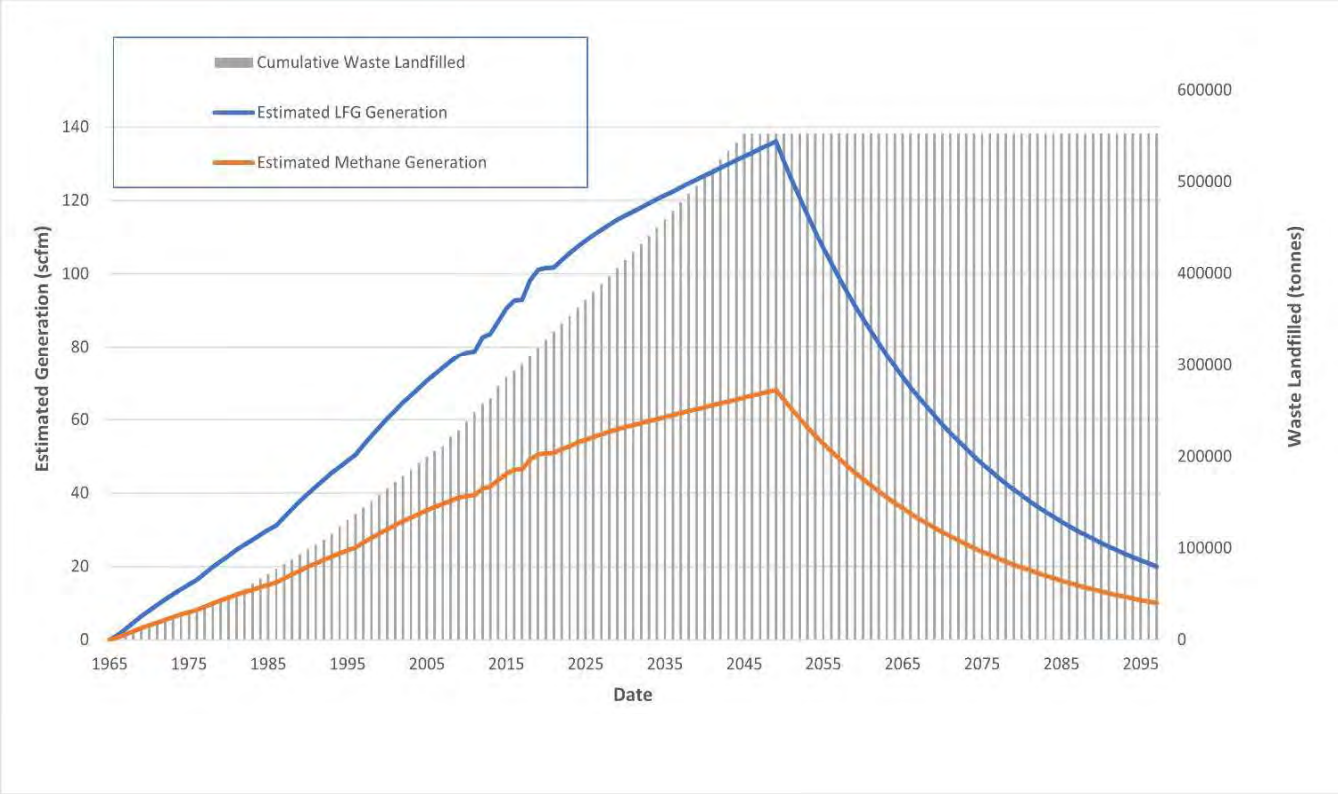


**Figure B4-1: Estimated Landfill Gas and Methane Generation Rates from LandGEM Model**

**Table B4-1: Summary of Total Estimated Landfill Gas and Methane Generation for the Boyne Landfill Expansion**

| Year | Landfill Gas Generation Estimate | Landfill Gas Generation Estimate | Methane Generation Estimate* | Methane Generation Estimate* |
|---|---|---|---|---|
| | scfm | $m^3/hr$ | scfm | $m^3/hr$ |
| 2021 | 101.8 | 172.9 | 50.8 | 86.4 |
| 2035 | 121.4 | 206.2 | 60.7 | 103.1 |
| 2048 (landfill closure) | 135.0 | 229.4 | 67.5 | 114.7 |
| 2049 (peak LFG generation) | 136.0 | 231.2 | 68.0 | 115.6 |
| 2065 | 71.8 | 122.0 | 35.9 | 61.0 |
| 2080 | 39.4 | 67.0 | 19.7 | 33.5 |

**Notes:**
* Assumes LFG is comprised of 50% methane
$m^3$ = cubic metres
scfm = standard cubic feet per minute

## 2.0 REFERENCES

MOE, Air Resources Branch. *Interim Guide to Estimate and Assess Landfill Air Impacts.* October 1992. United State Environmental Protection Agency. *Landfill Gas Emissions Model (LandGEM) Version 3.03 (June 2020) User's Guide*. May 2005.

**Table B4-2: LandGEM Waste Inputs**

| Year | Est. Fill Rate ($m^3$) Waste+ Cover | Waste Fill Rate (m3/year) | Waste Input (Mg/year) |
|---|---|---|---|
| 1965 | 3188 | 2550 | 1785 |
| 1966 | 5000 | 4000 | 2800 |
| 1967 | 5000 | 4000 | 2800 |
| 1968 | 5000 | 4000 | 2800 |
| 1969 | 5000 | 4000 | 2800 |
| 1970 | 5000 | 4000 | 2800 |
| 1971 | 5000 | 4000 | 2800 |
| 1972 | 5000 | 4000 | 2800 |
| 1973 | 5000 | 4000 | 2800 |
| 1974 | 5000 | 4000 | 2800 |
| 1975 | 5000 | 4000 | 2800 |
| 1976 | 6500 | 5200 | 3640 |
| 1977 | 6500 | 5200 | 3640 |
| 1978 | 6500 | 5200 | 3640 |
| 1979 | 6500 | 5200 | 3640 |
| 1980 | 6500 | 5200 | 3640 |
| 1981 | 6500 | 5200 | 3640 |
| 1982 | 6500 | 5200 | 3640 |
| 1983 | 6500 | 5200 | 3640 |
| 1984 | 6500 | 5200 | 3640 |
| 1985 | 6500 | 5200 | 3640 |
| 1986 | 9500 | 7600 | 5320 |
| 1987 | 9500 | 7600 | 5320 |
| 1988 | 9500 | 7600 | 5320 |
| 1989 | 9500 | 7600 | 5320 |
| 1990 | 9500 | 7600 | 5320 |
| 1991 | 9500 | 7600 | 5320 |
| 1992 | 9500 | 7600 | 5320 |
| 1993 | 9500 | 7600 | 5320 |
| 1994 | 9500 | 7600 | 5320 |
| 1995 | 9500 | 7600 | 5320 |
| 1996 | 12454 | 9963 | 6974 |
| 1997 | 12443 | 9954 | 6968 |
| 1998 | 12432 | 9946 | 6962 |
| 1999 | 12421 | 9937 | 6956 |

| Year | Est. Fill Rate ($m^3$) Waste+ Cover | Waste Fill Rate (m3/year) | Waste Input (Mg/year) |
|---|---|---|---|
| 2000 | 12410 | 9928 | 6950 |
| 2001 | 12399 | 9919 | 6943 |
| 2002 | 12417 | 9934 | 6954 |
| 2003 | 12435 | 9948 | 6964 |
| 2004 | 12453 | 9962 | 6974 |
| 2005 | 12471 | 9977 | 6984 |
| 2006 | 12489 | 9991 | 6994 |
| 2007 | 12518 | 10014 | 7010 |
| 2008 | 12547 | 10038 | 7026 |
| 2009 | 10400 | 8320 | 5824 |
| 2010 | 9500 | 7600 | 5320 |
| 2011 | 18600 | 14880 | 10416 |
| 2012 | 11500 | 9200 | 6440 |
| 2013 | 18000 | 14400 | 10080 |
| 2014 | 18900 | 15120 | 10584 |
| 2015 | 15500 | 12400 | 8680 |
| 2016 | 10360 | 8288 | 5802 |
| 2017 | 23909 | 19127 | 13389 |
| 2018 | 18587 | 14870 | 10409 |
| 2019 | 11897 | 9518 | 6662 |
| 2020 | 13470 | 10776 | 7543 |
| 2021 | 16200 | 12960 | 9072 |
| 2022 | 16100 | 12880 | 9016 |
| 2023 | 16000 | 12800 | 8960 |
| 2024 | 15800 | 12640 | 8848 |
| 2025 | 15700 | 12560 | 8792 |
| 2026 | 15700 | 12560 | 8792 |
| 2027 | 15600 | 12480 | 8736 |
| 2028 | 15500 | 12400 | 8680 |
| 2029 | 15400 | 12320 | 8624 |
| 2030 | 15300 | 12240 | 8568 |
| 2031 | 15400 | 12320 | 8624 |
| 2032 | 15500 | 12400 | 8680 |
| 2033 | 15600 | 12480 | 8736 |
| 2034 | 15700 | 12560 | 8792 |
| 2035 | 15800 | 12640 | 8848 |

| Year | Est. Fill Rate ($m^3$) Waste+ Cover | Waste Fill Rate (m3/year) | Waste Input (Mg/year) |
|---|---|---|---|
| 2036 | 15900 | 12720 | 8904 |
| 2037 | 16000 | 12800 | 8960 |
| 2038 | 16100 | 12880 | 9016 |
| 2039 | 16200 | 12960 | 9072 |
| 2040 | 16300 | 13040 | 9128 |
| 2041 | 16400 | 13120 | 9184 |
| 2042 | 16500 | 13200 | 9240 |
| 2043 | 16600 | 13280 | 9296 |
| 2044 | 16700 | 13360 | 9352 |
| 2045 | 16800 | 13440 | 9408 |
| 2046 | 16900 | 13520 | 9464 |
| 2047 | 17000 | 13600 | 9520 |
| 2048 | 17100 | 13680 | 9576 |

# APPENDIX C

## Noise

**Appendix C-1 Key Concepts**
**Appendix C-2 Letter to MECP re Boyne Road Landfill Expansion January 5, 2021**

# Appendix C-1 Key Concepts

Acoustic values can be described in terms of noise or sound. While noise is defined as unwanted sound, the terms noise and sound are often used interchangeably. An introduction to key concepts used in the assessment of outdoor acoustics is provided below:

- "Noise" or "noise levels" refers to the levels that can be heard or measured at a Point of Reception (POR).
- A noise "receptor" or "POR" is any location on a noise sensitive land use where noise is received.
- The "level" of a noise is expressed on a logarithmic scale, in units called decibels (dB). Since the scale is logarithmic, a noise that is twice the noise level as another will be three decibels (3 dB) higher. "Sound pressure level" is the physical quantity that is measured in the environment that describes sound waves quantitatively. It is a ratio of the absolute pressure relative to a reference (i.e., 20 micropascals [µPa]). This ratio of pressures is converted to a decibel scale (dB).
- Noise emissions and noise levels have an associated frequency. The human ear does not respond to all frequencies in the same way. Mid-range frequencies are most readily detected by the human ear, while the human ear is generally less sensitive to low and high frequencies. Environmental noise levels used in this assessment are presented as "A-weighted decibels" (or dBA), which incorporates the frequency response of the human ear.
- Outdoor noise is usually expressed as an "equivalent noise level" ($L_{eq, T}$), which is a logarithmic average (i.e., energy average) of the measured or predicted noise levels over a given period of time (T). An equivalent noise level measured or predicted over the nighttime period would be referred to as $L_{eq, night}$.
- The "percentile noise level", designated Ln, is the noise level exceeded "n" percent of a specified time period and is measured in dBA. The $L_{90}$, for instance, is the noise level exceeded 90% of the time. It is a noise level index that commonly refers to the baseline noise level and is most often referenced in a rural setting.
- Environmental noise levels vary throughout the day and it is therefore important to distinguish between the time of day (i.e., daytime / evening / nighttime). For the purposes of this assessment, in general the day is divided into two periods for which noise is evaluated: daytime from 07:00 to 23:00 and nighttime from 23:00 to 07:00. However, applicable guidance documents for this assessment provide other definitions of daytime and nighttime, or define three periods (i.e., daytime, evening, and nighttime), which were also considered depending on the assessment criteria being evaluated.

# Appendix C-2 Letter to MECP re Boyne Road Landfill Expansion January 5, 2021

TOWNSHIP OF
North Dundas

Ministry of Environment, Conservation and Parks
Environmental Assessment and Permissions Division
Environmental Permissions Branch
Noise Approvals
135 St Clair Avenue West,
Toronto, ON
M4V 1P5
Attention: Header Merza, Senior Noise Engineer

Dear Mr. Header Merza,

The Township of North Dundas (the Township) is currently undertaking an Individual Environmental Assessment (EA) for the waste management plan (EA Study) that requires approval under the provincial Environmental Assessment Act (EAA). This EA has been completed and will be submitted to the Ministry of Environment, Conservation and Parks (MECP) following the approved Terms of Reference (ToR) as required by subsection 6.1(1) of the EAA, and in accordance with the requirements of subsection 6.1(2) of the EAA.

The rationale for the EA Study is that as part of a previous application procedure intended to update a number of items related to site operations and amend the Township's Boyne Road Landfill's Environmental Compliance Approval (ECA) located at 12620 Boyne Rd, Winchester, ON K0C 2K0 (the Landfill), the MECP determined that the Landfill had exceeded its approved capacity and is in an overfill situation. It is this overfill situation that triggered the need for the EA process. The Township evaluated long term waste management alternatives, with the EA Study . The result of the comparative evaluation was that expansion of the existing Landfill, together with current and future waste diversion activities, was identified as the Township's preferred long-term waste management alternative.

One of the several technical studies being prepared for the EA Study is the noise impact assessment. On Monday December 13, 2021, there was a conference call between yourself, the assigned MECP reviewer for the EA Study, the Environmental Assessment Services MECP Project Officer and Golder Associates regarding the identification of Points of Reception (PORs) for the purposes of the noise impact assessment, and specifically the Townships current land use planning policy. The following is a summary of key items discussed during the conference call:

- The Township currently follows the United Counties of Stormont, Dundas, and Glengarry Official Plan (the Official Plan). According to the Official Plan, most lands in the vicinity of the Landfill are zoned as "Rural District". This land use designation allows for noise sensitive land uses.

- Noise sensitive PORs were identified through a desktop review in accordance with "Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning Publication NPC-300" (NPC-300). As per NPC-300, a noise impact assessment is carried out at both existing and vacant lot noise sensitive PORs.
- The Official Plan states "*Development within 500 metres of an existing waste management system shall generally be discouraged unless supported by an appropriate study or studies which confirm that there will be no negative impacts on the proposed development related to current uses/activities associated with the normal operation of the waste management system.*". The Township will be revisiting their zoning bylaws in 2022, requiring the minimum separation distance of 500 m between the Landfill and noise sensitive land uses as defined in NPC-300, be applied to any proposed development in the vicinity of the Landfill. In the interim, the Township has adopted this requirement.
- The land directly adjacent to the east of the Landfill is owned by the Township and vacant. The Township will not permit noise sensitive land uses on these lands even though zoned as "Rural District" since they are within 500 m of the Landfill.
- The lands located to the northwest, west and southwest are identified as 'Contamination Attenuation Zone' (CAZ) and vacant. These lands are not owned by the Township, but the Township has control over the groundwater rights through easement agreements; as such, a water supply well cannot be drilled on these lands, thereby eliminating potential development on these vacant lands by a noise sensitive use. Therefore, the Township will not permit noise sensitive land uses on these CAZ lands since potable water supply is not permitted and also the CAZ lands are within 500 m of the Landfill.

As requested by you during the conference call, please accept this letter as confirmation the Township will not permit a noise sensitive land use within 500 m of the Landfill or within the existing or any future CAZ. Therefore as agreed upon during the conference call, the EA Study noise impact assessment will not require an assessment be carried out at noise sensitive PORs within 500 m of the Landfill or within the existing or any future CAZ.

We believe this letter summaries our recent discussion but please let us know otherwise and if you require any further clarification or additional information.

Thank You,

Doug Froats
Director of Waste Management

cc. Trish Edmond, Golder Associates Ltd.
Jordan Hughes, MECP Project Officer

# APPENDIX D

## Geology, Hydrogeology, and Geotechnical

**Appendix D-1 Borehole Logs**
**Appendix D-2 Boyne Road Landfill Slope Stability Technical Memorandum**
**Appendix D-3 POLLUTE Output**



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# Appendix D-1 Borehole Logs

# LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures, and in the text of the report are as follows:

## I. SAMPLE TYPE

| | |
|---|---|
| AS | Auger sample |
| BS | Block sample |
| CS | Chunk sample |
| DO or DP | Seamless open-ended, driven or pushed tube samplers |
| DS | Denison type sample |
| FS | Foil sample |
| RC | Rock core |
| SC | Soil core |
| SS | Split spoon sampler |
| ST | Slotted tube |
| TO | Thin-walled, open |
| TP | Thin-walled, piston |
| WS | Wash sample |
| DT | Dual tube sample |
| DD | Diamond drilling |

## II. PENETRATION RESISTANCE

**Standard Penetration Resistance (SPT), N:**

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split spoon sampler for a distance of 300 mm (12 in.).

**Dynamic Cone Penetration Resistance (DCPT); $N_d$:**

The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive an uncased 50 mm (2 in.) diameter, $60^0$ cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

| | |
|---|---|
| **PH:** | Sampler advanced by hydraulic pressure |
| **PM:** | Sampler advanced by manual pressure |
| **WH:** | Sampler advanced by static weight of hammer |
| **WR:** | Sampler advanced by weight of sampler and rod |

**Cone Penetration Test (CPT):**

An electronic cone penetrometer with a $60^0$ conical tip and a projected end area of 10 $cm^2$ pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance ($q_t$), porewater pressure (u) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

## III. SOIL DESCRIPTION

**(a) Cohesionless Soils**

| **Density Index (Relative Density)** | **N** Blows/300 mm Or Blows/ft. |
|---|---|
| Very loose | 0 to 4 |
| Loose | 4 to 10 |
| Compact | 10 to 30 |
| Dense | 30 to 50 |
| Very dense | over 50 |

**(b) Cohesive Soils**

**$C_u$ or $S_u$**

| **Consistency** | kPa | Psf |
|---|---|---|
| Very soft | 0 to 12 | 0 to 250 |
| Soft | 12 to 25 | 250 to 500 |
| Firm | 25 to 50 | 500 to 1,000 |
| Stiff | 50 to 100 | 1,000 to 2,000 |
| Very stiff | 100 to 200 | 2,000 to 4,000 |
| Hard | Over 200 | Over 4,000 |

## IV. SOIL TESTS

| | |
|---|---|
| w | Water content |
| $w_p$ or PL | Plastic limited |
| $w_l$ or LL | Liquid limit |
| C | Consolidaiton (oedometer) test |
| CHEM | Chemical analysis (refer to text) |
| CID | Consolidated isotropically drained triaxial test[1] |
| CIU | Consolidated isotropically undrained triaxial test with porewater pressure measurement[1] |
| $D_R$ | Relative density |
| DS | Direct shear test |
| Gs | Specific gravity |
| M | Sieve analysis for particle size |
| MH | Combined sieve and hydrometer (H) analysis |
| MPC | Modified Proctor compaction test |
| SPC | Standard Proctor compaction test |
| OC | Organic content test |
| $SO_4$ | Concentration of water-soluble sulphates |
| UC | Unconfined compression test |
| UU | Unconsolidated undrained triaxial test |
| V | Field vane test (LV-laboratory vane test) |
| $\gamma$ | Unit weight |

Note: [1] Tests which are anisotropically consolidated prior shear are shown as CAD, CAU.

# LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

## I. GENERAL

| | |
|---|---|
| $\pi$ | 3.1416 |
| ln x | natural logarithm of x |
| $\log_{10}$ x or log x | logarithm of x to base 10 |
| g | acceleration due to gravity |
| t | time |
| FOS | factor of safety |
| V | volume |
| W | weight |

## II. STRESS AND STRAIN

| | |
|---|---|
| $\gamma$ | shear strain |
| $\Delta$ | change in, e.g. in stress: $\Delta \sigma'$ |
| $\varepsilon$ | linear strain |
| $\varepsilon_v$ | volumetric strain |
| $\eta$ | coefficient of viscosity |
| $\nu$ | Poisson's ratio |
| $\sigma$ | total stress |
| $\sigma'$ | effective stress ($\sigma' = \sigma - u$) |
| $\sigma'_{vo}$ | initial vertical effective overburden stress |
| $\sigma_1\sigma_2\sigma_3$ | principal stresses (major, intermediate, minor) |
| $\sigma_{oct}$ | mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3) / 3$ |
| $\tau$ | shear stress |
| u | porewater pressure |
| E | modulus of deformation |
| G | shear modulus of deformation |
| K | bulk modulus of compressibility |

## III. SOIL PROPERTIES

### (a) Index Properties

| | |
|---|---|
| $\rho(\gamma)$ | bulk density (bulk unit weight)* |
| $\rho_d(\gamma_d)$ | dry density (dry unit weight) |
| $\rho_w(\gamma_w)$ | density (unit weight) of water |
| $\rho_s(\gamma_s)$ | density (unit weight) of solid particles |
| $\gamma'$ | unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$) |
| $D_R$ | relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) formerly ($G_s$) |
| e | void ratio |
| n | porosity |
| S | degree of saturation |

* Density symbol is $\rho$. Unit weight symbol is $\gamma$ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

### (a) Index Properties (continued)

| | |
|---|---|
| w | water content |
| $w_1$ or LL | liquid limit |
| $w_p$ or PL | plastic limit |
| $I_p$ or PI | plasticity Index = $(w_1 - w_p)$ |
| $w_s$ | shrinkage limit |
| $I_L$ | liquidity index = $(w - w_p) / I_p$ |
| $I_c$ | consistency index = $(w_1 - w) / I_p$ |
| $e_{max}$ | void ratio in loosest state |
| $e_{min}$ | void ratio in densest state |
| $I_D$ | density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density) |

### (b) Hydraulic Properties

| | |
|---|---|
| h | hydraulic head or potential |
| q | rate of flow |
| v | velocity of flow |
| i | hydraulic gradient |
| k | hydraulic conductivity (coefficient of permeability) |
| j | seepage force per unit volume |

### (c) Consolidation (one-dimensional)

| | |
|---|---|
| $C_c$ | compression index (normally consolidated range) |
| $C_r$ | recompression index (overconsolidated range) |
| $C_s$ | swelling index |
| $C_\alpha$ | coefficient of secondary consolidation |
| $m_v$ | coefficient of volume change |
| $c_v$ | coefficient of consolidation (vertical direction) |
| $T_v$ | time factor (vertical direction) |
| U | degree of consolidation |
| $\sigma'_p$ | pre-consolidation stress |
| OCR | overconsolidation ratio = $\sigma'_p / \sigma'_{vo}$ |

### (d) Shear Strength

| | |
|---|---|
| $\tau_p$ or $\tau_r$ | peak and residual shear strength |
| $\phi'$ | effective angle of internal friction |
| $\delta$ | angle of interface friction |
| $\mu$ | coefficient of friction = tan $\delta$ |
| c' | effective cohesion |
| $c_u$ or $s_u$ | undrained shear strength ($\phi = 0$ analysis) |
| p | mean total stress $(\sigma_1 + \sigma_3) / 2$ |
| p' | mean effective stress $(\sigma'_1 + \sigma'_3) / 2$ |
| q | $(\sigma_1 - \sigma_3) / 2$ or $(\sigma'_1 - \sigma'_3) / 2$ |
| $q_u$ | compressive strength $(\sigma_1 - \sigma_3)$ |
| $S_t$ | sensitivity |

Notes: [1] $\tau = c' + \sigma' \tan \phi'$

[2] shear strength = (compressive strength) / 2

# LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

## WEATHERING STATE

**Fresh**: no visible sign of rock material weathering
**Faintly Weathered**: weathering limited to the surface of major discontinuities.
**Slightly weathered**: penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.
**Moderately weathered:** weathering extends throughout the rock mass but the rock material is not friable
**Highly weathered:** weathering extends throughout rock mass and the rock material is partly friable.
**Completely weathered:** rock is wholly decomposed and in a friable condition but the rock texture and structure are preserved.

## BEDDING THICKNESS

| Description | Bedding Plane Spacing |
|---|---|
| Very Thickly Bedded | > 2 m |
| Thickly Bedded | 0.6 m to 2m |
| Medium Bedded | 0.2 m to 0.6 m |
| Thinly Bedded | 60 mm to 0.2 m |
| Very Thinly Bedded | 20 mm to 60 mm |
| Laminated | 6 mm to 20 mm |
| Thinly Laminated | < 6 mm |

## JOINT OR FOLIATION SPACING

| Description | Spacing |
|---|---|
| Very Wide | > 3 m |
| Wide | 1 – 3 m |
| Moderately Close | 0.3 – 1 m |
| Close | 50 – 300 mm |
| Very Close | < 50 mm |

## GRAIN SIZE

| Term | Size* |
|---|---|
| Very Coarse Grained | > 60 mm |
| Coarse Grained | 2 – 60 mm |
| Medium Grained | 60 microns – 2mm |
| Fine Grained | 2 – 60 microns |
| Very Fine Grained | < 2 microns |

Note: *Grains > 60 microns diameter are visible to the naked eye.

## CORE CONDITION

**Total Core Recovery**
The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

**Solid Core Recovery (SCR)**
The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

**Rock Quality Designation (RQD)**
The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varies from 0% for completely broken core 100% for core in solid sticks.

## DISCONTINUITY DATA

**Fracture Index**
A count of the number of discontinuities (physical separations) in the rock core, including naturally occurring fractures but not including mechanically induced breaks caused by drilling.

**Dip with Respect to (W.R.T.) Core Axis**
The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a $90^0$ angle is horizontal.

**Description and Notes**
An abbreviated description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature information concerning the nature of fracture surfaces and infillings are also noted.

**Abbreviations**

| | | | |
|---|---|---|---|
| BD - | Bedding | PY - | Pyrite |
| FO - | Foliation/Schistosity | Ca - | Calcite |
| CL - | Clean | PO - | Polished |
| SH - | Shear Plane/Zone | K - | Slickensided |
| VN - | Vein | SM - | Smooth |
| FLT - | Fault | RO - | Ridged/Rough |
| CO - | Contact | ST - | Stepped |
| JN - | Joint | PL - | Planar |
| FR - | Fracture | IR - | Irregular |
| MB - | Mechanical Break | UN - | Undulating |
| BR - | Broken Rock | CU - | Curved |
| BL - | Blast Induced | TCA - | To Core Axis |
| ǁ - | Parallel To | STR - | Stress Induced |
| OR - | Orthogonal | | |

PROJECT: 14-1125-0007/Boyne Road Landfill

# RECORD OF BOREHOLE: MW06-22R

SHEET 1 OF 1

LOCATION: N 4994479.6; E 474643.5 (UTM NAD83 Zone 18T)

BORING DATE: May 1, 2014

DATUM: Geodetic

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 82.96 | | | | | | | |
| 0 | Power Auger 200 mm Diam. (Hollow Stem) | Waste (FILL) | | 0.00 | | | | | | | Bentonite Seal |
| 2 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 10 | | | | 71.99 | | | | | | | Silica Sand |
| | | Grey brown SILTY CLAY | | 10.97 | | | | | | | 32 mm Diam. PVC #10 Slot Screen |
| 12 | | | | 70.16 | | | | | | | Cave in |
| | | End of Borehole | | 12.80 | | | | | | | |
| 14 | | | | | | | | | | | |
| 16 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 20 | | | | | | | | | | | |

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: MIB

CHECKED: YJM

MIS-BHS 001 1411250007.GPJ GAL-MIS.GDT 11/07/14 JM

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: MW07-23

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 4, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) | SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕; Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, $k_s$ cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) | WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 74.97 | | | | | | | | | |
| 0 | Power Auger 200mm diam. (Hollow Stem) | TOPSOIL | | 0.00 / 74.76 | | | | | | | | | |
| | | Very stiff grey brown SILTY CLAY (Weathered Crust) | | 0.21 | | | | | | | | | |
| 1 | | | | 73.90 | 1 | SS DO | 20 | | | | | | Bentonite Seal |
| | | Brown SILTY CLAY, trace gravel | | 1.07 | | | | | | | | | Silica Sand |
| | | | | 73.35 | | | | | | | | | |
| 2 | | Dense brown to grey sandy SILT, some grey clay, occasional sand seam (GLACIAL TILL) | | 1.62 | 2 | SS DO | 35 | | | | | | |
| | | | | | 3 | SS DO | 39 | | | | | | 32mm Diam. PVC #10 Slot Screen |
| 3 | | | | | 4 | SS DO | 32 | | | | | | |
| | | | | 71.25 | | | | | | | | | |
| 4 | | End of Borhole (Auger Refusal) | | 3.72 | | | | | | | | | WL in screen at Elev. 72.56m on Sept. 25, 2007 |
| 5 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | |

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: HLRF

MIS-BHS 001 061122127-3.GPJ GAL-MISS.GDT 3/25/08 MLF

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: MW07-24

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 4, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕; Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80) | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 75.32 | | | | | | | |
| 0 | Power Auger 200mm Diam. (Hollow Stem) | Dark brown PEAT | | 0.00 | | | | | | | Bentonite Seal |
| | | | | 74.77 | | | | | | | |
| | | Grey brown SILTY CLAY (Weathered Crush) | | 0.55 | | | | | | | Native Backfill |
| 1 | | | | 74.25 | 1 | 50 DO | 13 | | | | Bentonite Seal |
| | | Compact grey brown CLAYEY SILT, trace gravel | | 1.07 | | | | | | | Silica Sand |
| | | | | 73.49 | 2 | 50 DO | 13 | | | | |
| 2 | | Brown grey SANDY SILT, some gravel, occasional cobbles | | 1.83 | | | | | | | 38mm Diam. PVC #10 Slot Screen |
| | | | | | 3 | 50 DO | 40 | | | | |
| 3 | | | | | 4 | 50 DO | 44 | | | | |
| | | | | 72.03 | | | | | | | |
| | | End of Borehole (Auger Refusal) | | 3.29 | | | | | | | WL in screen at Elev. 73.49m on Sept. 25, 2007 |
| 4 | | | | | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: HLRF

MIS-BHS 001 061122127-3 GPJ GAL-MISS GDT 3/25/08 MLF

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: MW07-25

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 5, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$); WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80) | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 74.13 | | | | | | | |
| 0 | Power Auger 200mm Diam. (Hollow Stem) | Dark brown PEAT | | 0.00 | | | | | | | Bentonite Seal |
| | | | | 73.58 | | | | | | | |
| 1 | | Grey brown SILTY CLAY (Weathered Crush) | | 0.55 | | | | | | | Native Backfill |
| | | | | | 1 | 50 DO | 8 | | | | |
| 2 | | | | | | | | | | | |
| | | | | 71.45 | 2 | 50 DO | 17 | | | | Bentonite Seal |
| | | Compact to dense brown grey SANDY SILT, some gravel & clay, trace cobbles (GLACIAL TILL) | | 2.68 | | | | | | | Silica Sand |
| 3 | | | | | 3 | 50 DO | 22 | | | | |
| 4 | | | | | 4 | 50 DO | 14 | | | | |
| | | | | | 5 | 50 DO | 90 | | | | 38mm Diam. PVC #10 Slot Screen |
| 5 | | | | | | | | | | | |
| 6 | | | | 67.88 | 6 | 50 DO | | | | | |
| | | End of Borehole (Auger Refusal) | | 6.25 | | | | | | | WL in screen at Elev. 72.71m on Sept. 25, 2007 |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: MLRF

MIS-BHS 001 061122127-3.GPJ GAL-MISS.GDT 3/25/08 MLF

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: BR07-26

SHEET 1 OF 1

LOCATION:

BORING DATE: September 7, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-4}$ $10^{-5}$ $10^{-6}$ $10^{-7}$); WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80) | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Power Auger 200mm Diam. (Hollow Stem) | Ground Surface | | 74.67 | | | | | | | |
| | | Dark brown PEAT | | 0.00 | | | | | | | Bentonite Seal |
| 1 | | | | 73.63 | | | | | | | |
| | | Very stiff grey brown SILTY CLAY (Weathered Crush) | | 1.04 | 1 | 50 DO | 5 | | | | |
| 2 | | | | | 2 | 50 DO | 3 | | | | |
| 3 | | | | 71.62 | | | | | | | Native Backfill |
| | | Stiff grey SILTY CLAY | | 3.05 | 3 | 50 DO | 1 | | | | |
| | | | | 70.71 | | | | | | | |
| 4 | | Grey SANDY SILT, some gravel, occasional cobbles (GLACIAL TILL) | | 3.96 | 4 | 50 DO | DO | | | | |
| | | | | 69.82 | | | | | | | |
| 5 | Rotary Drill HQ Core | Slightly weathered grey LIMESTONE BEDROCK, with shale interbeded, and thin mud seam | | 4.85 | 5 | NQ RC | | T.C.R. (%) 100; S.C.R. (%) 98; R.Q.D. (%) 60 | | | Bentonite Seal |
| 6 | | | | | 6 | NQ RC | | T.C.R. (%) 98; S.C.R. (%) 83; R.Q.D. (%) 80 | | | Silica Sand |
| 7 | | | | 67.14 | 7 | NQ RC | | T.C.R. (%) 100; S.C.R. (%) 90; R.Q.D. (%) 71 | | | 32mm Diam. PVC #10 Slot Screen |
| | | Fresh grey LIMESTONE BEDROCK, with shale interbed | | 7.53 | | | | | | | |
| 8 | | | | | 8 | NQ RC | | T.C.R. (%) 100; S.C.R. (%) 97; R.Q.D. (%) 75 | | | |
| 9 | | | | 65.53 | | | | | | | |
| | | End of Borehole | | 9.14 | | | | | | | WL in screen at Elev. 73.29m on Sept. 25, 2007 |
| 10 | | | | | | | | | | | |

BOREHOLE 061122127-3.GPJ HYDROGEO.GDT 3/26/08

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: MLRF

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: BRW1

SHEET 1 OF 3

LOCATION: See Site Plan

BORING DATE: September 7, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) | SHEAR STRENGTH Cu, kPa (nat V. + O - ●, rem V. ⊕ U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) | WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80) | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 75.54 | | | | | | | | | |
| 0 | | (Note: Stratigaphy from BRW-1, June 1992)<br>SILTY CLAY | | 0.00 | | | | | | | | | Concrete |
| 1 | | | | | | | | | | | | | |
| 2 | | | | 73.54 | | | | | | | | | |
| | | Glacial Till | | 2.00 | | | | | | | | | |
| 3 | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | Bentonite Seal |
| 6 | | | | | | | | | | | | | |
| 7 | | | | 68.14 | | | | | | | | | |
| | | Linestone Bedrock | | 7.40 | | | | | | | | | |
| 8 | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | Silica Sand<br>32mm Diam. PVC #10 Slot Screen C |
| 10 | | *CONTINUED NEXT PAGE* | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: HLLF

MIS-BHS 001 061122127-3.GPJ GAL-MISS.GDT 3/25/08 MLF

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: BRW1

SHEET 2 OF 3

LOCATION: See Site Plan

BORING DATE: September 7, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | --- CONTINUED FROM PREVIOUS PAGE --- | | | | | | | | | |
| 10 | | Limestone Bedrock | | | | | | | | | |
| 11 | | | | | | | | | | | 32mm Diam. PVC #10 Slot Screen C |
| 12 | | | | | | | | | | | |
| 13 | | | | | | | | | | | Silica Sand |
| 14 | | | | | | | | | | | Bentonite Seal |
| 15 | | | | | | | | | | | Silica Sand |
| 16 | | | | | | | | | | | |
| 17 | | | | | | | | | | | 32mm Diam. PVC #10 Slot Screen B |
| 18 | | | | | | | | | | | |
| 19 | | | | | | | | | | | Silica Sand |
| 20 | | CONTINUED NEXT PAGE | | | | | | | | | Bentonite Seal |

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: HLRF

MIS-BHS 001 061122127-3.GPJ GAL-MISS.GDT 3/25/06 MLF

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: BRW1

SHEET 3 OF 3

LOCATION: See Site Plan

BORING DATE: September 7, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) | SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) | WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | | — CONTINUED FROM PREVIOUS PAGE — | | | | | | | | | | | |
| | | Linestone Bedrock | | | | | | | | | | | Bentonite Seal |
| 21 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | Silica Sand |
| 22 | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | 32mm Diam. PVC #10 Slot Screen A |
| 24 | | | | | | | | | | | | | |
| | | | | 50.54 | | | | | | | | | |
| 25 | | End of Hole | | 25.00 | | | | | | | | | |
| | | | | | | | | | | | | | WL in screen A at Elev. 72.99m on Sept. 25, 2007 |
| 26 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | WL in screen B at Elev. 72.99m on Sept. 25, 2007 |
| 27 | | | | | | | | | | | | | |
| | | | | | | | | | | | | | WL in screen C at Elev. 73.02m on Sept. 25, 2007 |
| 28 | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: HLRF

MIS-BHS 001. 061122127-3.GPJ GAL-MISS.GDT 3/25/08 MLF

PROJECT: 06-1122-127-6200

# RECORD OF MONITORING WELL: MW 06-20

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Nov. 23, 2006

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) | SHEAR STRENGTH Cu, kPa (nat V. + Ω - ●, rem V. ⊕ U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) | WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80) | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 75.64 | | | | | | | | | |
| 0 | Power Auger 200mm Diam (Hollow Stem) | TOPSOIL | | 0.00 / 75.40 | | | | | | | | | |
| 1 | | Very stiff grey brown SILTY CLAY (Weathered Crust) | | 0.24 / 74.18 | | | | | | | | | Protective casing set in Bentonite Seal |
| 2 | | Compact grey SANDY SILT, some gravel, trace clay, occasional silty sand and silt seam or layer (GLACIAL TILL) | | 1.46 | 1 | 50 DO | 21 | | | | | | |
| 3 | | | | | 2 | 50 DO | 28 | | | | | | 38mm Diam PVC #10 Slot Screen |
| 4 | | | | 71.37 | | | | | | | | | |
| | | End of Borehole Auger Refusal | | 4.27 | | | | | | | | | |
| 5 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | |

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: D.J.S.
CHECKED: HLRF

MIS-BHS 001 0611221127-6200.GPJ GAL-MISS.GDT 3/25/08

PROJECT: 06-1122-127-6200

# RECORD OF MONITORING WELL: MW 06-21

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Nov. 23, 2006

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) | HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT (Wp, W, Wl) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 74.93 | | | | | | | |
| 0 | Power Auger 200mm Diam (Hollow Stem) | TOPSOIL | | 0.00 / 74.72 | | | | | | | |
| | | Grey brown SILTY CLAY (Weathered Crust) | | 0.21 / 74.32 | | | | | | | Protective casing set in Bentonite Seal |
| 1 | | Grey brown SANDY SILT, some gravel, trace clay, occasional cobble (GLACIAL TILL) | | 0.61 | | | | | | | |
| | | | | | 1 | SS | 50 DO | 62 | | | |
| 2 | | | | 72.49 | | | | | | | |
| | | Compact grey SILTY SAND, some gravel, occasional fine to coarse sand layer (GLACIAL TILL) | | 2.44 | | | | | | | 38mm Diam PVC #10 Slot Screen |
| 3 | | | | | 2 | SS | 50 DO | 26 | | | |
| | | | | 71.27 | | | | | | | |
| | | Grey SANDY SILT, some gravel and clay (GLACIAL TILL) | | 3.66 / 70.88 | | | | | | | |
| 4 | | End of Borehole Auger Refusal | | 4.05 | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20, 40, 60, 80

SHEAR STRENGTH Cu, kPa: 20, 40, 60, 80

HYDRAULIC CONDUCTIVITY, k, cm/s: $10^{-6}$, $10^{-5}$, $10^{-4}$, $10^{-3}$

WATER CONTENT PERCENT: 20, 40, 60, 80

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: H.L.R.F.

MIS-BHS 001 061122127-6200.GPJ GAL-MISS.GDT 3/25/08

PROJECT: 06-1122-127-6200

# RECORD OF MONITORING WELL: MW 06-22

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Nov. 23, 2006

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Power Auger 200mm Diam (Hollow Stem) | GROUND SURFACE | | 82.10 | | | | | | | |
| | | GARBAGE (FILL) | | 0.00 | | | | | | | Protective casing set in Bentonite Seal |
| 1 | | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | Caved Material |
| 5 | | | | | | | | | | | Silica Sand |
| 6 | | | | | 1 | 50 DO | 19 | | | | 38mm Diam PVC #10 Slot Screen |
| 7 | | | | | 2 | 50 DO | 5 | | | | |
| | | | | 74.48 | | | | | | | |
| | | PEAT | | 7.62 | | | | | | | |
| | | Grey brown SILTY CLAY | | 7.77 | 3 | 50 DO | 10 | | | | |
| 8 | | | | 74.02 | | | | | | | Bentonite Seal |
| | | Grey brown SANDY SILT | | 8.08 | | | | | | | |
| | | End of Borehole | | 8.23 | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: MLRF

MIS-BHS 001 061122127-6200.GPJ GAL-MISS.GDT 3/25/08

PROJECT: 1416664-6000

# RECORD OF BOREHOLE: 15-1

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: July 23, 2015

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 74.40 | | | | | | | |
| 0 | Power Auger 200 mm Diam. (Hollow Stem) | TOPSOIL | | 0.00<br>74.05 | | | | | | | Bentonite Seal |
| | | (CL/ML) CLAYEY SILT, low to medium plasticity; brown; cohesive, w>PL, very stiff | | 0.35<br>73.49 | 1 | AS | - | | | | Silica Sand |
| 1 | | (ML) sandy SILT, some low plasticity fines, some gravel, subrounded; grey brown (GLACIAL TILL); wet, compact | | 0.91<br>72.72 | 2 | SS | >50 | | | | 50 mm Diam. PVC #10 Slot Screen |
| | | End of Borehole<br>Auger Refusal | | 1.68 | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

LOGGED: PAH

CHECKED: MIB

Golder Associates

MIS-BHS 001 1416664-6000.GPJ GAL-MIS.GDT 12/14/15 JM

PROJECT: 1416664-6000

# RECORD OF BOREHOLE: 15-2

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: July 23, 2015

DATUM: Geodetic

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 74.68 | | | | | | | |
| 0 | Power Auger 200 mm Diam. (Hollow Stem) | TOPSOIL | | 0.00<br>74.47 | | | | | | | |
| | | (CL/ML) CLAYEY SILT, trace gravel and low plasticity fines; grey brown; cohesive, w~PL, very stiff | | 0.21 | | | | | | | Bentonite Seal<br>Silica Sand<br>50 mm Diam. PVC #10 Slot Screen |
| 1 | | | | | 1 | AS | - | | | | |
| | | | | 73.28 | | | | | | | |
| | | End of Borehole<br>Auger Refusal | | 1.40 | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: PAH
CHECKED: MIB

MIS-BHS 001 1416664-6000.GPJ GAL-MIS.GDT 12/14/15 JM

PROJECT: 1416664-6000

# RECORD OF BOREHOLE: 15-3

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: July 21, 2015

DATUM: Geodetic

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 75.41 | | | | | | | |
| 0 | Power Auger 200 mm Diam. (Hollow Stem) | TOPSOIL | | 0.00<br>75.16 | | | | | | | Bentonite Seal |
| | | (CI/CH) SILTY CLAY, trace sand; grey brown, fissured (WEATHERED CRUST); cohesive, w~PL, very stiff | | 0.25 | | | | | | | |
| 1 | | | | | | | | | | | Silica Sand |
| | | | | 73.89 | | | | | | | |
| | | GLACIAL TILL | | 1.52 | | | | | | | |
| 2 | | | | | | | | | | | Bentonite Seal |
| 3 | | | | | | | | | | | Native Backfill |
| | | | | 71.45 | | | | | | | |
| 4 | | Fresh, grey LIMESTONE | | 3.96 | | | | | | | |
| | | Borehole continued on RECORD OF DRILLHOLE 15-3 | | 4.09 | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: PAH

CHECKED: MIB

MIS-BHS 001 1416664-6000.GPJ GAL-MIS.GDT 12/14/15 JM

PROJECT: 1416664-6000

# RECORD OF DRILLHOLE: 15-3

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: July 21, 2015

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 55

DRILLING CONTRACTOR: Downing Drilling

JN - Joint; FLT - Fault; SHR- Shear; VN - Vein; CJ - Conjugate
BD- Bedding; FO- Foliation; CO- Contact; OR- Orthogonal; CL - Cleavage
PL - Planar; CU- Curved; UN- Undulating; ST - Stepped; IR - Irregular
PO- Polished; K - Slickensided; SM- Smooth; Ro - Rough; MB- Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. / DEPTH (m) | RUN No. | COLOUR / % RETURN / FLUSH | RECOVERY: TOTAL CORE % | RECOVERY: SOLID CORE % | R.Q.D. % | FRACT. INDEX PER 0.25 m | DISCONTINUITY DATA: B Angle | DISCONTINUITY DATA: DIP w.r.t. CORE AXIS | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION | Jcon | Jr | Ja | HYDRAULIC CONDUCTIVITY K, cm/sec | Diametral Point Load Index (MPa) | RMC -'Q' AVG. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BEDROCK SURFACE | | 71.32 | | | | | | | | | | | | | | | | |
| | Rotary Drill / NQ Core | Fresh, grey LIMESTONE | | 4.09 | 1 | 100 | | | | | | | | | | | | | | Bentonite Seal |
| 5 | | - Lost core from 4.87 m to 5.03 m | | | 2 | 90 | | | | | | | | | | | | | | Silica Sand |
| | | - Lost core from 5.49 m to 5.53 m | | | | | | | | | | | | | | | | | | |
| 6 | | - Lost core from 5.69 m to 5.74 m | | | | | | | | | | | | | | | | | | |
| | | | | | 3 | 90 | | | | | | | | | | | | | | 32 mm Diam. PVC #10 Slot Screen |
| 7 | | - Lost core from 6.96 m to 7.01 m | | | | | | | | | | | | | | | | | | |
| | | | | | 4 | 90 | | | | | | | | | | | | | | |
| 8 | | | | 67.33 | | | | | | | | | | | | | | | | |
| | | End of Drillhole | | 8.08 | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE
1 : 50

LOGGED: PAH
CHECKED: MIB

Golder Associates

MIS-RCK 004 1416664-6000.GPJ GAL-MISS.GDT 12/14/15 JM

PROJECT: 1650505

# RECORD OF BOREHOLE: 16-1

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: December 8, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 74.71 | | | | | | | |
| 0 | Power Auger 200 mm Diam. (Hollow Stem) | (PT) sandy SILT, some organics; dark brown (PEAT); non-cohesive, moist, very loose | | 0.00 | 1 | SS | 1 | | | | |
| 1 | | | | 73.41 | | | | | | | |
| | | (CL/MC) CLAYEY SILT to SILTY CLAY, trace gravel; grey brown (WEATHERED CRUST); cohesive, very stiff | | 1.30 | 2 | SS | 5 | | | | Bentonite Seal |
| 2 | | | | 72.60 | | | | | | | |
| | | (CL/MC) CLAYEY SILT to SILTY CLAY; trace gravel; grey; cohesive, very stiff | | 2.11 | | | | | | | |
| 3 | | | | | 3 | SS | 4 | | | | Silica Sand |
| 4 | | | | 69.99 | | | | | | | |
| | | (ML) sandy SILT, some gravel, trace clay; grey (GLACIAL TILL); non-cohesive, wet, compact to very dense | | 4.72 | 4 | SS | 2 | | | | 32 mm Diam. PVC #10 Slot Screen 'B' |
| 5 | | | | | | | | | | | |
| 6 | | | | | 5 | SS | >50 | | | | |
| | | | | 67.93 | | | | | | | Bentonite Seal |
| 7 | | Borehole continued on RECORD OF DRILLHOLE 16-1 | | 6.78 | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

LOGGED: JD

CHECKED: MIB

Golder Associates

MIS-BHS 001 1650505-8000.GPJ GAL-MIS.GDT 03/23/17 JM

PROJECT: 1650505

# RECORD OF DRILLHOLE: 16-1

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: December 8, 2016

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME

DRILLING CONTRACTOR: Downing Drilling

JN - Joint; FLT - Fault; SHR- Shear; VN - Vein; CJ - Conjugate
BD- Bedding; FO- Foliation; CO- Contact; OR- Orthogonal; CL - Cleavage
PL - Planar; CU- Curved; UN- Undulating; ST - Stepped; IR - Irregular
PO- Polished; K - Slickensided; SM- Smooth; Ro - Rough; MB- Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. / DEPTH (m) | RUN No. | COLOUR % RETURN / FLUSH | RECOVERY: TOTAL CORE % | RECOVERY: SOLID CORE % | R.Q.D. % | FRACT. INDEX PER 0.25 m | DISCONTINUITY DATA: B Angle | DISCONTINUITY DATA: DIP w.r.t. CORE AXIS | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION | Jcon | Jr | Ja | HYDRAULIC CONDUCTIVITY K, cm/sec | Diametral Point Load Index (MPa) | RMC 'Q' AVG. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BEDROCK SURFACE | | 67.93 | | | | | | | | | | | | | | | | |
| 7 | Rotary Drill / NQ Core | Slightly weathered to weathered, highly fractured, grey LIMESTONE, with shale interbedded | | 6.78 | 1 | 20 | | | | | | | | | | | | | | Bentonite Seal |
| 8 | | | | | 2 | 20 | | | | | | | | | | | | | | 32 mm Diam. PVC #10 Slot Screen 'A' |
| | | | | 65.95 | | | | | | | | | | | | | | | | Cave |
| | | End of Drillhole | | 8.76 | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JD
CHECKED: MIB

MIS-RCK 004 1650505-8000.GPJ GAL-MISS.GDT 03/23/17 JM

PROJECT: 1650505

# RECORD OF BOREHOLE: 16-2

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: December 8, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 74.72 | | | | | | | |
| 0 | Power Auger 200 mm Diam. (Hollow Stem) | (PT) sandy SILT, trace organics; dark brown (PEAT); non-cohesive, moist, very loose | | 0.00 | 1 | SS | 1 | | | | |
| 1 | | | | | 2 | SS | 1 | | | | Native Backfill |
| | | | | 72.89 | 3 | SS | 1 | | | | |
| 2 | | (CL/MC) CLAYEY SILT to SILTY CLAY, trace gravel; grey brown; cohesive, very stiff | | 1.83 | 4 | SS | 5 | | | | Bentonite Seal |
| 3 | | | | | 5 | SS | 2 | | | | Silica Sand |
| 4 | | | | | 6 | SS | 3 | | | | |
| 5 | | | | | 7 | SS | 1 | | | | 32 mm Diam. PVC #10 Slot Screen |
| | | | | | 8 | SS | 2 | | | | |
| 6 | | | | 68.62 | | | | | | | |
| | | (ML) sandy SILT, some gravel; grey (GLACIAL TILL); non-cohesive, wet, compact | | 6.10 | 9 | SS | 22 | | | | |
| | | | | 68.01 | | | | | | | |
| | | End of Borehole Auger Refusal | | 6.71 | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

LOGGED: JD

CHECKED: MIB

Golder Associates

MIS-BHS 001 1650505-8000.GPJ GAL-MIS.GDT 03/23/17 JM

PROJECT: 1650505

# RECORD OF BOREHOLE: 16-3

SHEET 1 OF 3

LOCATION: See Site Plan

BORING DATE: December 8, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 75.05 | | | | | | | |
| 0 | Power Auger | (PT) sandy SILT, some organics; dark brown (PEAT); non-cohesive, moist, very loose | | 0.00 | 1 | SS | 1 | | | | Bentonite Seal |
| 1 | 200 mm Diam. (Hollow Stem) | | | | 2 | SS | WH | | | | |
| | | | | 73.53 | | | | | | | |
| | | (CL/MC) CLAYEY SILT to SILTY CLAY, trace gravel; grey brown (WEATHERED CRUST); cohesive, very stiff | | 1.52 | 3 | SS | 1 | | | | Silica Sand |
| 2 | | | | | 4 | SS | 4 | | | | 32 mm Diam. PVC #10 Slot Screen 'C' |
| | | | | 72.00 | | | | | | | |
| 3 | | (CL/MC) CLAYEY SILT to SILTY CLAY; grey; cohesive, stiff | | 3.05 | 5 | SS | WH | | | | Silica Sand |
| 4 | | | | | 6 | SS | WH | | | | |
| | | | | | 7 | SS | WH | | | | |
| 5 | | | | | 8 | SS | WH | | | | Bentonite Seal |
| 6 | | | | | 9 | SS | 1 | | | | |
| | | | | | 10 | SS | 9 | | | | |
| 7 | | | | 67.73 | | | | | | | |
| | | (SP) gravelly SAND, some silt; reddish grey; non-cohesive, wet, loose | | 7.32 | 11 | SS | 3 | | | | Silica Sand |
| 8 | | | | | 12 | SS | 9 | | | | 32 mm Diam. PVC #10 Slot Screen 'B' |
| 9 | | | | 65.88 | | | | | | | |
| | | (ML) sandy SILT, some gravel, trace clay; grey (GLACIAL TILL); non-cohesive, wet, compact to very dense | | 9.17 | 13 | SS | 22 | | | | Silica Sand |
| | | | | | 14 | SS | 28 | | | | Bentonite Seal |
| 10 | | *CONTINUED NEXT PAGE* | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JD

CHECKED: MIB

MIS-BHS 001 1650505-8000.GPJ GAL-MIS.GDT 03/23/17 JM

PROJECT: 1650505

# RECORD OF BOREHOLE: 16-3

SHEET 2 OF 3

LOCATION: See Site Plan

BORING DATE: December 8, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *--- CONTINUED FROM PREVIOUS PAGE ---* | | | | | | | | | |
| 10 | Power Auger | (ML) sandy SILT, some gravel, trace clay; grey (GLACIAL TILL); non-cohesive, wet, compact to very dense | | | 14 | SS | 28 | | | | |
| 11 | Wash Boring / NW Casing | | | | 15 | SS | 64 | | | | Bentonite Seal |
| | | | | 63.47 | 16 | SS | >50 | | | | |
| | | Borehole continued on RECORD OF DRILLHOLE 16-3 | | 11.58 | | | | | | | |
| 12 | | | | | | | | | | | |
| 13 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |
| 16 | | | | | | | | | | | |
| 17 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 19 | | | | | | | | | | | |
| 20 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JD

CHECKED: MIB

MIS-BHS 001 1650505-8000.GPJ GAL-MIS.GDT 03/23/17 JM

PROJECT: 1650505

# RECORD OF DRILLHOLE: 16-3

SHEET 3 OF 3

LOCATION: See Site Plan

DRILLING DATE: December 8, 2016

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME

DRILLING CONTRACTOR: Downing Drilling

JN - Joint; FLT - Fault; SHR - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; Ro - Rough; MB - Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. / DEPTH (m) | RUN No. | COLOUR / % RETURN / FLUSH | RECOVERY: TOTAL CORE % | RECOVERY: SOLID CORE % | R.Q.D. % | FRACT. INDEX PER 0.25 m | DISCONTINUITY DATA: B Angle | DISCONTINUITY DATA: DIP w.r.t. CORE AXIS | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION | Jcon | Jr | Ja | HYDRAULIC CONDUCTIVITY K, cm/sec | Diametral Point Load Index (MPa) | RMC 'Q' AVG. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BEDROCK SURFACE | | 63.47 | | | | | | | | | | | | | | | | |
| 12 | WB NW Rotary Drill NQ Core | Slightly weathered to weathered, highly fractured, grey LIMESTONE, with shale interbedded | | 11.58 | 1 | 20 | | | | | | | | | | | | | | Bentonite Seal; Silica Sand |
| 13 | | | | | 2 | 20 | | | | | | | | | | | | | | 32 mm Diam. PVC #10 Slot Screen 'A' |
| 14 | | | | 61.05 | 3 | 20 | | | | | | | | | | | | | | Silica Sand |
| | | End of Drillhole | | 14.00 | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | |

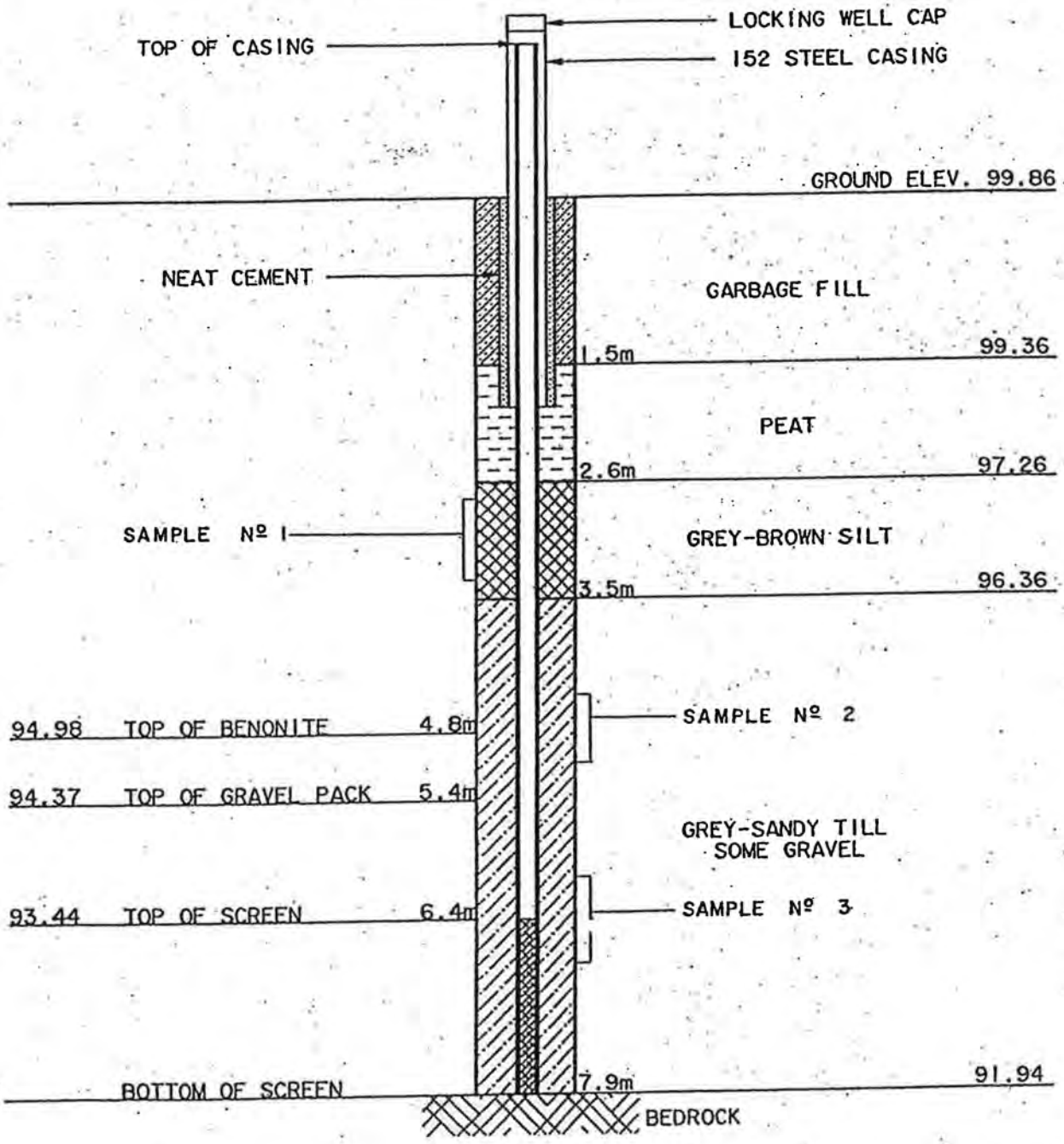
DEPTH SCALE
1 : 50

LOGGED: JD
CHECKED: MIB

Golder Associates

MIS-RCK 004 1650505-8000.GPJ GAL-MISS.GDT 03/23/17 JM

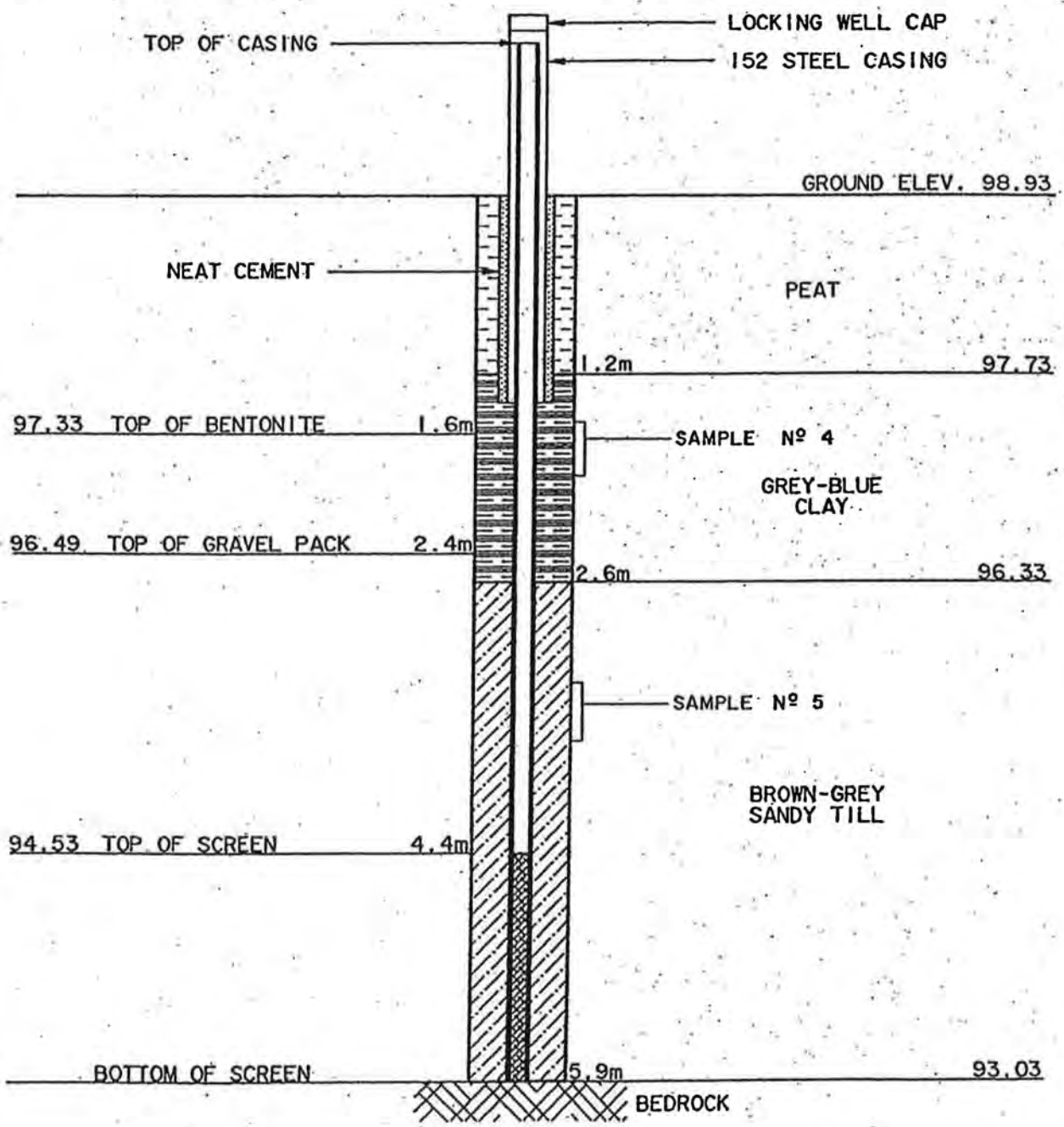
# MONITORING WELL #1 BOREHOLE LOG




OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Nepean, Ontario

| | | |
|---|---|---|
| DATE: MARCH. 1991 | CLIENT: TOWNSHIP OF WINCHESTER LANDFILL | DRAWING NO. 90-7848 |
| SCALE: N.T.S. | TITLE: MONITORING WELL INSTALLATION | |

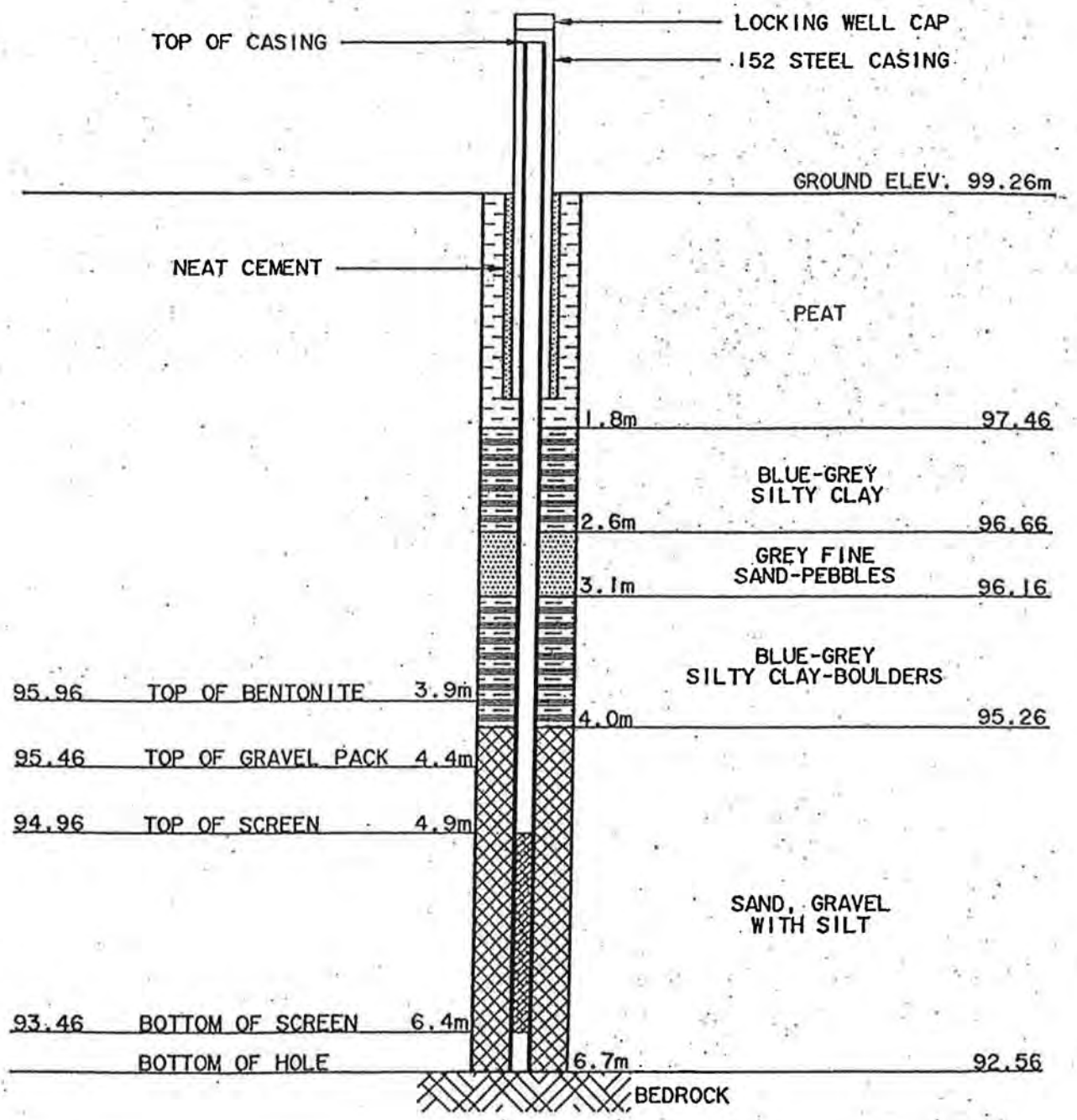
# MONITORING WELL #2 BOREHOLE LOG




OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Nepean, Ontario

| DATE: | CLIENT: | DRAWING NO. |
|---|---|---|
| MARCH, 1991 | TOWNSHIP OF WINCHESTER LANDFILL | 90-7848 |
| SCALE: N.T.S. | TITLE: MONITORING WELL INSTALLATION | |

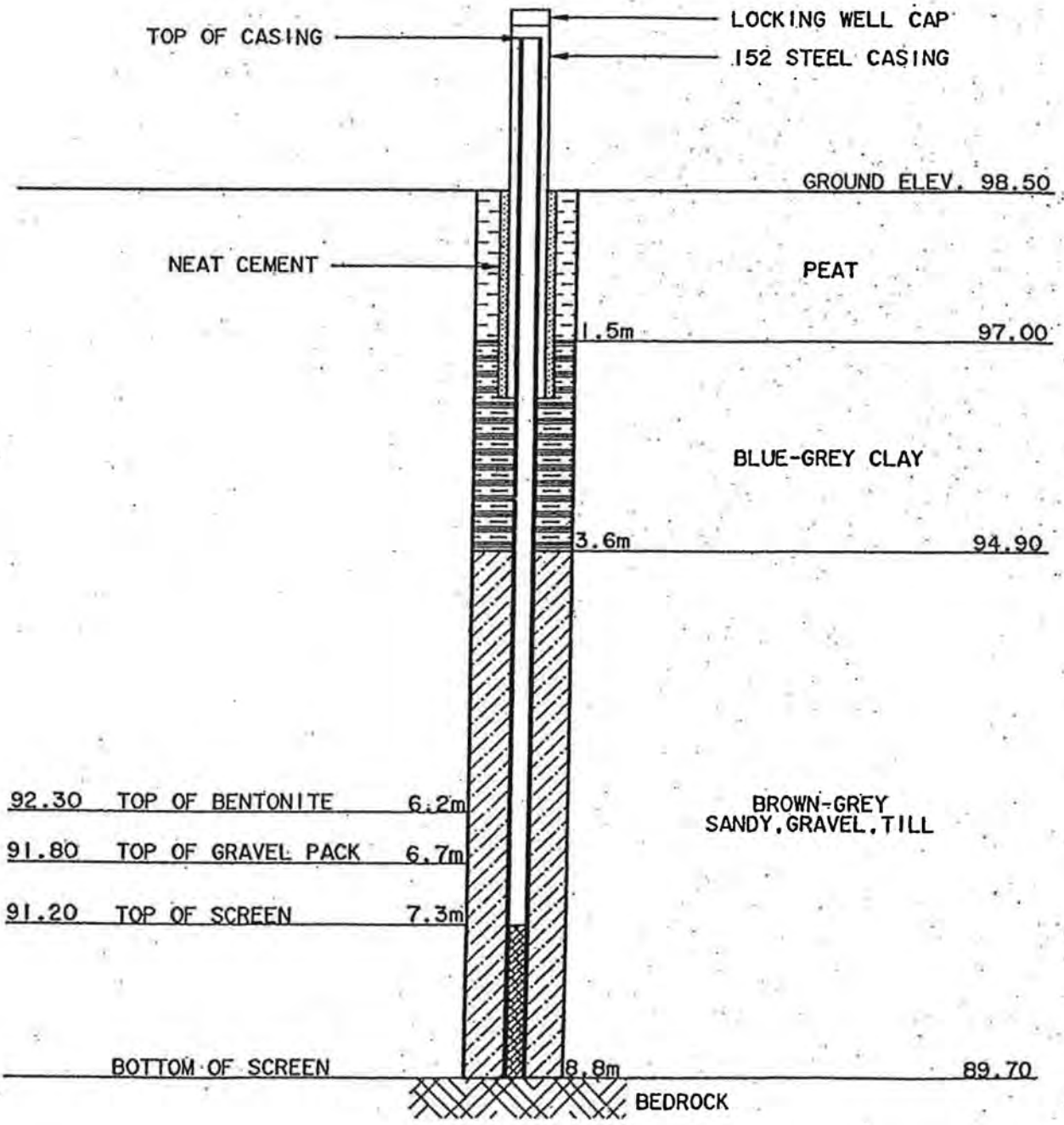
# MONITORING WELL #3 BOREHOLE LOG




OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Nepean, Ontario

| | | |
|---|---|---|
| DATE: MARCH. 1991 | CLIENT: TOWNSHIP OF WINCHESTER LANDFILL | DRAWING NO. 90-7848 |
| SCALE: N.T.S. | TITLE: MONITORING WELL INSTALLATION | |

# MONITORING WELL #4 BOREHOLE LOG

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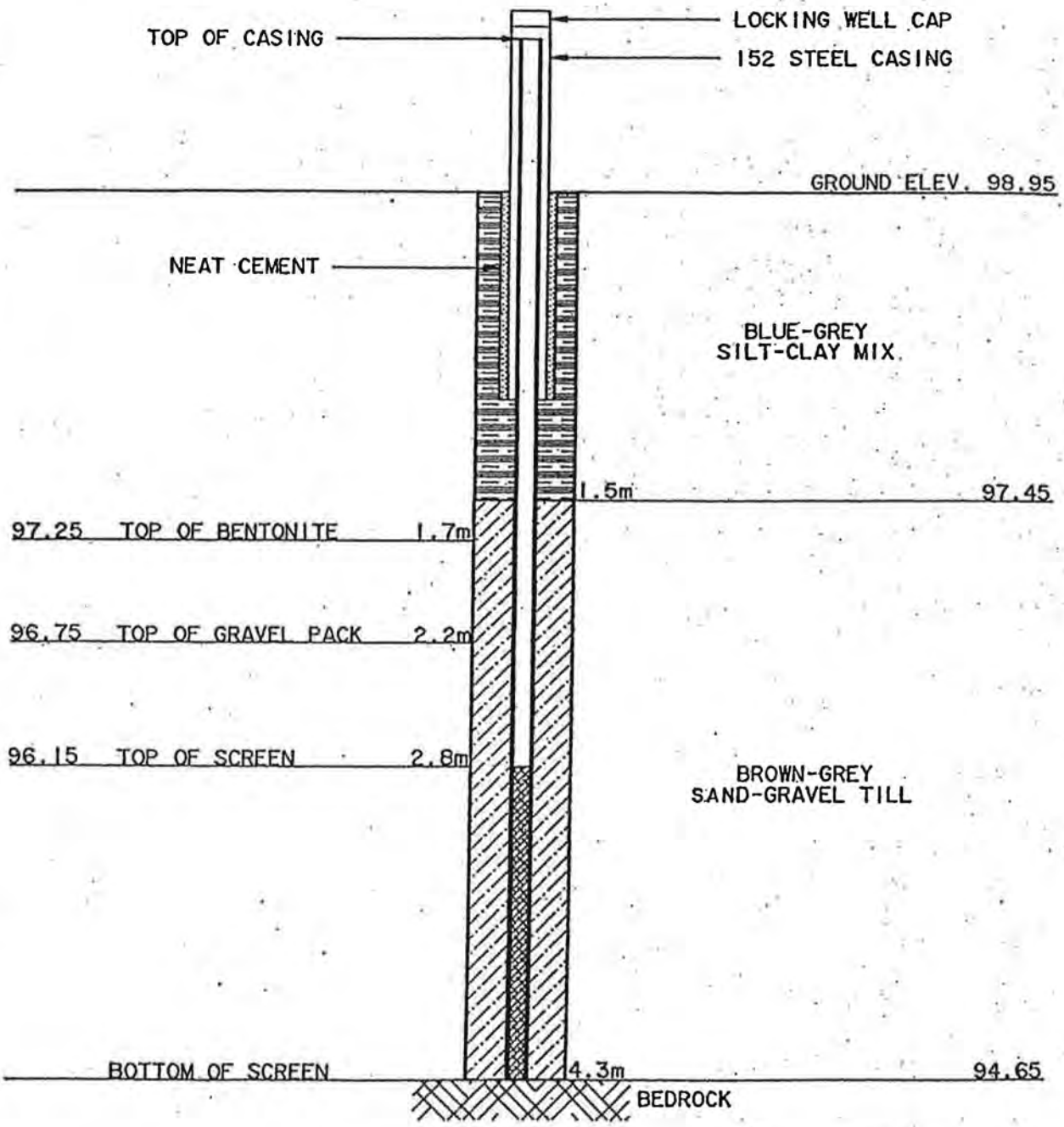
& ASSOCIATES LIMITED
Consulting Engineers
Nepean, Ontario

| | | |
|---|---|---|
| DATE: MARCH, 1991 | CLIENT: TOWNSHIP OF WINCHESTER LANDFILL | DRAWING NO. 90-7848 |
| SCALE: N.T.S. | TITLE: MONITORING WELL INSTALLATION | |

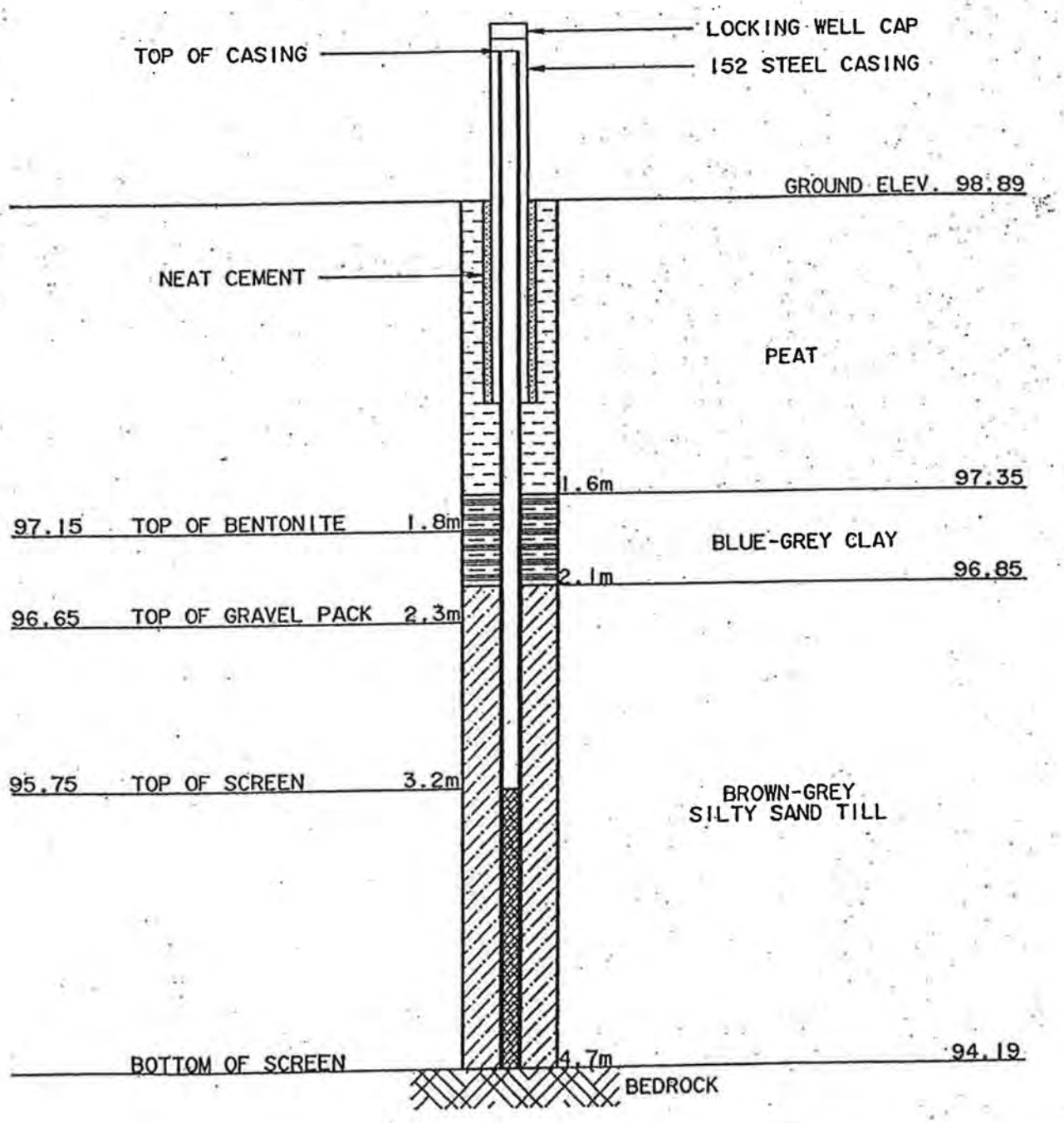
# MONITORING WELL #5 BOREHOLE LOG




OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Nepean, Ontario

| | | |
|---|---|---|
| DATE: MARCH, 1991 | CLIENT: TOWNSHIP OF WINCHESTER LANDFILL | DRAWING NO. 90-7848 |
| SCALE: N.T.S. | TITLE: MONITORING WELL INSTALLATION | |

# MONITORING WELL #6 BOREHOLE LOG

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& ASSOCIATES LIMITED
Consulting Engineers
Nepean, Ontario

| | | |
|---|---|---|
| DATE: MARCH, 1991 | CLIENT: TOWNSHIP OF WINCHESTER LANDFILL | DRAWING NO. 90-7848 |
| SCALE: N.T.S. | TITLE: MONITORING WELL INSTALLATION | |

STRATIGRAPHIC DESCRIPTION AND OVER-BURDEN MONITORING WELL INSTALLATION

WINCHESTER TOWNSHIP LANDFILL SITE

ONITORING WELL NUMBER: MW 7

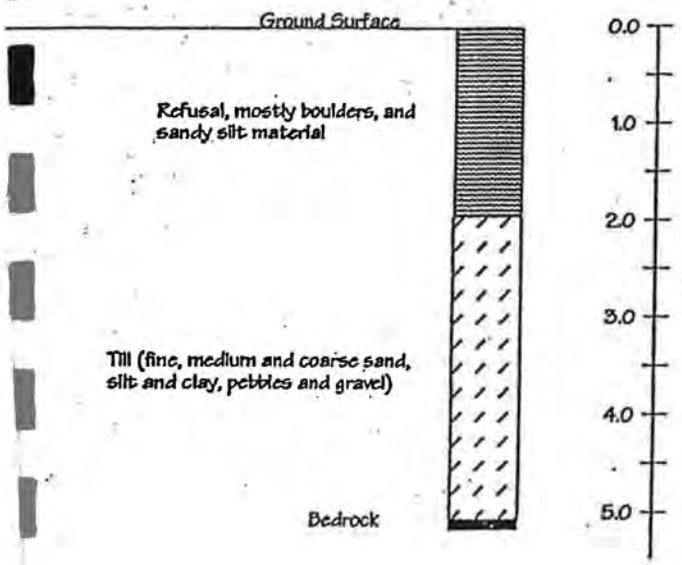
RILL TYPE: CME 55 HOLLOW STEM AUGER

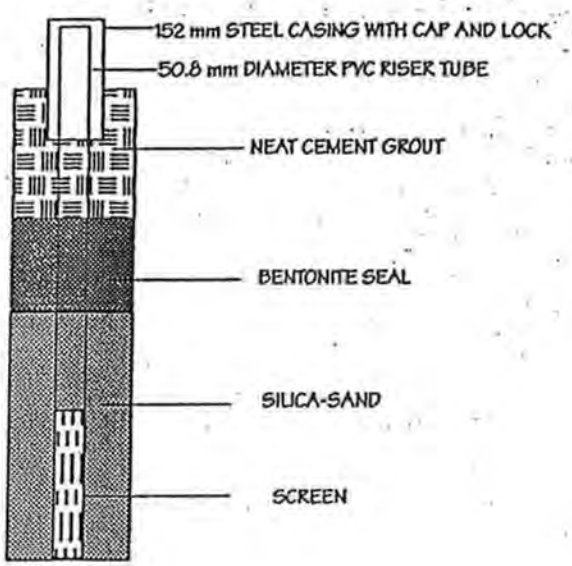
RILLER: MARATHON

LOCATION: CONCESSION VII, LOT 8

DATE: JUNE 9, 1992

| SOIL DESCRIPTION | STRAT. | DEPTH (m) | ELEV. (m) | PIEZOMETER INSTALLATION |
|---|---|---|---|---|




| | | |
|---|---|---|
| I. S. THOMPSON & SSOCIATES LTD. | FIGURE TITLE: SOIL PROFILE AND PIEZOMETER CONSTRUCTION | DATE: JUNE 1992 |
| | | SCALE: AS SHOWN |
| | | DRAWN: MHM |
| NSULTING ENGINEERS | JOB: WINCHESTER TOWNSHIP LANDFILL SITE | JOB No.: 92094 |
| ROSEMOUNT AVE. CORNWALL K6J 3E5 | | FIGURE: |

STRATIGRAPHIC DESCRIPTION AND OVER-BURDEN MONITORING WELL INSTALLATION

WINCHESTER TOWNSHIP LANDFILL SITE

MONITORING WELL NUMBER: MW 8

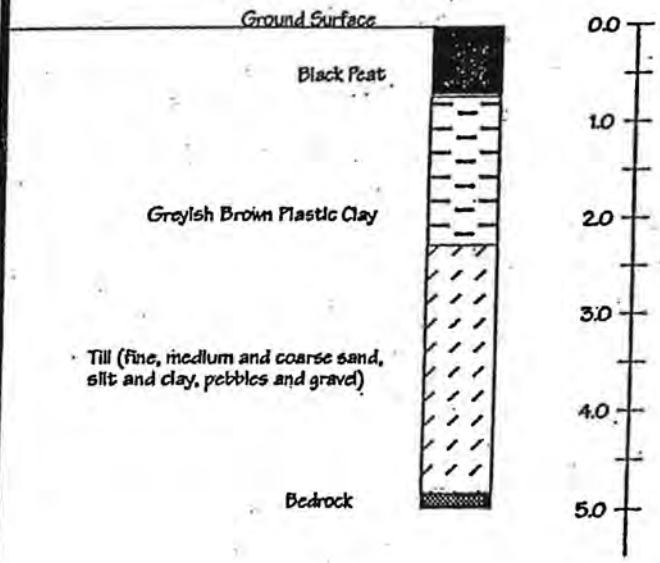
DRILL TYPE: CME 55 HOLLOW STEM AUGER

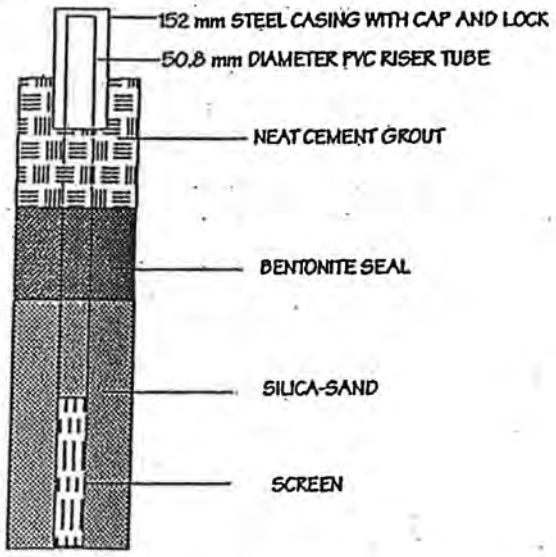
DRILLER: MARATHON

LOCATION: CONCESSION VII, LOT 8

DATE: JUNE 9, 1992

| SOIL DESCRIPTION | STRAT. | DEPTH (m) | ELEV. (m) | PIEZOMETER INSTALLATION |
|---|---|---|---|---|





M. S. THOMPSON & ASSOCIATES LTD.

CONSULTING ENGINEERS

1345 ROSEMOUNT AVE. CORNWALL K6J 3E5


FIGURE TITLE

SOIL PROFILE AND PIEZOMETER CONSTRUCTION

JOB

WINCHESTER TOWNSHIP LANDFILL SITE

| | |
|---|---|
| DATE | JUNE 1992 |
| SCALE | AS SHOWN |
| DRAWN | MHM |
| JOB No. | 92094 |
| FIGURE: | |

STRATIGRAPHIC DESCRIPTION AND OVER-BURDEN MONITORING WELL INSTALLATION

WINCHESTER TOWNSHIP LANDFILL SITE

MONITORING WELL NUMBER: MW 9

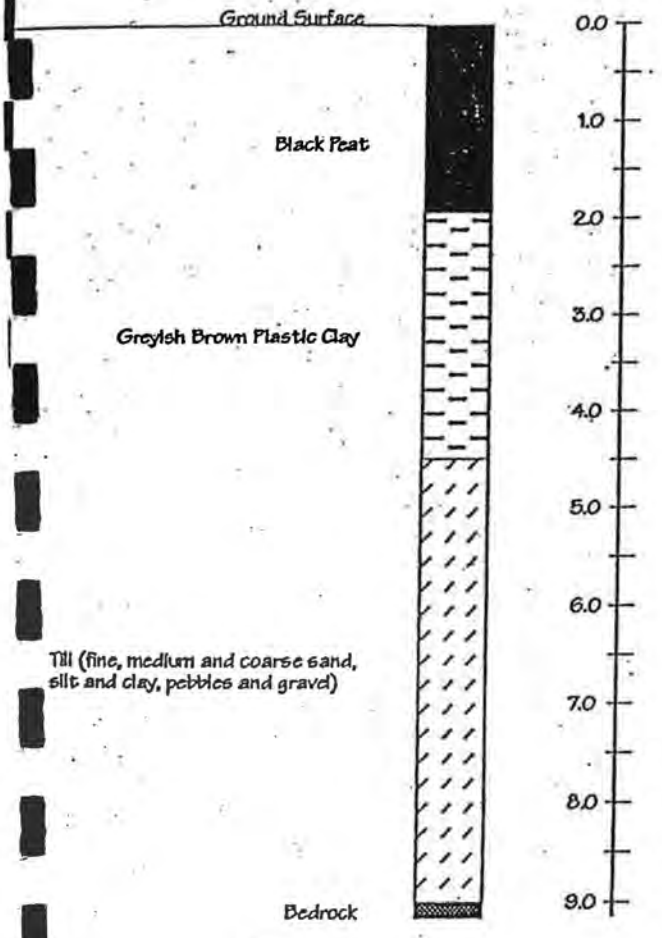
LOCATION: CONCESSION VII, LOT 8

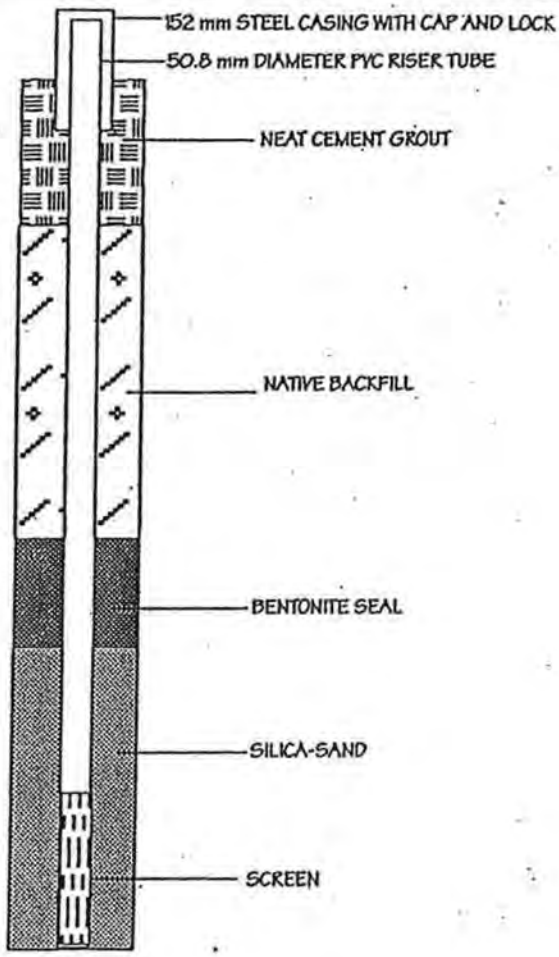
DRILL TYPE: CME 55 HOLLOW STEM AUGER

DATE: JUNE 9, 1992

DRILLER: MARATHON

| SOIL DESCRIPTION | STRAT. | DEPTH (m) | ELEV. (m) | PIEZOMETER INSTALLATION |
|---|---|---|---|---|




M. S. THOMPSON & ASSOCIATES LTD.

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345 ROSEMOUNT AVE. CORNWALL K6J 3E5

FIGURE TITLE

SOIL PROFILE AND PIEZOMETER CONSTRUCTION

JOB

WINCHESTER TOWNSHIP LANDFILL SITE

DATE JUNE 1992

SCALE AS SHOWN

DRAWN MHM

JOB No. 92094

FIGURE:

# STRATIGRAPHIC DESCRIPTION AND OVER-BURDEN MONITORING WELL INSTALLATION

## WINCHESTER TOWNSHIP LANDFILL SITE

MONITORING BEDROCK WELL: BRW-1

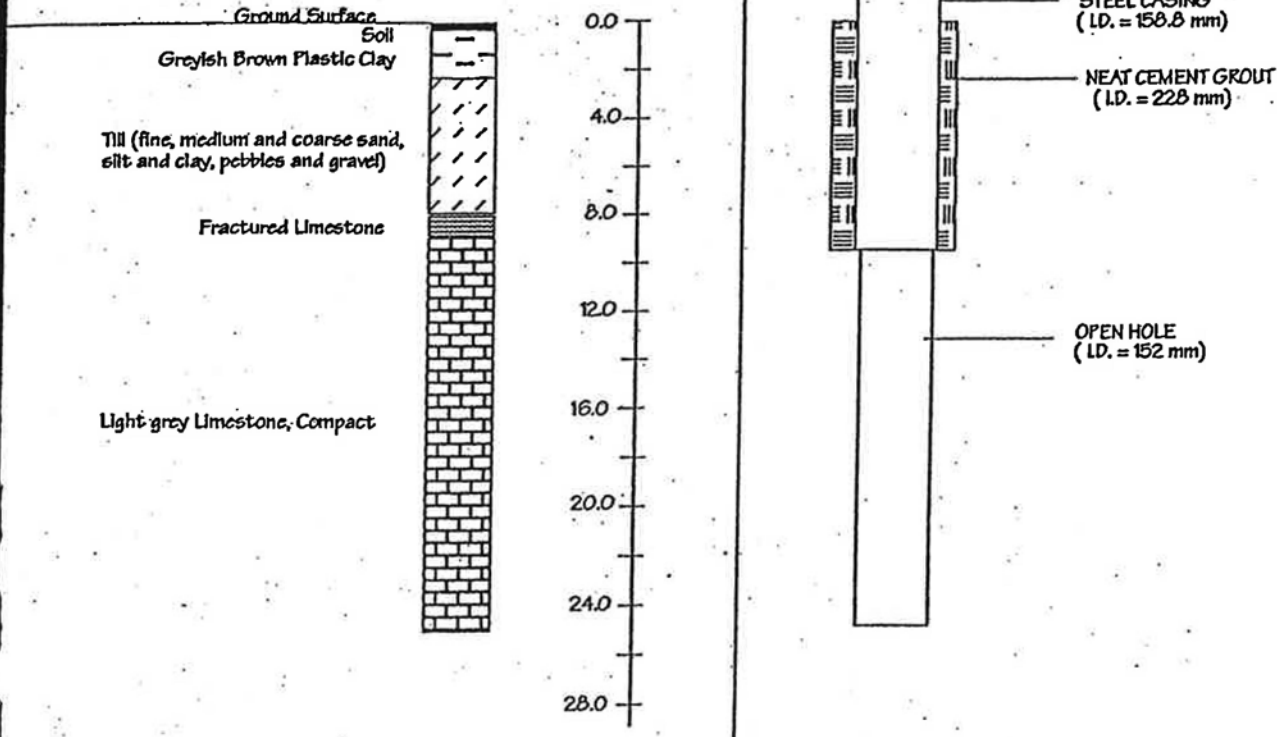
LOCATION: CONCESSION VII, LOT 8

DRILL TYPE: CME 55 HOLLOW STEM AUGER

DATE: JUNE 10, 1992

DRILLER: MARATHON

| SOIL DESCRIPTION | STRAT. | DEPTH (m) | ELEV. (m) | PIEZOMETER INSTALLATION |
|---|---|---|---|---|



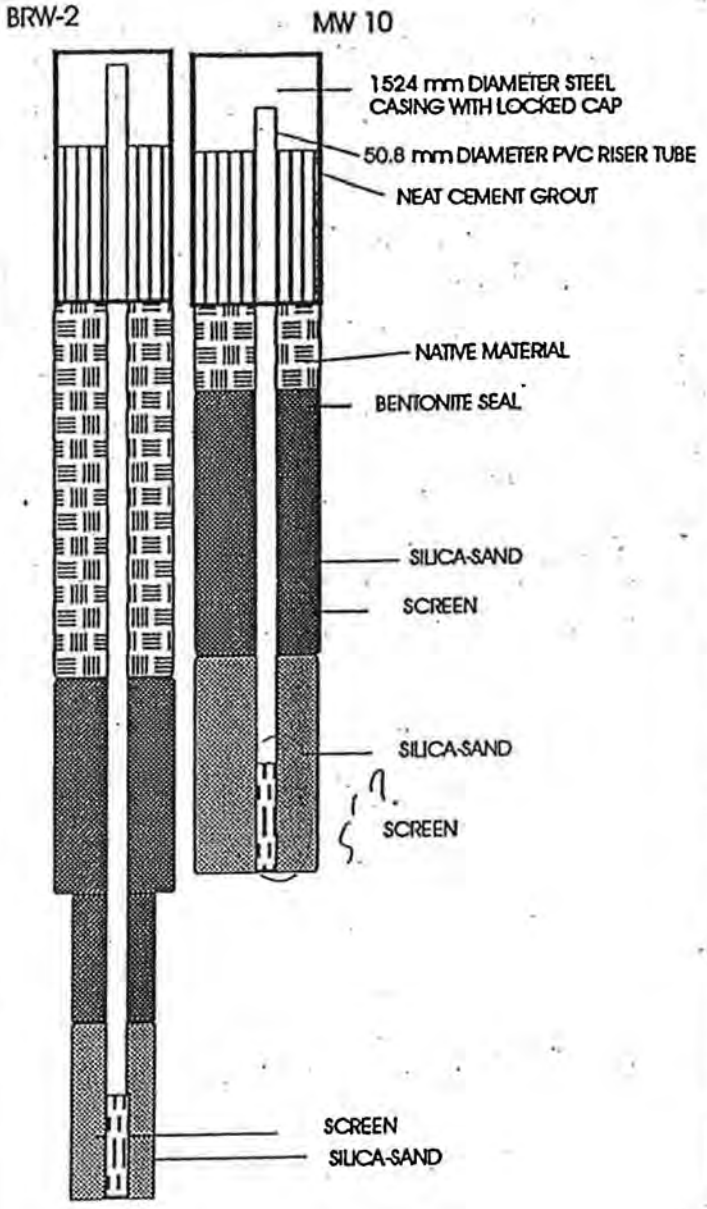

| | | |
|---|---|---|
| M. S. THOMPSON & ASSOCIATES LTD. | FIGURE TITLE | DATE JUNE 1992 |
| CONSULTING ENGINEERS | SOIL PROFILE AND PIEZOMETER CONSTRUCTION | SCALE AS SHOWN |
| | | DRAWN MHM |
| 1345 ROSEMOUNT AVE. CORNWALL K6J 3E5 | JOB WINCHESTER TOWNSHIP LANDFILL SITE | JOB No. 92094 |
| | | FIGURE: |

MONITORING WELL NUMBER: MW10 & BRW-12
DRILL TYPE: CME 55 HOLLOW STEM AUGER
DRILLER: MARATHON

LOCATION: WINCHESTER TOWNSHIP WASTE DISPOSAL SITE
DATE: JULY 1993

| SOIL DESCRIPTION | STRAT. | DEPTH (m) | ELEV. (m) |
|---|---|---|---|
| GROUND SURFACE | | 0.0 | 74.54 |
| DARK, SILTY, ORGANIC SOIL | | | |
| GREYISH TO BLUISH BROWN MOIST, PLASTIC CLAY | | 1.0 | 73.54 |
| | | 2 | 72.54 |
| | | 3.0 | 71.54 |
| GREYISH PURPLE, SANDY SILT WITH CLAY, PEBBLES AND GRAVEL | | 4.0 | 70.54 |
| | | 5.0 | 69.54 |
| FRACTURED LIMESTONE | | 6.0 | 68.54 |
| | | 7.0 | 67.54 |
| | | 8.0 | 66.54 |

PIEZOMETER INSTALLATION




M. S. THOMPSON & ASSOCIATES LTD.
CONSULTING ENGINEERS
1345 ROSEMOUNT AVE. CORNWALL K6J 3E5

FIGURE TITLE
SOIL PROFILE AND PIEZOMETER CONSTRUCTION

JOB
WINCHESTER TOWNSHIP WASTE DISPOSAL SITE

| | |
|---|---|
| DATE | MARCH 1993 |
| SCALE | AS SHOWN |
| DRAWN | MHM |
| JOB No. | 92094 |

Project No: MC12684A

# Log of MW 16

Project: North Dundas Landfill - Boyne Rd.

Client: Township of North Dundas

Location: Winchester, ON

Logged by: Matt Prince

Trow

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Depth (ft / m) | Symbol | Description | Elev. | Number | Type | Recovery | Volatile Organic Compounds ppmv (25 75 125 175) | Well Data | Lab Analysis |
| 0 / 0 | | Ground Surface | 0 | | | | | | |
| 0–2 / 0 | | ***TOPSOIL*** Topsoil. | -0.76 | AU 1 | | | | | |
| 3–7 / 1–2 | | ***CLAYEY SILT*** Medium grey, moist, soft, fractured clayey silt with traces of sand till. | -2.3 | SS 2<br>SS 3 | | | | | |
| 8–15 / 3–4 | | ***SILTY SAND*** Medium brown to grey, moist to saturated, silty sand with some coarse gravel till. | -4.6 | SS 4<br>SS 5<br>SS 6 | | | | | |
| 15 / 5 | | End of Borehole | | | | | | | |
| 16–20 / 5–6 | | | | | | | | | |

Drill Method: Hollow Stem Auger

Drill Date: September 26, 2002

Hole Size: 0.15 metres

**Trow Consulting Engineers Ltd.**
154 Colonnade Road South
Nepean, Ontario K2E 7J5

Datum:

Checked by: B.Coons

Sheet: 1 of 1

# Log of MW 17

**Project No:** MC12684A

**Project:** North Dundas Landfill - Boyne Rd.

**Client:** Township of North Dundas

**Location:** Winchester, ON

**Logged by:** Matt Prince

Trow

| Depth (ft) | Depth (m) | Symbol | Description | Elev. | Sample Number | Sample Type | Recovery | Volatile Organic Compounds (ppmv) | Well Data | Lab Analysis |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Ground Surface | 0 | | | | | | |
| 0 | 0 | | ***TOPSOIL*** Topsoil. | -0.3 | AU 1 | | | | | |
| 3 | 1 | | | | SS 2 | | | | | |
| 5 | | | ***SILTY GRAVELLY SAND*** Medium brown, dry, hard, silty gravelly sand till. | | | | | | | |
| 6 | 2 | | | | AU 3 | | | | | |
| 10 | 3 | | | -3 | | | | | | |
| 11 | | | | | SS 4 | | | | | |
| 12 | | | ***SILTY GRAVELLY SAND*** Medium grey, wet, hard, silty gravelly sand till. | | | | | | | |
| 13 | 4 | | | | AU 5 | | | | | |
| 15 | | | | -4.6 | | | | | | |
| | | | End of Borehole | | | | | | | |
| 16 | 5 | | | | | | | | | |
| 19 | 6 | | | | | | | | | |
| 20 | | | | | | | | | | |

Volatile Organic Compounds ppmv: 25 75 125 175

**Drill Method:** Hollow Stem Auger

**Drill Date:** September 26, 2002

**Hole Size:** 0.15 metres

**Trow Consulting Engineers Ltd.**
154 Colonnade Road South
Nepean, Ontario K2E 7J5

**Datum:**

**Checked by:** B.Coons

**Sheet:** 1 of 1

Project No: MC12684A

# Log of MW 18

Project: North Dundas Landfill - Boyne Rd.

Client: Township of North Dundas

Location: Winchester, ON

Logged by: Matt Prince

Trow

| Depth (ft / m) | Symbol | Description | Elev. | Sample Number | Sample Type | Recovery | Volatile Organic Compounds (ppmv, 25 75 125 175) | Well Data | Lab Analysis |
|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | | Ground Surface | 0 | | | | | | |
| 0 / 0 | | ***TOPSOIL*** Topsoil. | -0.3 | AU 1 | | | | | |
| 3 / 1 | | ***SILTY CLAY*** Medium brown, moist, silty fractured clay. | -1.2 | SS 2 | | | | | |
| 6 / 2 | | ***SILTY SAND*** Medium brown, dry, silty sand with some gravel till. | -3 | SS 3 | | | | | |
| 8 / 2 | | | | SS 4 | | | | | |
| 10 / 3 | | ***SILTY SANDY GRAVEL*** Medium grey, wet, silty sandy gravel till. Refusal at 11 feet. | -3.4 | SS 5 | | | | | |
| | | End of Borehole | | | | | | | |

Drill Method: Hollow Stem Auger

Drill Date: September 26, 2002

Hole Size: 0.15 metres

**Trow Consulting Engineers Ltd.**
154 Colonnade Road South
Nepean, Ontario K2E 7J5

Datum:

Checked by: B.Coons

Sheet: 1 of 1

Project No: MC12684A

# Log of MW 19

Project: North Dundas Landfill - Boyne Rd.

Client: Township of North Dundas

Location: Winchester, ON

Logged by: Matt Prince

Trow

| Depth (ft / m) | Symbol | Description | Elev. | Number | Type | Recovery | Volatile Organic Compounds ppmv (25 75 125 175) | Well Data | Lab Analysis |
|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | | Ground Surface | 0 | | | | | | |
| 0 / 0 | | ***TOPSOIL*** Topsoil. | -0.3 | AU 1 | | | | | |
| 3 / 1 | | | | SS 2 | | | | | |
| 5 / 1 | | ***SILTY CLAY*** Medium brown, dry, hard, silty clay with some gravel till. | | AU 3 | | | | | |
| 8 / 2 | | | | AU 4 | | | | | |
| 10 / 3 | | | -3 | | | | | | |
| 10 / 3 | | ***SILTY SAND*** Medium grey, dry, hard, silty sand with some gravel till. Refusal at 11'2". | -3.4 | SS 5 | | | | | |
| 13 / 4 | | End of Borehole | | | | | | | |

Drill Method: Hollow Stem Auger

Drill Date: September 26, 2002

Hole Size: 0.15 metres

**Trow Consulting Engineers Ltd.**
154 Colonnade Road South
Nepean, Ontario K2E 7J5

Datum:

Checked by: B.Coons

Sheet: 1 of 1

# Appendix D-2 Boyne Road Landfill Slope Stability Technical Memorandum

**Final Report**
**Dec 2022 / Rev Feb 2023**

GOLDER
MEMBER OF WSP

**TECHNICAL MEMORANDUM**

**DATE** January 28, 2022 **Project No.1648253**

**TO** Trish Edmond, P.Eng.
Golder Associates Ltd.

**FROM** Bridgit Bocage, P.Eng. **EMAIL Bridgit_Bocage@golder.com**
William Cavers, P.Eng. **William_Cavers@golder.com**

**INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN, BOYNE ROAD LANDFILL EXPANSION - GEOTECHNICAL ASSESSMENT**

This memorandum provides the results of the geotechnical assessment carried out considering the updated landfilling configuration for the proposed expansion of the Boyne Road Landfill site.

## 1.0 PROJECT DETAILS

The Boyne Road Landfill site is located on Boyne Road just east of Belanger Road in the Township of North Dundas, Ontario.

It is understood that the proposed expansion consists primarily of horizontal expansion on the south side of the existing footprint. The horizontal expansion adds an additional 3.8 hectares of footprint for a total landfill footprint of 11.9 hectares. The total expanded landfill capacity for waste, including the daily cover, will be about 1,060,750 $m^3$. The maximum elevation of the top of waste will be at about elevation 90.5 masl; a 0.75 thick final soil cover will be placed above the waste. This is approximately 15 m above the average ground surface elevation in the vicinity of the landfill expansion and approximately 2.5 m higher than the existing approved landfill.

The geometry of the proposed landfill side slopes are proposed to be 4H:1V or flatter and landfill top area slopes no steeper than 20H:1V.

An approximately 1 m thick pad of imported permeable fill material will be placed above the existing ground surface as a base layer for the waste disposal.

## 2.0 BOREHOLE INVESTIGATIONS

Several borehole investigations have been carried out at the site. Previous work included investigations carried out by Golder in 2006, 2007, 2014 to 2016, and geotechnical investigations carried out in 1991 by Olivier Mangione McCalla and Associates Ltd., in 1992 and 1993 by M.S. Thompson Associates Ltd., and in 2002 by Trow Associates Inc. The relevant boreholes within the footprint of the expansion are shown on the attached Site Plan

(Figure 2 - Site Plan from Golder Report titled, “2020 Groundwater and Subsurface Water Monitoring Program and Operations Monitoring, Boyce Road Landfill, Project No. 20139489”). The relevant borehole logs are appended following the text of this memorandum.

## 3.0 SLOPE STABILITY ASSESSMENT

In general, six main components are typically involved in assessing the stability of a slope:

1) The geometry of the slope;
2) The geology of the slope (i.e., the composition of the various soil layers within the slope and their depth, thickness, and orientation);
3) The groundwater conditions (the groundwater levels and the hydraulic gradient/flow conditions);
4) The strength parameters for the soils and waste;
5) The unit weights (i.e., densities) of the soils and waste within the slope; and,
6) External loading (i.e., surcharge, seismic forces).

Two overall cross-sections (denoted as A-A’ and B-B’) were used for analysis. The critical side of each cross section was modelled, resulting in consideration of a total of two analysis sections. The sections were developed based on the proposed new fill placement plans and considered the existing ground surface profile along with the overlying proposed fill surface.

The stability of the waste pile and side slopes was evaluated using the SLOPE/W computer program. The Morgernstern Price method, which satisfies both moment and force equilibrium, was used to compute a factor of safety. The factor of safety is defined as the ratio of the magnitude of the forces tending to resist failure to the magnitude of the forces tending to cause failure.

Theoretically, a slope with a factor of safety of less than 1.0 will undergo movement and one with a factor of safety of 1.0 or greater will not undergo movement. For analyses of the stability of slopes under static loading conditions, a factor of safety of greater than about 1.3 can be considered acceptable for this project and reflects inherent uncertainties related to waste material and subsurface variabilities, geometric imprecision, strain incompatibilities, and other risk factors.

The seismic loads imposed on a slope are modelled in a simplified manner by applying a horizontal “pseudo static” force to the soil mass. The “pseudo-static” force, $F_s$, is calculated as:

$$F_s = k_s \times M$$

Where: $k_s$ = horizontal seismic coefficient; and,

M = mass of soil contained within the failure surface.

A minimum factor of safety of 1.1 is recommended under seismic loading conditions.

The seismic slope stability evaluations were carried out assuming that the design earthquake would correspond to an event with a 2% probability of occurrence in 50 years (i.e., the 2,475-year design earthquake). Based on the methodology outlined in CHBDC (2014) and NBCC (2015), the Site Class was determined using representative average values of $N_{60}$. The average shear wave velocity in the upper 30 m at the site was calculated to be about 600 m/s, which corresponds to a Site Class C. The ground surface PGA is about 0.36 g. Therefore, a $k_h$ value of 0.18 g, equal to one-half the ground surface PGA, was used in the slope stability analyses.

## 3.1 Material Properties

The subsurface stratigraphy was inferred from subsurface information obtained previously by Golder and others.

The key material properties required to complete a stability analysis are the unit weight and shear strength of the materials. The shear strength of soil or waste is conventionally described using a Mohr-Coulomb criterion. This criterion describes the shear strength of a soil in terms of cohesive and frictional components. The magnitude of the frictional component depends on the stress acting perpendicular to the potential failure plane. From this criterion, the strength of a soil to resist shear stress (i.e., to resist sliding) is described by:

$$\tau = c' + \sigma' \tan \phi'$$

$\tau$ = Strength of the soil;

$c'$ = Effective cohesion of the soil;

$\sigma'$ = Effective normal stress (i.e., stress acting perpendicular to the shear plane); and,

$\phi'$ = Effective internal friction angle.

The groundwater level was set at the bottom of the landfill base layer in the slope stability analyses.

The material parameters adopted for the analysis are summarized in the table below. The unit weights of the soils and waste were estimated from our experience with similar materials. The value of the unit weight of the waste fill was 13 kN/m$^3$.

The strength parameters assigned to the soils were based on the results of the in-situ testing. The undrained shear strength of the clay soils, where encountered, was estimated based on the N-values shown on the borehole records since shear strength values were not obtained in any of the boreholes within the landfill footprint. The ranges provided below represent a summary of the values used in the analyses. The drained parameters for the clay were based on the work carried out by Lefebvre (1981) studying the strength characteristics of the clay in this region and their influence on slope stability.

| Material | Bulk Unit Weight ($kN/m^3$) | Drained Parameters | | Undrained Parameters |
|---|---|---|---|---|
| | | Effective Cohesion (kPa) | Effective Internal Friction Angle (°) | Cohesion (kPa) |
| Cover Layer | 19 | 0 | 32 | N/A |
| Waste Fill | 13 | 0 | 32 | N/A |
| Topsoil or Peat | 11.5 | 0 | 10 | N/A |
| Silty Clay (firm to stiff) | 16 | 7.4 | 28.7 | 50 |
| Glacial Till | 21 | 0 | 35 | N/A |
| Landfill Base Layer | 20.5 | 0 | 35 | N/A |

## 3.2 Slope Stability Analysis Results

Two overall cross sections (identified as A-A' and B-B') were analyzed. The locations of the cross-sections are shown on attached Figure 12-2 (Site Plan of Proposed Expansion taken from Section 12.0 of the EASR). The stability results are graphically shown on the attached Figures 1 to 6.

The following table indicates the global factors of safety obtained for both static and dynamic analyses for the proposed expanded landfill configuration as shown in Figure 12-3 dated November 2021.

| Section | Global Factor of Safety | | |
|---|---|---|---|
| | Static Drained | Static Undrained | Seismic |
| A-A' West | 1.9 | 1.8 | 1.1 |
| B-B' South | 2.7 | 2.6 | 1.5 |

The results of the stability assessment carried out based on the November 2021 fill plan, indicate that the factor of safety against deep-seated static instability of the analyzed sections is greater than 1.5; the proposed expansion configuration is therefore considered acceptable for static conditions.

The results of the seismic slope stability analyses carried out using a simple "pseudo-static" model where a horizontal force is applied to the failure mass to represent the seismic loading, indicate that the factor of safety against deep-seated instability would be 1.1, or greater, for all sections.

### 3.3 Settlement

Based on the existing subsurface conditions within the footprint of the landfill expansion, it is anticipated that settlements due to waste fill placement will be minimal. It should also be noted that there is no landfill infrastructure beneath the existing landfill that could be adversely affected by compression of subgrade soils under the weight of the waste.

## 4.0 CLOSURE

We trust this memorandum contains sufficient information for your present requirements.

Yours truly,

**GOLDER ASSOCIATES LTD.**

Bridgit Bocage, P.Eng.
*Geotechnical Engineer*

Sarah MacDonald P.Eng.
*Senior Geotechnical Engineer*

BB/WC/PAS/hdw
https://golderassociates.sharepoint.com/sites/117046/project files/6 deliverables/3 geotechnical/slope stability memo/1648253-tm-rev0-boyne rd landfill slope stability-2022 01 20.docx

**Attachments:**

- Figure 2 – Site Plan from Golder Report titled, “2020 Groundwater and Subsurface Water Monitoring Program and Operations Monitoring, Boyce Road Landfill, Project No. 20139489”
- Figure 12-2 – Site Plan of Proposed Expansion taken from Section 12.0 of the EASR
- Figure 12-3 – Cross-Sections of Proposed Expansion taken from Section 12.0 of the EASR
- Record of Borehole Sheets
- Figures 1 to 6 – SLOPE/W Output Sections

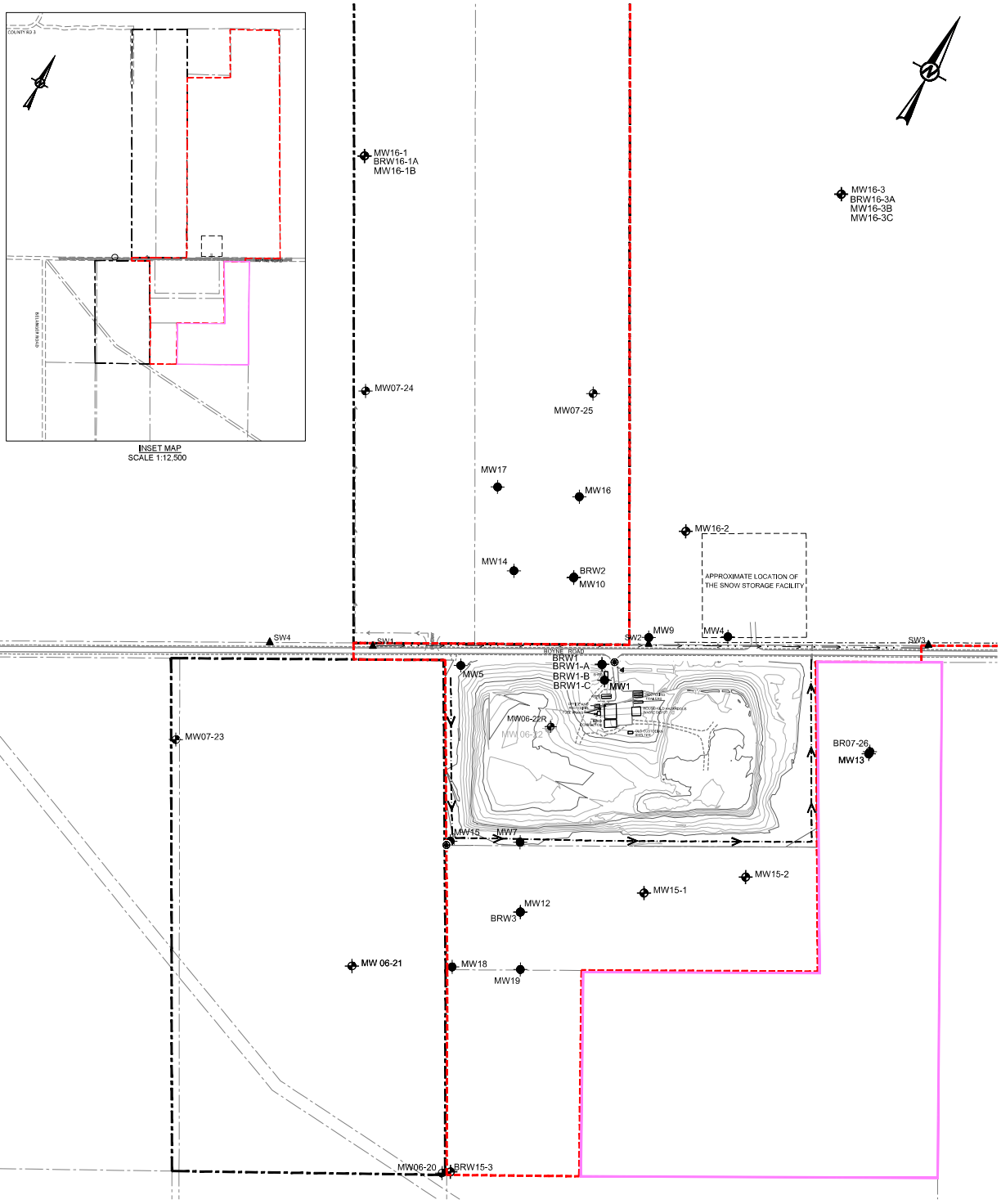
**References:**

Bray, J.D., Zekkos, D., Kavazanjian Jr., E., Athanasopoulos, G.A., Riemer, M.F. (2009). “Shear Strength of Municipal Solid Waste.” *Journal of Geotechnical and Geoenvironmental Engineering*, 135(6), 709-722.

Lefebvre, G. (1981). “Fourth Canadian Geotechnical Colloquium: Strength and slope stability in Canadian soft clay deposits.” *Canadian Geotechnical Journal*, 18(3), 420-442.

**ATTACHMENTS - FIGURES**

- Figure 2 – Site Plan
- Figure 12-2 – Site Plan of Proposed Expansion
- Figure 12-3 – Cross-Sections of Proposed Expansion




**LEGEND**

- DESTROYED MONITORING WELL NO LONGER IN USE
- APPROXIMATE BOREHOLE LOCATION IN PLAN, ESTABLISHED BY GOLDER ASSOCIATES LTD.
- APPROXIMATE BOREHOLE LOCATION IN PLAN, ESTABLISHED BY OTHERS
- APPROXIMATE SURFACE WATER SAMPLING LOCATION IN PLAN
- GEO-REFERENCING POINTS
- 85.0 GROUND SURFACE CONTOURS (M), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 AND 2020
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- APPROXIMATE BOUNDARY OF CONTAMINANT ATTENUATION ZONE
- ADDITIONAL LAND OWNED BY TOWNSHIP
- APPROXIMATE LOCATION OF PERIMETER DITCH AND INFERRED FLOW DIRECTION
- INFERRED FLOW DIRECTION IN THE DRAINAGE DITCH ALONG BOYNE ROAD

**NOTES**

1. ALL LOCATIONS ARE APPROXIMATE

**REFERENCE**

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND NOVEMBER 2019, APRIL 2020 AND DECEMBER 2020 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATE SYSTEM: MTM ZONE 9 NAD83

0 100 200
1:2,500 METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

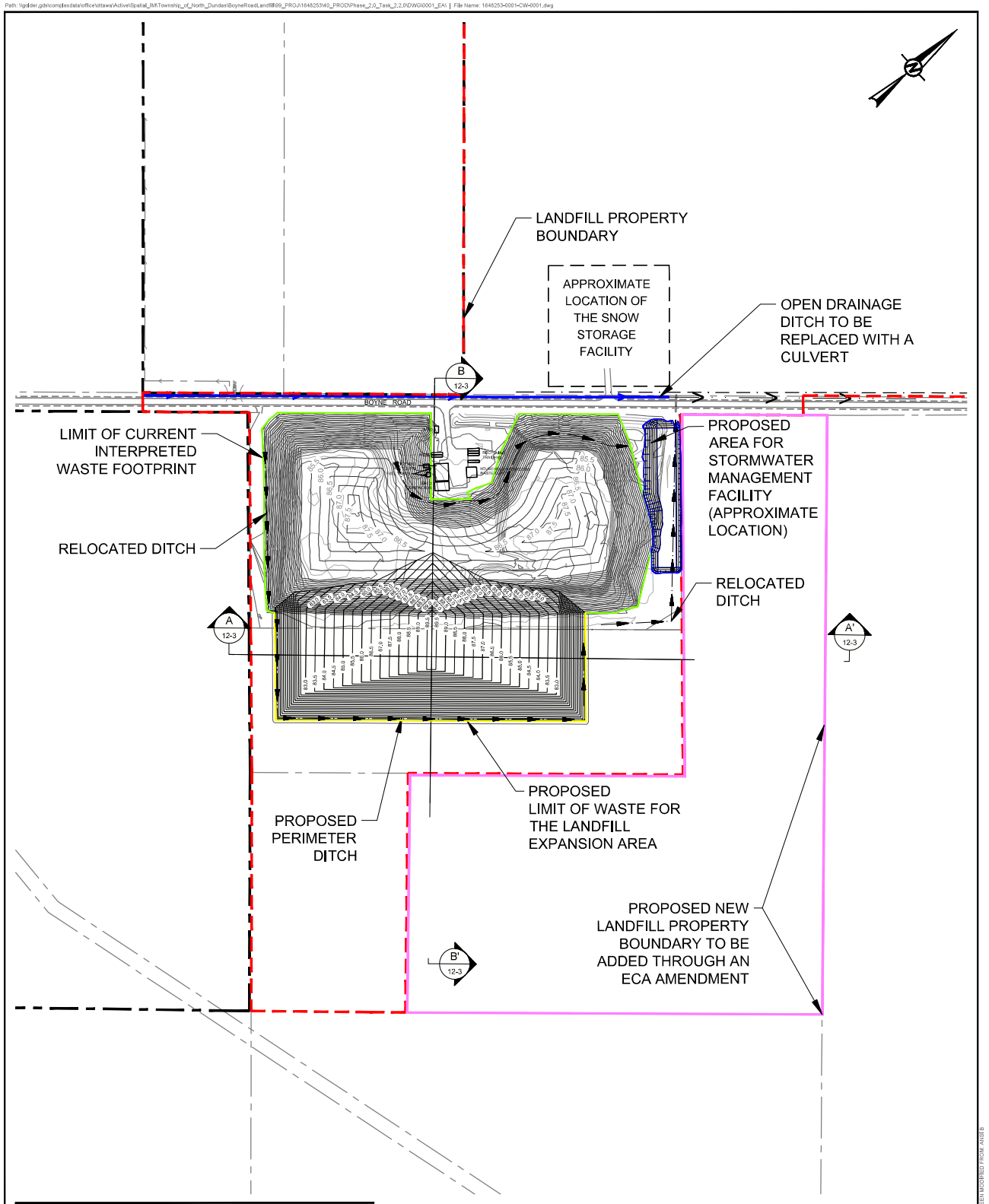
CONSULTANT
GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2021-01-07 |
| PREPARED | ABD |
| DESIGN | RM |
| REVIEW | PS |
| APPROVED | PAS |

PROJECT
2020 GROUNDWATER AND SURFACE WATER MONITORING PROGRAM AND OPERATIONS MONITORING BOYNE ROAD LANDFILL

TITLE
**SITE PLAN**

| PROJECT No. | CONTROL | Rev. | FIGURE |
|---|---|---|---|
| 20139489 | 0004 | A | 2 |




**LEGEND**

- 85,0 — GROUND SURFACE CONTOURS (MASL), BASED ON RESULTS OF THE SURVEYS CONDUCTED IN 2008, 2010, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 AND 2020
- 89,5 — PROPOSED EXPANSION TOP OF WASTE ELEVATION CONTOURS (MASL)
- APPROXIMATE PROPERTY BOUNDARY OF LANDFILL SITE
- APPROXIMATE BOUNDARY OF EXISTING CONTAMINANT ATTENUATION ZONE EASEMENT LANDS
- PROPOSED PERIMETER DITCH
- EXISTING ROADSIDE DITCH TO BE REPLACED WITH A CULVERT (APPROXIMATE LOCATION)
- PROPOSED NEW LANDFILL PROPERTY BOUNDARY TO BE ADDED THROUGH AN ECA AMENDMENT

**REFERENCE(S)**

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY STANTEC CONSULTING LTD.
2. 2008 AND 2010 SURVEYS COMPLETED BY STANTEC CONSULTING LTD.
3. MAY 2012, JULY 2013, NOVEMBER 2014, DECEMBER 2015, NOVEMBER 2016, DECEMBER 2017, DECEMBER 2018 AND NOVEMBER 2019, APRIL 2020 AND DECEMBER 2020 SURVEYS COMPLETED BY GOLDER ASSOCIATES LTD.
4. COORDINATES SYSTEM: MTM ZONE 9 NAD83 DATUM CGVD28

0 100 200
1:4,000 METRES

NOT FOR CONSTRUCTION

**DRAFT**

CLIENT
TOWNSHIP OF NORTH DUNDAS

CONSULTANT
GOLDER
MEMBER OF WSP

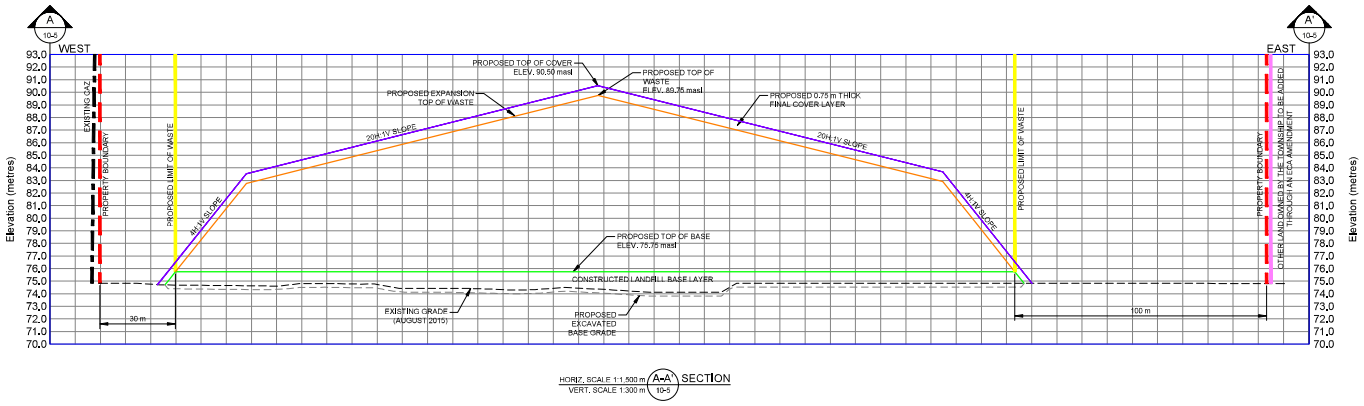
| | |
|---|---|
| YYYY-MM-DD | 2021-11-16 |
| DESIGNED | YJM |
| PREPARED | ABD |
| REVIEWED | PLE |
| APPROVED | PAS |

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

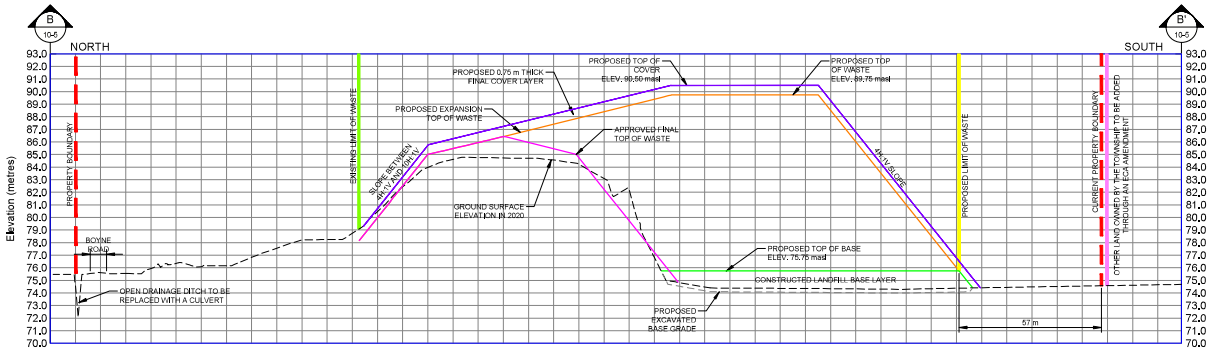
TITLE
**SITE PLAN OF PROPOSED EXPANSION**

| PROJECT NO. | PHASE/TASK | REV. | FIGURE |
|---|---|---|---|
| 1648253 | 2.0\2.2.0. | 0 | 12-2 |

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25 mm




HORIZ. SCALE 1:1,500 m
VERT. SCALE 1:300 m
A-A' 10-5 SECTION




HORIZ. SCALE 1:1,500 m
VERT. SCALE 1:300 m
B-B' 10-5 SECTION

NOT FOR CONSTRUCTION

**DRAFT**

0 25 50
1:1,500 HORIZONTAL SCALE METRES

0 5 10
1:300 VERTICAL SCALE METRES

CLIENT
TOWNSHIP OF NORTH DUNDAS

CONSULTANT
GOLDER

| | |
|---|---|
| YYYY-MM-DD | 2021-11-16 |
| DESIGNED | YJM |
| PREPARED | ABD |
| REVIEWED | PLE |
| APPROVED | PAS |

PROJECT
INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE
TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN

TITLE
**CROSS-SECTIONS OF PROPOSED EXPANSION**

| PROJECT NO. | PHASE/TASK | REV. | FIGURE |
|---|---|---|---|
| 1648253 | 2.0\2.2.0. | 0 | 12-3 |

**ATTACHMENTS**

- Record of Borehole Sheets

# LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures, and in the text of the report are as follows:

## I. SAMPLE TYPE

| | |
|---|---|
| AS | Auger sample |
| BS | Block sample |
| CS | Chunk sample |
| DO or DP | Seamless open-ended, driven or pushed tube samplers |
| DS | Denison type sample |
| FS | Foil sample |
| RC | Rock core |
| SC | Soil core |
| SS | Split spoon sampler |
| ST | Slotted tube |
| TO | Thin-walled, open |
| TP | Thin-walled, piston |
| WS | Wash sample |
| DT | Dual tube sample |
| DD | Diamond drilling |

## II. PENETRATION RESISTANCE

**Standard Penetration Resistance (SPT), N:**

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split spoon sampler for a distance of 300 mm (12 in.).

**Dynamic Cone Penetration Resistance (DCPT); $N_d$:**

The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive an uncased 50 mm (2 in.) diameter, $60^0$ cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

| | |
|---|---|
| **PH:** | Sampler advanced by hydraulic pressure |
| **PM:** | Sampler advanced by manual pressure |
| **WH:** | Sampler advanced by static weight of hammer |
| **WR:** | Sampler advanced by weight of sampler and rod |

**Cone Penetration Test (CPT):**

An electronic cone penetrometer with a $60^0$ conical tip and a projected end area of 10 $cm^2$ pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance ($q_t$), porewater pressure (u) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

## III. SOIL DESCRIPTION

**(a) Cohesionless Soils**

| **Density Index (Relative Density)** | **N** Blows/300 mm Or Blows/ft. |
|---|---|
| Very loose | 0 to 4 |
| Loose | 4 to 10 |
| Compact | 10 to 30 |
| Dense | 30 to 50 |
| Very dense | over 50 |

**(b) Cohesive Soils**

**$C_u$ or $S_u$**

| **Consistency** | kPa | Psf |
|---|---|---|
| Very soft | 0 to 12 | 0 to 250 |
| Soft | 12 to 25 | 250 to 500 |
| Firm | 25 to 50 | 500 to 1,000 |
| Stiff | 50 to 100 | 1,000 to 2,000 |
| Very stiff | 100 to 200 | 2,000 to 4,000 |
| Hard | Over 200 | Over 4,000 |

## IV. SOIL TESTS

| | |
|---|---|
| w | Water content |
| $w_p$ or PL | Plastic limited |
| $w_l$ or LL | Liquid limit |
| C | Consolidaiton (oedometer) test |
| CHEM | Chemical analysis (refer to text) |
| CID | Consolidated isotropically drained triaxial test[1] |
| CIU | Consolidated isotropically undrained triaxial test with porewater pressure measurement[1] |
| $D_R$ | Relative density |
| DS | Direct shear test |
| Gs | Specific gravity |
| M | Sieve analysis for particle size |
| MH | Combined sieve and hydrometer (H) analysis |
| MPC | Modified Proctor compaction test |
| SPC | Standard Proctor compaction test |
| OC | Organic content test |
| $SO_4$ | Concentration of water-soluble sulphates |
| UC | Unconfined compression test |
| UU | Unconsolidated undrained triaxial test |
| V | Field vane test (LV-laboratory vane test) |
| $\gamma$ | Unit weight |

Note: [1] Tests which are anisotropically consolidated prior shear are shown as CAD, CAU.

# LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

## I. GENERAL

| | |
|---|---|
| $\pi$ | 3.1416 |
| ln x | natural logarithm of x |
| $\log_{10}$ x or log x | logarithm of x to base 10 |
| g | acceleration due to gravity |
| t | time |
| FOS | factor of safety |
| V | volume |
| W | weight |

## II. STRESS AND STRAIN

| | |
|---|---|
| $\gamma$ | shear strain |
| $\Delta$ | change in, e.g. in stress: $\Delta \sigma'$ |
| $\varepsilon$ | linear strain |
| $\varepsilon_v$ | volumetric strain |
| $\eta$ | coefficient of viscosity |
| $\nu$ | Poisson's ratio |
| $\sigma$ | total stress |
| $\sigma'$ | effective stress ($\sigma' = \sigma - u$) |
| $\sigma'_{vo}$ | initial vertical effective overburden stress |
| $\sigma_1\sigma_2\sigma_3$ | principal stresses (major, intermediate, minor) |
| $\sigma_{oct}$ | mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3) / 3$ |
| $\tau$ | shear stress |
| u | porewater pressure |
| E | modulus of deformation |
| G | shear modulus of deformation |
| K | bulk modulus of compressibility |

## III. SOIL PROPERTIES

### (a) Index Properties

| | |
|---|---|
| $\rho(\gamma)$ | bulk density (bulk unit weight)* |
| $\rho_d(\gamma_d)$ | dry density (dry unit weight) |
| $\rho_w(\gamma_w)$ | density (unit weight) of water |
| $\rho_s(\gamma_s)$ | density (unit weight) of solid particles |
| $\gamma'$ | unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$) |
| $D_R$ | relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) formerly ($G_s$) |
| e | void ratio |
| n | porosity |
| S | degree of saturation |

* Density symbol is $\rho$. Unit weight symbol is $\gamma$ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

### (a) Index Properties (continued)

| | |
|---|---|
| w | water content |
| $w_1$ or LL | liquid limit |
| $w_p$ or PL | plastic limit |
| $I_p$ or PI | plasticity Index = $(w_1 - w_p)$ |
| $w_s$ | shrinkage limit |
| $I_L$ | liquidity index = $(w - w_p) / I_p$ |
| $I_c$ | consistency index = $(w_1 - w) / I_p$ |
| $e_{max}$ | void ratio in loosest state |
| $e_{min}$ | void ratio in densest state |
| $I_D$ | density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density) |

### (b) Hydraulic Properties

| | |
|---|---|
| h | hydraulic head or potential |
| q | rate of flow |
| v | velocity of flow |
| i | hydraulic gradient |
| k | hydraulic conductivity (coefficient of permeability) |
| j | seepage force per unit volume |

### (c) Consolidation (one-dimensional)

| | |
|---|---|
| $C_c$ | compression index (normally consolidated range) |
| $C_r$ | recompression index (overconsolidated range) |
| $C_s$ | swelling index |
| $C_\alpha$ | coefficient of secondary consolidation |
| $m_v$ | coefficient of volume change |
| $c_v$ | coefficient of consolidation (vertical direction) |
| $T_v$ | time factor (vertical direction) |
| U | degree of consolidation |
| $\sigma'_p$ | pre-consolidation stress |
| OCR | overconsolidation ratio = $\sigma'_p / \sigma'_{vo}$ |

### (d) Shear Strength

| | |
|---|---|
| $\tau_p$ or $\tau_r$ | peak and residual shear strength |
| $\phi'$ | effective angle of internal friction |
| $\delta$ | angle of interface friction |
| $\mu$ | coefficient of friction = tan $\delta$ |
| c' | effective cohesion |
| $c_u$ or $s_u$ | undrained shear strength ($\phi = 0$ analysis) |
| p | mean total stress $(\sigma_1 + \sigma_3) / 2$ |
| p' | mean effective stress $(\sigma'_1 + \sigma'_3) / 2$ |
| q | $(\sigma_1 - \sigma_3) / 2$ or $(\sigma'_1 - \sigma'_3) / 2$ |
| $q_u$ | compressive strength $(\sigma_1 - \sigma_3)$ |
| $S_t$ | sensitivity |

Notes:
[1] $\tau = c' + \sigma' \tan \phi'$
[2] shear strength = (compressive strength) / 2

# LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

## WEATHERING STATE

**Fresh**: no visible sign of rock material weathering
**Faintly Weathered**: weathering limited to the surface of major discontinuities.
**Slightly weathered**: penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.
**Moderately weathered:** weathering extends throughout the rock mass but the rock material is not friable
**Highly weathered:** weathering extends throughout rock mass and the rock material is partly friable.
**Completely weathered:** rock is wholly decomposed and in a friable condition but the rock texture and structure are preserved.

## BEDDING THICKNESS

| Description | Bedding Plane Spacing |
|---|---|
| Very Thickly Bedded | > 2 m |
| Thickly Bedded | 0.6 m to 2m |
| Medium Bedded | 0.2 m to 0.6 m |
| Thinly Bedded | 60 mm to 0.2 m |
| Very Thinly Bedded | 20 mm to 60 mm |
| Laminated | 6 mm to 20 mm |
| Thinly Laminated | < 6 mm |

## JOINT OR FOLIATION SPACING

| Description | Spacing |
|---|---|
| Very Wide | > 3 m |
| Wide | 1 – 3 m |
| Moderately Close | 0.3 – 1 m |
| Close | 50 – 300 mm |
| Very Close | < 50 mm |

## GRAIN SIZE

| Term | Size* |
|---|---|
| Very Coarse Grained | > 60 mm |
| Coarse Grained | 2 – 60 mm |
| Medium Grained | 60 microns – 2mm |
| Fine Grained | 2 – 60 microns |
| Very Fine Grained | < 2 microns |

Note: *Grains > 60 microns diameter are visible to the naked eye.

## CORE CONDITION

**Total Core Recovery**
The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

**Solid Core Recovery (SCR)**
The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

**Rock Quality Designation (RQD)**
The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varies from 0% for completely broken core 100% for core in solid sticks.

## DISCONTINUITY DATA

**Fracture Index**
A count of the number of discontinuities (physical separations) in the rock core, including naturally occurring fractures but not including mechanically induced breaks caused by drilling.

**Dip with Respect to (W.R.T.) Core Axis**
The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a $90^0$ angle is horizontal.

**Description and Notes**
An abbreviated description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature information concerning the nature of fracture surfaces and infillings are also noted.

**Abbreviations**

| | | | |
|---|---|---|---|
| BD - | Bedding | PY - | Pyrite |
| FO - | Foliation/Schistosity | Ca - | Calcite |
| CL - | Clean | PO - | Polished |
| SH - | Shear Plane/Zone | K - | Slickensided |
| VN - | Vein | SM - | Smooth |
| FLT - | Fault | RO - | Ridged/Rough |
| CO - | Contact | ST - | Stepped |
| JN - | Joint | PL - | Planar |
| FR - | Fracture | IR - | Irregular |
| MB - | Mechanical Break | UN - | Undulating |
| BR - | Broken Rock | CU - | Curved |
| BL - | Blast Induced | TCA - | To Core Axis |
| ll - | Parallel To | STR - | Stress Induced |
| OR - | Orthogonal | | |

PROJECT: 14-1125-0007/Boyne Road Landfill

# RECORD OF BOREHOLE: MW06-22R

SHEET 1 OF 1

LOCATION: N 4994479.6; E 474643.5 (UTM NAD83 Zone 18T)

BORING DATE: May 1, 2014

DATUM: Geodetic

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 82.96 | | | | | | | |
| 0 | Power Auger 200 mm Diam. (Hollow Stem) | Waste (FILL) | | 0.00 | | | | | | | |
| 2 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 6 | | | | | | | | | | | Bentonite Seal |
| 8 | | | | | | | | | | | |
| 10 | | | | | | | | | | | Silica Sand |
| | | Grey brown SILTY CLAY | | 71.99 10.97 | | | | | | | 32 mm Diam. PVC #10 Slot Screen |
| 12 | | | | | | | | | | | Cave in |
| | | End of Borehole | | 70.16 12.80 | | | | | | | |
| 14 | | | | | | | | | | | |
| 16 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 20 | | | | | | | | | | | |

DEPTH SCALE

1 : 100

Golder Associates

LOGGED: MIB

CHECKED: YJM

MIS-BHS 001 1411250007.GPJ GAL-MIS.GDT 11/07/14 JM

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: MW07-23

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 4, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) | SHEAR STRENGTH Cu, kPa (nat V. +, rem V ⊕; Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) | WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | GROUND SURFACE | | 74.97 | | | | | | | | | |
| | Power Auger 200mm diam. (Hollow Stem) | TOPSOIL | | 0.00 / 74.76 | | | | | | | | | |
| | | Very stiff grey brown SILTY CLAY (Weathered Crust) | | 0.21 / 73.90 | | | | | | | | | |
| 1 | | Brown SILTY CLAY, trace gravel | | 1.07 / 73.35 | 1 | 50 DO | 20 | | | | | | Bentonite Seal |
| | | Dense brown to grey sandy SILT, some grey clay, occasional sand seam (GLACIAL TILL) | | 1.62 | 2 | 50 DO | 35 | | | | | | Silica Sand |
| 2 | | | | | 3 | 50 DO | 39 | | | | | | 32mm Diam. PVC #10 Slot Screen |
| 3 | | | | | 4 | 50 DO | 32 | | | | | | |
| | | End of Borhole (Auger Refusal) | | 71.25 / 3.72 | | | | | | | | | WL in screen at Elev 72.56m on Sept. 25, 2007 |
| 4 | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: HLRF

MIS-BHS 001 061122127-3.GPJ GAL-MISS.GDT 3/25/08 MLF

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: MW07-24

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 4, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) | SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-4}$ $10^{-5}$ $10^{-6}$ $10^{-7}$) | WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80) | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 75.32 | | | | | | | | | |
| 0 | Power Auger 200mm Diam. (Hollow Stem) | Dark brown PEAT | | 0.00 | | | | | | | | | Bentonite Seal |
| | | | | 74.77 | | | | | | | | | |
| | | Grey brown SILTY CLAY (Weathered Crush) | | 0.55 | | | | | | | | | Native Backfill |
| 1 | | | | 74.25 | 1 | 50 DO | 13 | | | | | | |
| | | Compact grey brown CLAYEY SILT, trace gravel | | 1.07 | | | | | | | | | Bentonite Seal |
| | | | | 73.49 | 2 | 50 DO | 13 | | | | | | Silica Sand |
| 2 | | Brown grey SANDY SILT, some gravel, occasional cobbles | | 1.83 | | | | | | | | | |
| | | | | | 3 | 50 DO | 40 | | | | | | 38mm Diam. PVC #10 Slot Screen |
| 3 | | | | | 4 | 50 DO | 44 | | | | | | |
| | | | | 72.03 | | | | | | | | | |
| | | End of Borehole (Auger Refusal) | | 3.20 | | | | | | | | | WL in screen at Elev. 73.49m on Sept. 25, 2007 |
| 4 | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: HLRF

MIS-BHS 001 061122127-3.GPJ GAL-MISS.GDT 3/25/08 MLF

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: MW07-25

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: September 5, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 74.13 | | | | SHEAR STRENGTH Cu, kPa (20 40 60 80); nat V +, rem V ⊕; Q - ●, U - ○ | WATER CONTENT PERCENT Wp ⊢ W ⊣ Wl (20 40 60 80) | | |
| 0 | Power Auger 200mm Diam. (Hollow Stem) | Dark brown PEAT | | 0.00 / 73.58 | | | | | | | Bentonite Seal |
| 1 | | Grey brown SILTY CLAY (Weathered Crush) | | 0.55 | | | | | | | |
| 2 | | | | | 1 | 50 DO | 8 | | | | Native Backfill |
| | | | | 71.45 | 2 | 50 DO | 17 | | | | Bentonite Seal |
| 3 | | Compact to dense brown grey SANDY SILT, some gravel & clay, trace cobbles (GLACIAL TILL) | | 2.68 | | | | | | | Silica Sand |
| | | | | | 3 | 50 DO | 22 | | | | |
| 4 | | | | | 4 | 50 DO | 14 | | | | |
| | | | | | 5 | 50 DO | 90 | | | | 38mm Diam. PVC #10 Slot Screen |
| 5 | | | | | | | | | | | |
| 6 | | | | 67.88 | 6 | 50 DO | | | | | |
| | | End of Borehole (Auger Refusal) | | 6.25 | | | | | | | WL in screen at Elev. 72.71m on Sept. 25, 2007 |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: MLRF

MIS-BHS 001 061122127-3.GPJ GAL-MISS.GDT 3/25/08 MLF

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: BR07-26

SHEET 1 OF 1

LOCATION:

BORING DATE: September 7, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat V +, rem V ⊕, Q - ●, U - ○) | HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT (Wp, W, Wl) | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Power Auger 200mm Diam (Hollow Stem) | Ground Surface | | 74.67 | | | | | | | |
| | | Dark brown PEAT | | 0.00 | | | | | | | Bentonite Seal |
| 1 | | | | 73.63 | | | | | | | |
| | | Very stiff grey brown SILTY CLAY (Weathered Crush) | | 1.04 | 1 | 50 DO | 5 | | | | |
| 2 | | | | | 2 | 50 DO | 3 | | | | |
| 3 | | | | 71.62 | | | | | | | Native Backfill |
| | | Stiff grey SILTY CLAY | | 3.05 | 3 | 50 DO | 1 | | | | |
| 4 | | | | 70.71 | | | | | | | |
| | | Grey SANDY SILT, some gravel, occasional cobbles (GLACIAL TILL) | | 3.96 | 4 | 50 DO | DD | | | | |
| | Rotary Drill HQ Core | | | 69.82 | | | | | | | |
| 5 | | Slightly weathered grey LIMESTONE BEDROCK, with shale interbeded, and thin mud seam | | 4.85 | 5 | NQ RC | | T.C.R. (%) 100; S.C.R. (%) 98; R.Q.D. (%) 66 | | | Bentonite Seal |
| 6 | | | | | 6 | NQ RC | | T.C.R. (%) 98; S.C.R. (%) 83; R.Q.D. (%) 69 | | | Silica Sand |
| 7 | | | | 67.14 | 7 | NQ RC | | T.C.R. (%) 100; S.C.R. (%) 90; R.Q.D. (%) 71 | | | 32mm Diam. PVC #10 Slot Screen |
| | | Fresh grey LIMESTONE BEDROCK, with shale interbed | | 7.53 | | | | | | | |
| 8 | | | | | 8 | NQ RC | | T.C.R. (%) 100; S.C.R. (%) 97; R.Q.D. (%) 75 | | | |
| 9 | | | | 65.53 | | | | | | | |
| | | End of Borehole | | 9.14 | | | | | | | WL in screen at Elev. 73.29m on Sept. 25, 2007 |
| 10 | | | | | | | | | | | |

BOREHOLE 061122127-3.GPJ HYDROGEO.GDT 3/26/08

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D J S

CHECKED: HLRF

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: BRW1

SHEET 1 OF 3

LOCATION: See Site Plan

BORING DATE: September 7, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V +, rem V ⊕; 20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl; 20 40 60 80) | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | GROUND SURFACE | | 75.54 | | | | | | | |
| | | (Note: Stratigaphy from BRW-1, June 1992)<br>SILTY CLAY | | 0.00 | | | | | | | Concrete |
| 1 | | | | | | | | | | | |
| 2 | | | | 73.54 | | | | | | | |
| | | Glacial Till | | 2.00 | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 5 | | | | | | | | | | | |
| | | | | | | | | | | | Bentonite Seal |
| 6 | | | | | | | | | | | |
| 7 | | | | 68.14 | | | | | | | |
| | | Linestone Bedrock | | 7.40 | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| | | | | | | | | | | | Silica Sand |
| | | | | | | | | | | | 32mm Diam. PVC #10 Slot Screen C |
| 10 | | *CONTINUED NEXT PAGE* | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: HLLF

MIS-BHS 001 061122127-3.GPJ GAL-MISS.GDT 3/25/08 MLF

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: BRW1

SHEET 2 OF 3

LOCATION: See Site Plan

BORING DATE: September 7, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕; Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | | --- CONTINUED FROM PREVIOUS PAGE --- | | | | | | | | | |
| | | Linestone Bedrock | | | | | | | | | 32mm Diam. PVC #10 Slot Screen C |
| 11 | | | | | | | | | | | |
| 12 | | | | | | | | | | | Silica Sand |
| 13 | | | | | | | | | | | |
| 14 | | | | | | | | | | | Bentonite Seal |
| 15 | | | | | | | | | | | Silica Sand |
| 16 | | | | | | | | | | | |
| 17 | | | | | | | | | | | 32mm Diam. PVC #10 Slot Screen B |
| 18 | | | | | | | | | | | |
| 19 | | | | | | | | | | | Silica Sand |
| | | | | | | | | | | | Bentonite Seal |
| 20 | | CONTINUED NEXT PAGE | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: HLRF

MIS-BHS 001 061122127-3.GPJ GAL-MISS.GDT 3/25/08 MLF

PROJECT: 06-1122-127-3

# RECORD OF BOREHOLE: BRW1

SHEET 3 OF 3

LOCATION: See Site Plan

BORING DATE: September 7, 2007

DATUM: Local

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp — W — Wl) | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 20 | | — CONTINUED FROM PREVIOUS PAGE — | | | | | | 20 40 60 80 | 20 40 60 80 | | |
| | | Limestone Bedrock | | | | | | | | | Bentonite Seal |
| 21 | | | | | | | | | | | |
| | | | | | | | | | | | Silica Sand |
| 22 | | | | | | | | | | | |
| 23 | | | | | | | | | | | |
| | | | | | | | | | | | 32mm Diam. PVC #10 Slot Screen A |
| 24 | | | | | | | | | | | |
| | | | | 50.54 | | | | | | | |
| 25 | | End of Hole | | 25.00 | | | | | | | |
| | | | | | | | | | | | WL in screen A at Elev. 72.99m on Sept. 25, 2007 |
| 26 | | | | | | | | | | | |
| | | | | | | | | | | | WL in screen B at Elev. 72.99m on Sept. 25, 2007 |
| 27 | | | | | | | | | | | |
| | | | | | | | | | | | WL in screen C at Elev. 73.02m on Sept. 25, 2007 |
| 28 | | | | | | | | | | | |
| 29 | | | | | | | | | | | |
| 30 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: HLRF

MIS-BHS 001 061122127-3.GPJ GAL-MISS.GDT 3/25/08 MLF

PROJECT: 06-1122-127-6200

# RECORD OF MONITORING WELL: MW 06-20

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Nov 23, 2006

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0 3m (20 40 60 80) | SHEAR STRENGTH Cu, kPa (nat V +, rem V ⊕; Q -, U -) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) | WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 75.64 | | | | | | | | | |
| 0 | Power Auger 200mm Diam (Hollow Stem) | TOPSOIL | | 0.00 / 75.40 | | | | | | | | | |
| 1 | | Very stiff grey brown SILTY CLAY (Weathered Crust) | | 0.24 / 74.16 | | | | | | | | | Protective casing set in Bentonite Seal |
| 2 | | Compact grey SANDY SILT, some gravel, trace clay, occasional silty sand and silt seam or layer (GLACIAL TILL) | | 1.40 | 1 | SS DO | 21 | | | | | | 38mm Diam PVC #10 Slot Screen |
| 3 | | | | | | | | | | | | | |
| 4 | | | | | 2 | SS DO | 28 | | | | | | |
| | | End of Borehole Auger Refusal | | 4.27 / 71.37 | | | | | | | | | |
| 5 | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | |

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: D.J.S.
CHECKED: HLRF

MIS-BHS 001 0611221127-6200.GPJ GAL-MISS.GDT 3/25/08

PROJECT: 06-1122-127-6200

# RECORD OF MONITORING WELL: MW 06-21

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Nov. 23, 2006

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$); WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 74.93 | | | | | | | |
| 0 | Power Auger 200mm Diam (Hollow Stem) | TOPSOIL | | 0.00 / 74.72 | | | | | | | |
| | | Grey brown SILTY CLAY (Weathered Crust) | | 0.21 / 74.32 | | | | | | | |
| | | Grey brown SANDY SILT, some gravel, trace clay, occasional cobble (GLACIAL TILL) | | 0.61 | | | | | | | Protective casing set in Bentonite Seal |
| 1 | | | | | 1 | 50 DO | 07 | | | | |
| 2 | | | | 72.49 | | | | | | | |
| | | Compact grey SILTY SAND, some gravel, occasional fine to coarse sand layer (GLACIAL TILL) | | 2.44 | | | | | | | 38mm Diam PVC #10 Slot Screen |
| 3 | | | | | 2 | 50 DO | 26 | | | | |
| | | | | 71.27 | | | | | | | |
| | | Grey SANDY SILT, some gravel and clay (GLACIAL TILL) | | 3.66 / 70.88 | | | | | | | |
| 4 | | End of Borehole Auger Refusal | | 4.05 | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S.

CHECKED: HLRF

MIS-BHS 001 061122127-6200.GPJ GAL-MISS.GDT 3/25/08

PROJECT: 06-1122-127-6200

# RECORD OF MONITORING WELL: MW 06-22

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: Nov 23, 2006

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V +, rem V ⊕, Q - ●, U - ○) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-4}$ $10^{-5}$ $10^{-6}$ $10^{-7}$) / WATER CONTENT PERCENT (Wp, W, Wl) | ADDITIONAL LAB TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Power Auger 200mm Diam (Hollow Stem) | GROUND SURFACE | | 82.10 | | | | | | | |
| | | GARBAGE (FILL) | | 0.00 | | | | | | | Protective casing set in Bentonite Seal |
| 1 | | | | | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | Caved Material |
| 5 | | | | | | | | | | | Silica Sand |
| 6 | | | | | 1 | 50 DO | 10 | | | | 38mm Diam PVC #10 Slot Screen |
| 7 | | | | | 2 | 50 DO | 5 | | | | |
| | | | | 74.48 | | | | | | | |
| | | PEAT | | 7.62 | | | | | | | |
| | | Grey brown SILTY CLAY | | 7.77 | 3 | 50 DO | 10 | | | | |
| 8 | | | | 74.02 | | | | | | | Bentonite Seal |
| | | Grey brown SANDY SILT | | 8.08 | | | | | | | |
| | | End of Borehole | | 8.23 | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: D.J.S

CHECKED: MLRF

MIS-BHS 001 061122127-6200.GPJ GAL-MISS.GDT 3/25/08

PROJECT: 1416664-6000

# RECORD OF BOREHOLE: 15-1

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: July 23, 2015

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 74.40 | | | | | | | |
| 0 | Power Auger 200 mm Diam. (Hollow Stem) | TOPSOIL | | 0.00<br>74.05 | | | | | | | |
| | | (CL/ML) CLAYEY SILT, low to medium plasticity; brown; cohesive, w>PL, very stiff | | 0.35<br>73.49 | 1 | AS | - | | | | Bentonite Seal |
| 1 | | (ML) sandy SILT, some low plasticity fines, some gravel, subrounded; grey brown (GLACIAL TILL); wet, compact | | 0.91<br>72.72 | 2 | SS | >50 | | | | Silica Sand<br>50 mm Diam. PVC #10 Slot Screen |
| | | End of Borehole<br>Auger Refusal | | 1.68 | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: PAH
CHECKED: MIB

MIS-BHS 001 1416664-6000.GPJ GAL-MIS.GDT 12/14/15 JM

PROJECT: 1416664-6000

# RECORD OF BOREHOLE: 15-2

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: July 23, 2015

DATUM: Geodetic

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | GROUND SURFACE | | 74.68 | | | | | | | |
| | Power Auger 200 mm Diam. (Hollow Stem) | TOPSOIL | | 0.00<br>74.47 | | | | | | | |
| | | (CL/ML) CLAYEY SILT, trace gravel and low plasticity fines; grey brown; cohesive, w~PL, very stiff | | 0.21 | 1 | AS | - | | | | Bentonite Seal<br>Silica Sand<br>50 mm Diam. PVC #10 Slot Screen |
| 1 | | | | 73.28 | | | | | | | |
| | | End of Borehole<br>Auger Refusal | | 1.40 | | | | | | | |
| 2 | | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | | | | | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: PAH

CHECKED: MIB

MIS-BHS 001 1416664-6000.GPJ GAL-MIS.GDT 12/14/15 JM

PROJECT: 1416664-6000

# RECORD OF BOREHOLE: 15-3

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: July 21, 2015

DATUM: Geodetic

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp — W — Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 75.41 | | | | | | | |
| 0 | Power Auger 200 mm Diam. (Hollow Stem) | TOPSOIL | | 0.00<br>75.16 | | | | | | | |
| | | (CI/CH) SILTY CLAY, trace sand; grey brown, fissured (WEATHERED CRUST); cohesive, w~PL, very stiff | | 0.25 | | | | | | | Bentonite Seal |
| 1 | | | | | | | | | | | Silica Sand |
| | | | | 73.89 | | | | | | | |
| | | GLACIAL TILL | | 1.52 | | | | | | | |
| 2 | | | | | | | | | | | Bentonite Seal |
| 3 | | | | | | | | | | | Native Backfill |
| | | | | 71.45 | | | | | | | |
| 4 | | Fresh, grey LIMESTONE | | 3.96 | | | | | | | |
| | | Borehole continued on RECORD OF DRILLHOLE 15-3 | | 4.09 | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: PAH

CHECKED: MIB

MIS-BHS 001 1416664-6000.GPJ GAL-MIS.GDT 12/14/15 JM

PROJECT: 1416664-6000

# RECORD OF DRILLHOLE: 15-3

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: July 21, 2015

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME 55

DRILLING CONTRACTOR: Downing Drilling

JN - Joint; FLT - Fault; SHR - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; Ro - Rough; MB - Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. / DEPTH (m) | RUN No. | COLOUR / % RETURN / FLUSH | RECOVERY: TOTAL CORE % | RECOVERY: SOLID CORE % | R.Q.D. % | FRACT. INDEX PER 0.25 m | DISCONTINUITY DATA: B Angle | DISCONTINUITY DATA: DIP w.r.t. CORE AXIS | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION | Jcon | Jr | Ja | HYDRAULIC CONDUCTIVITY K, cm/sec | Diametral Point Load Index (MPa) | RMC -Q' AVG. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BEDROCK SURFACE | | 71.32 | | | | | | | | | | | | | | | | |
| | Rotary Drill NQ Core | Fresh, grey LIMESTONE | | 4.09 | 1 | 100 | | | | | | | | | | | | | | Bentonite Seal |
| 5 | | - Lost core from 4.87 m to 5.03 m | | | 2 | 90 | | | | | | | | | | | | | | Silica Sand |
| | | - Lost core from 5.49 m to 5.53 m | | | | | | | | | | | | | | | | | | |
| | | - Lost core from 5.69 m to 5.74 m | | | | | | | | | | | | | | | | | | |
| 6 | | | | | 3 | 90 | | | | | | | | | | | | | | 32 mm Diam. PVC #10 Slot Screen |
| 7 | | - Lost core from 6.96 m to 7.01 m | | | | | | | | | | | | | | | | | | |
| | | | | | 4 | 90 | | | | | | | | | | | | | | |
| 8 | | | | 67.33 | | | | | | | | | | | | | | | | |
| | | End of Drillhole | | 8.08 | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE
1 : 50

LOGGED: PAH
CHECKED: MIB

Golder Associates

MIS-RCK 004 1416664-6000.GPJ GAL-MISS.GDT 12/14/15 JM

PROJECT: 1650505

# RECORD OF BOREHOLE: 16-1

SHEET 1 OF 2

LOCATION: See Site Plan

BORING DATE: December 8, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp W Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 74.71 | | | | | | | |
| 0 | Power Auger 200 mm Diam. (Hollow Stem) | (PT) sandy SILT, some organics; dark brown (PEAT); non-cohesive, moist, very loose | | 0.00 | 1 | SS | 1 | | | | |
| 1 | | | | 73.41 | | | | | | | |
| | | (CL/MC) CLAYEY SILT to SILTY CLAY, trace gravel; grey brown (WEATHERED CRUST); cohesive, very stiff | | 1.30 | 2 | SS | 5 | | | | Bentonite Seal |
| 2 | | | | 72.60 | | | | | | | |
| | | (CL/MC) CLAYEY SILT to SILTY CLAY; trace gravel; grey; cohesive, very stiff | | 2.11 | | | | | | | |
| 3 | | | | | 3 | SS | 4 | | | | Silica Sand |
| 4 | | | | 69.99 | | | | | | | |
| | | (ML) sandy SILT, some gravel, trace clay; grey (GLACIAL TILL); non-cohesive, wet, compact to very dense | | 4.72 | 4 | SS | 2 | | | | 32 mm Diam. PVC #10 Slot Screen 'B' |
| 5 | | | | | | | | | | | |
| 6 | | | | | 5 | SS | >50 | | | | |
| | | | | 67.93 | | | | | | | Bentonite Seal |
| | | Borehole continued on RECORD OF DRILLHOLE 16-1 | | 6.78 | | | | | | | |
| 7 | | | | | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JD

CHECKED: MIB

MIS-BHS 001 1650505-8000.GPJ GAL-MIS.GDT 03/23/17 JM

PROJECT: 1650505

# RECORD OF DRILLHOLE: 16-1

SHEET 2 OF 2

LOCATION: See Site Plan

DRILLING DATE: December 8, 2016

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME

DRILLING CONTRACTOR: Downing Drilling

JN - Joint; FLT - Fault; SHR - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; Ro - Rough; MB - Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. / DEPTH (m) | RUN No. | COLOUR / % RETURN / FLUSH | RECOVERY: TOTAL CORE % | RECOVERY: SOLID CORE % | R.Q.D. % | FRACT. INDEX PER 0.25 m | DISCONTINUITY DATA: B Angle | DISCONTINUITY DATA: DIP w.r.t. CORE AXIS | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION | Jcon | Jr | Ja | HYDRAULIC CONDUCTIVITY K, cm/sec | Diametral Point Load Index (MPa) | RMC -Q' AVG. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BEDROCK SURFACE | | 67.93 | | | | | | | | | | | | | | | | |
| 7 | Rotary Drill / NQ Core | Slightly weathered to weathered, highly fractured, grey LIMESTONE, with shale interbedded | | 6.78 | 1 | 20 | | | | | | | | | | | | | | Bentonite Seal |
| 8 | | | | | 2 | 20 | | | | | | | | | | | | | | 32 mm Diam. PVC #10 Slot Screen 'A' |
| | | | | 65.95 | | | | | | | | | | | | | | | | Cave |
| | | End of Drillhole | | 8.76 | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JD

CHECKED: MIB

MIS-RCK 004 1650505-8000.GPJ GAL-MISS.GDT 03/23/17 JM

PROJECT: 1650505

# RECORD OF BOREHOLE: 16-2

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: December 8, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | GROUND SURFACE | | 74.72 | | | | | | | |
| 0 | Power Auger 200 mm Diam. (Hollow Stem) | (PT) sandy SILT, trace organics; dark brown (PEAT); non-cohesive, moist, very loose | | 0.00 | 1 | SS | 1 | | | | |
| 1 | | | | | 2 | SS | 1 | | | | Native Backfill |
| | | | | 72.89 | 3 | SS | 1 | | | | |
| 2 | | (CL/MC) CLAYEY SILT to SILTY CLAY, trace gravel; grey brown; cohesive, very stiff | | 1.83 | 4 | SS | 5 | | | | Bentonite Seal |
| 3 | | | | | 5 | SS | 2 | | | | Silica Sand |
| 4 | | | | | 6 | SS | 3 | | | | |
| 5 | | | | | 7 | SS | 1 | | | | 32 mm Diam. PVC #10 Slot Screen |
| 6 | | | | | 8 | SS | 2 | | | | |
| | | | | 68.62 | | | | | | | |
| 6 | | (ML) sandy SILT, some gravel; grey (GLACIAL TILL); non-cohesive, wet, compact | | 6.10 | 9 | SS | 22 | | | | |
| | | | | 68.01 | | | | | | | |
| 7 | | End of Borehole Auger Refusal | | 6.71 | | | | | | | |
| 8 | | | | | | | | | | | |
| 9 | | | | | | | | | | | |
| 10 | | | | | | | | | | | |

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JD

CHECKED: MIB

MIS-BHS 001 1650505-8000.GPJ GAL-MIS.GDT 03/23/17 JM

PROJECT: 1650505

# RECORD OF BOREHOLE: 16-3

SHEET 1 OF 3

LOCATION: See Site Plan

BORING DATE: December 8, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GROUND SURFACE | | 75.05 | | | | | | | |
| 0 | Power Auger 200 mm Diam. (Hollow Stem) | (PT) sandy SILT, some organics; dark brown (PEAT); non-cohesive, moist, very loose | | 0.00 | 1 | SS | 1 | | | | Bentonite Seal |
| 1 | | | | | 2 | SS | WH | | | | |
| | | | | 73.53 | | | | | | | |
| | | (CL/MC) CLAYEY SILT to SILTY CLAY, trace gravel; grey brown (WEATHERED CRUST); cohesive, very stiff | | 1.52 | 3 | SS | 1 | | | | Silica Sand |
| 2 | | | | | 4 | SS | 4 | | | | 32 mm Diam. PVC #10 Slot Screen 'C' |
| | | | | 72.00 | | | | | | | |
| 3 | | (CL/MC) CLAYEY SILT to SILTY CLAY; grey; cohesive, stiff | | 3.05 | 5 | SS | WH | | | | Silica Sand |
| 4 | | | | | 6 | SS | WH | | | | |
| | | | | | 7 | SS | WH | | | | |
| 5 | | | | | 8 | SS | WH | | | | Bentonite Seal |
| 6 | | | | | 9 | SS | 1 | | | | |
| 7 | | | | | 10 | SS | 9 | | | | |
| | | | | 67.73 | | | | | | | |
| | | (SP) gravelly SAND, some silt; reddish grey; non-cohesive, wet, loose | | 7.32 | 11 | SS | 3 | | | | Silica Sand |
| 8 | | | | | 12 | SS | 9 | | | | 32 mm Diam. PVC #10 Slot Screen 'B' |
| | | | | 65.88 | | | | | | | |
| 9 | | (ML) sandy SILT, some gravel, trace clay; grey (GLACIAL TILL); non-cohesive, wet, compact to very dense | | 9.17 | 13 | SS | 22 | | | | Silica Sand |
| | | | | | 14 | SS | 28 | | | | Bentonite Seal |
| 10 | | *CONTINUED NEXT PAGE* | | | | | | | | | |

DEPTH SCALE

1 : 50

LOGGED: JD

CHECKED: MIB

Golder Associates

MIS-BHS 001 1650505-8000.GPJ GAL-MIS.GDT 03/23/17 JM

PROJECT: 1650505

# RECORD OF BOREHOLE: 16-3

SHEET 2 OF 3

LOCATION: See Site Plan

BORING DATE: December 8, 2016

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

| DEPTH SCALE METRES | BORING METHOD | SOIL PROFILE: DESCRIPTION | STRATA PLOT | ELEV. / DEPTH (m) | SAMPLES: NUMBER | TYPE | BLOWS/0.30m | DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80) | HYDRAULIC CONDUCTIVITY, k, cm/s ($10^{-6}$ $10^{-5}$ $10^{-4}$ $10^{-3}$) / WATER CONTENT PERCENT (Wp, W, Wl) (20 40 60 80) | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *--- CONTINUED FROM PREVIOUS PAGE ---* | | | | | | | | | |
| 10 | Power Auger | (ML) sandy SILT, some gravel, trace clay; grey (GLACIAL TILL); non-cohesive, wet, compact to very dense | | | 14 | SS | 28 | | | | |
| 11 | Wash Boring / NW Casing | | | | 15 | SS | 64 | | | | Bentonite Seal |
| | | | | 63.47 | 16 | SS | >50 | | | | |
| | | Borehole continued on RECORD OF DRILLHOLE 16-3 | | 11.58 | | | | | | | |
| 12 | | | | | | | | | | | |
| 13 | | | | | | | | | | | |
| 14 | | | | | | | | | | | |
| 15 | | | | | | | | | | | |
| 16 | | | | | | | | | | | |
| 17 | | | | | | | | | | | |
| 18 | | | | | | | | | | | |
| 19 | | | | | | | | | | | |
| 20 | | | | | | | | | | | |

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: JD
CHECKED: MIB

MIS-BHS 001 1650505-8000.GPJ GAL-MIS.GDT 03/23/17 JM

PROJECT: 1650505

# RECORD OF DRILLHOLE: 16-3

SHEET 3 OF 3

LOCATION: See Site Plan

DRILLING DATE: December 8, 2016

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: —

DRILL RIG: CME

DRILLING CONTRACTOR: Downing Drilling

JN - Joint; FLT - Fault; SHR - Shear; VN - Vein; CJ - Conjugate
BD - Bedding; FO - Foliation; CO - Contact; OR - Orthogonal; CL - Cleavage
PL - Planar; CU - Curved; UN - Undulating; ST - Stepped; IR - Irregular
PO - Polished; K - Slickensided; SM - Smooth; Ro - Rough; MB - Mechanical Break
BR - Broken Rock
NOTE: For additional abbreviations refer to list of abbreviations & symbols.

| DEPTH SCALE METRES | DRILLING RECORD | DESCRIPTION | SYMBOLIC LOG | ELEV. / DEPTH (m) | RUN No. | COLOUR / % RETURN / FLUSH | RECOVERY: TOTAL CORE % | RECOVERY: SOLID CORE % | R.Q.D. % | FRACT. INDEX PER 0.25 m | DISCONTINUITY DATA: B Angle | DISCONTINUITY DATA: DIP w.r.t. CORE AXIS | DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION | Jcon | Jr | Ja | HYDRAULIC CONDUCTIVITY K, cm/sec | Diametral Point Load Index (MPa) | RMC -Q' AVG. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BEDROCK SURFACE | | 63.47 | | | | | | | | | | | | | | | | |
| 12 | WB NW Rotary Drill NQ Core | Slightly weathered to weathered, highly fractured, grey LIMESTONE, with shale interbedded | | 11.58 | 1 | 20 | | | | | | | | | | | | | | Bentonite Seal; Silica Sand |
| 13 | | | | | 2 | 20 | | | | | | | | | | | | | | 32 mm Diam. PVC #10 Slot Screen 'A' |
| 14 | | | | 61.05 | 3 | 20 | | | | | | | | | | | | | | Silica Sand |
| | | End of Drillhole | | 14.00 | | | | | | | | | | | | | | | | |

DEPTH SCALE

1 : 50

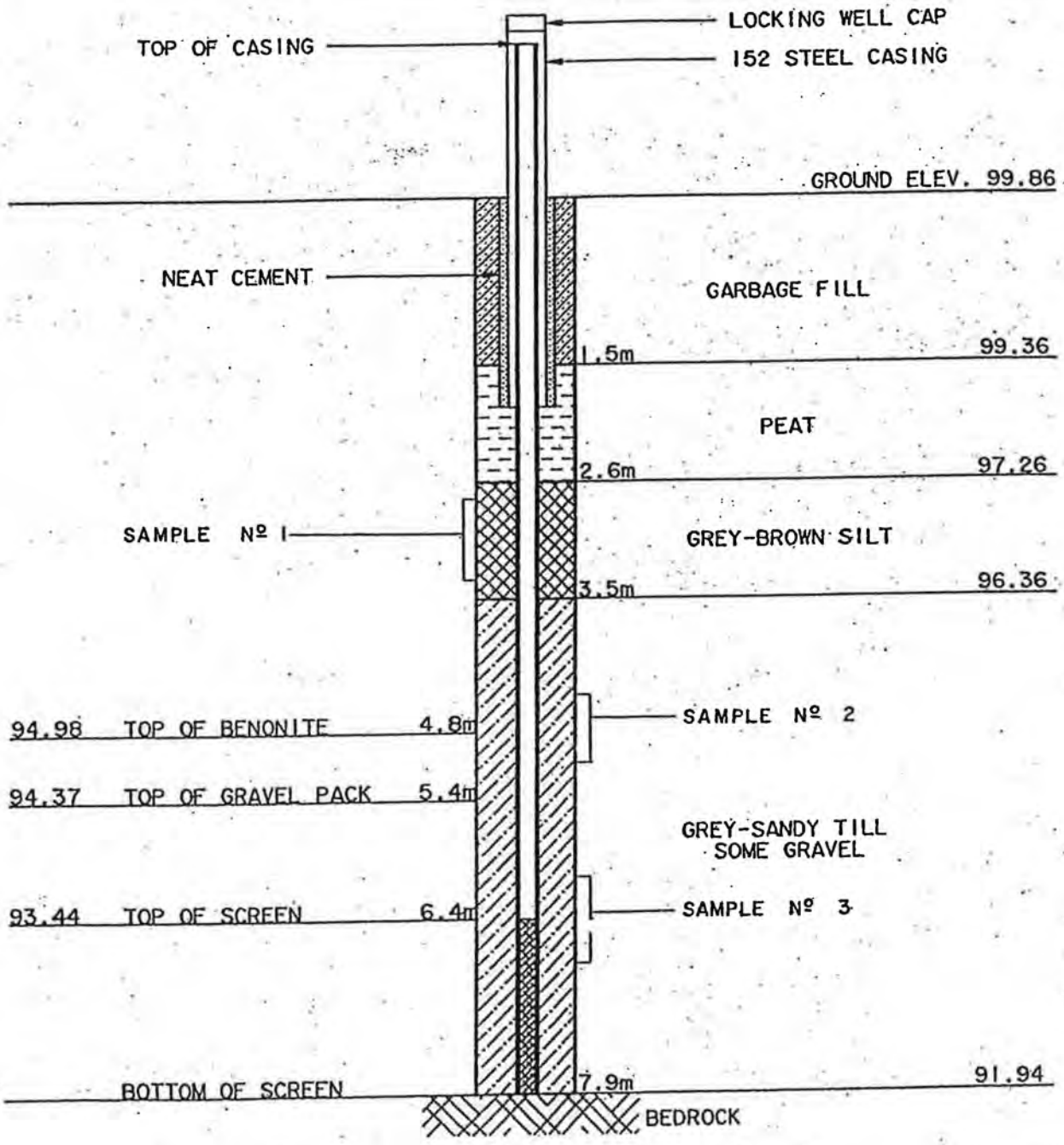
LOGGED: JD

CHECKED: MIB

Golder Associates

MIS-RCK 004 1650505-8000.GPJ GAL-MISS.GDT 03/23/17 JM

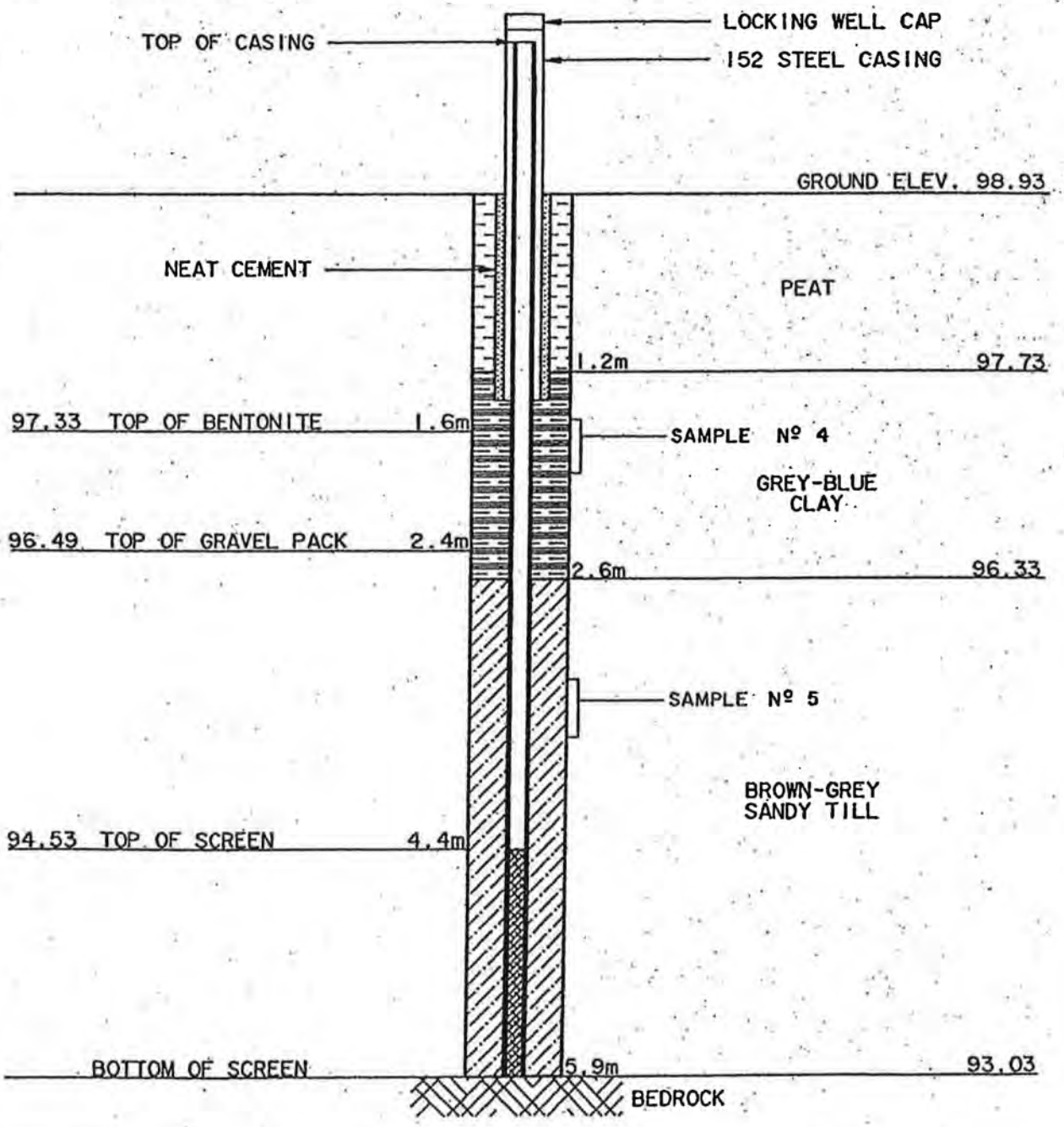
# MONITORING WELL #1 BOREHOLE LOG




OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Nepean, Ontario

| | | |
|---|---|---|
| DATE: MARCH. 1991 | CLIENT: TOWNSHIP OF WINCHESTER LANDFILL | DRAWING NO. 90-7848 |
| SCALE: N.T.S. | TITLE: MONITORING WELL INSTALLATION | |

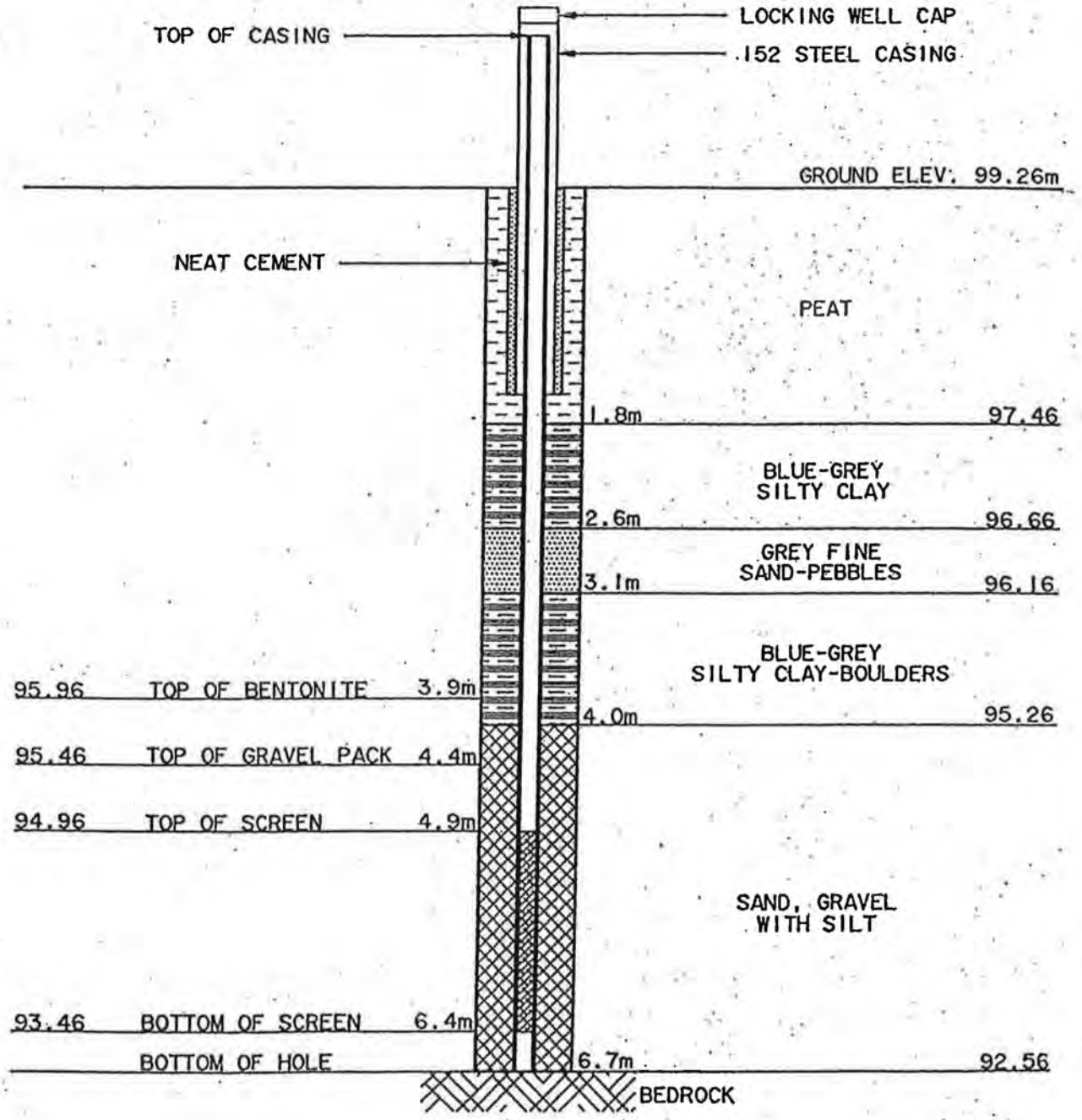
# MONITORING WELL #2 BOREHOLE LOG




OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Nepean, Ontario

| DATE: | CLIENT: | DRAWING NO. |
|---|---|---|
| MARCH, 1991 | TOWNSHIP OF WINCHESTER LANDFILL | 90-7848 |
| SCALE: N.T.S. | TITLE: MONITORING WELL INSTALLATION | |

# MONITORING WELL #3 BOREHOLE LOG




OLIVER MANGIONE McCALLA
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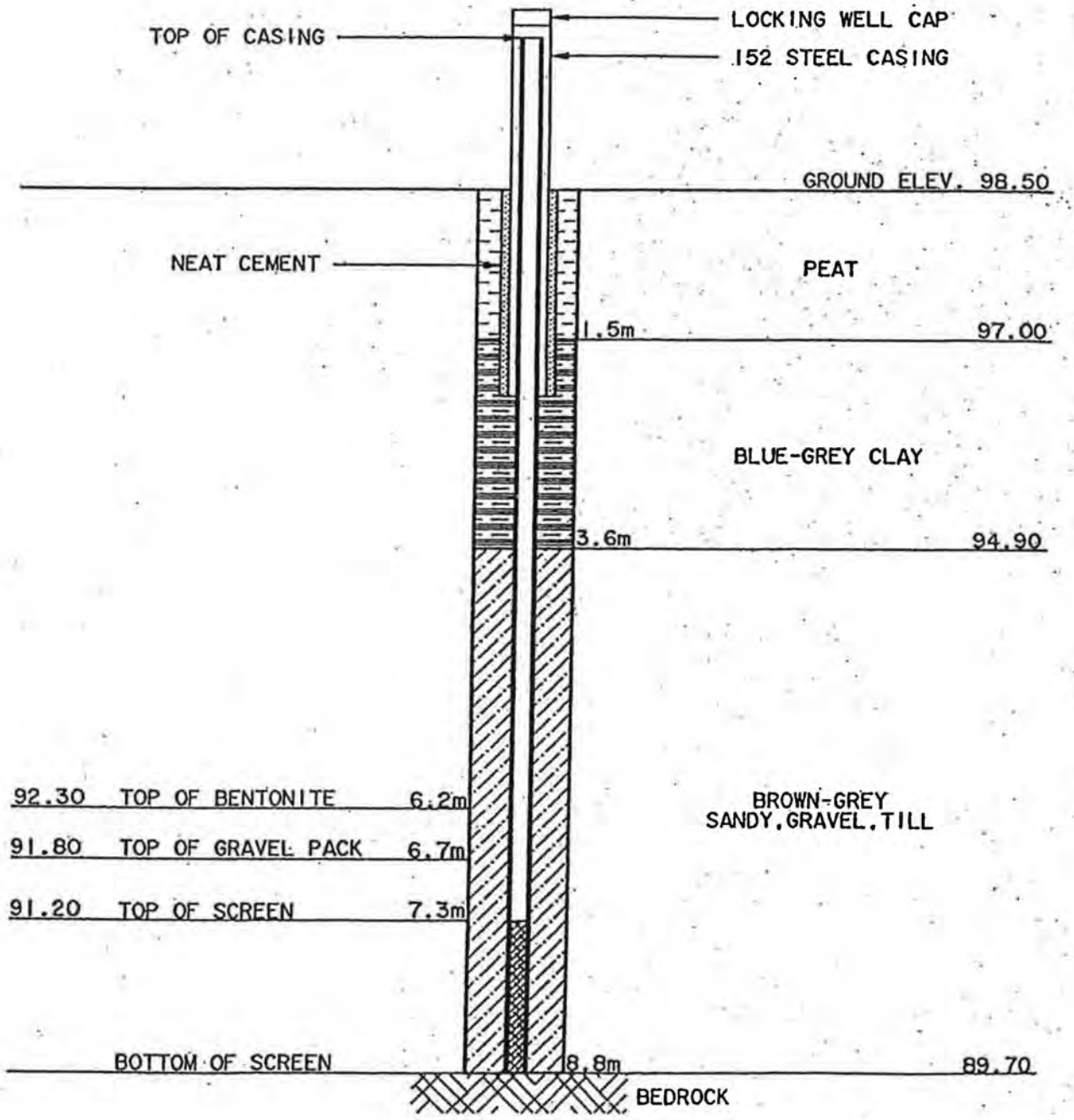
Consulting Engineers
Nepean, Ontario

| | | |
|---|---|---|
| DATE: MARCH. 1991 | CLIENT: TOWNSHIP OF WINCHESTER LANDFILL | DRAWING NO. 90-7848 |
| SCALE: N.T.S. | TITLE: MONITORING WELL INSTALLATION | |

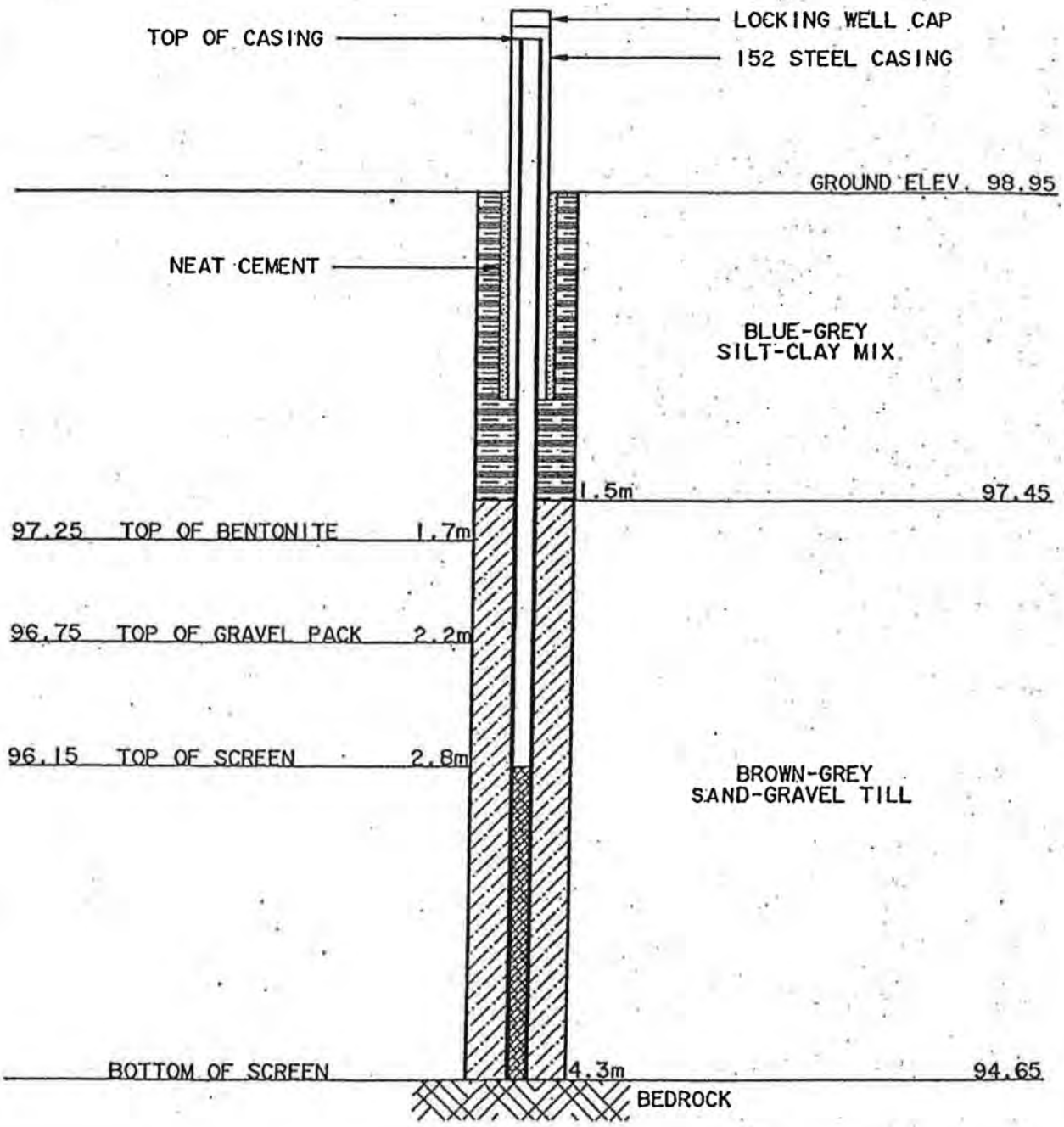
# MONITORING WELL #4 BOREHOLE LOG




OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Nepean, Ontario

| | | |
|---|---|---|
| DATE: MARCH, 1991 | CLIENT: TOWNSHIP OF WINCHESTER LANDFILL | DRAWING NO. 90-7848 |
| SCALE: N.T.S. | TITLE: MONITORING WELL INSTALLATION | |

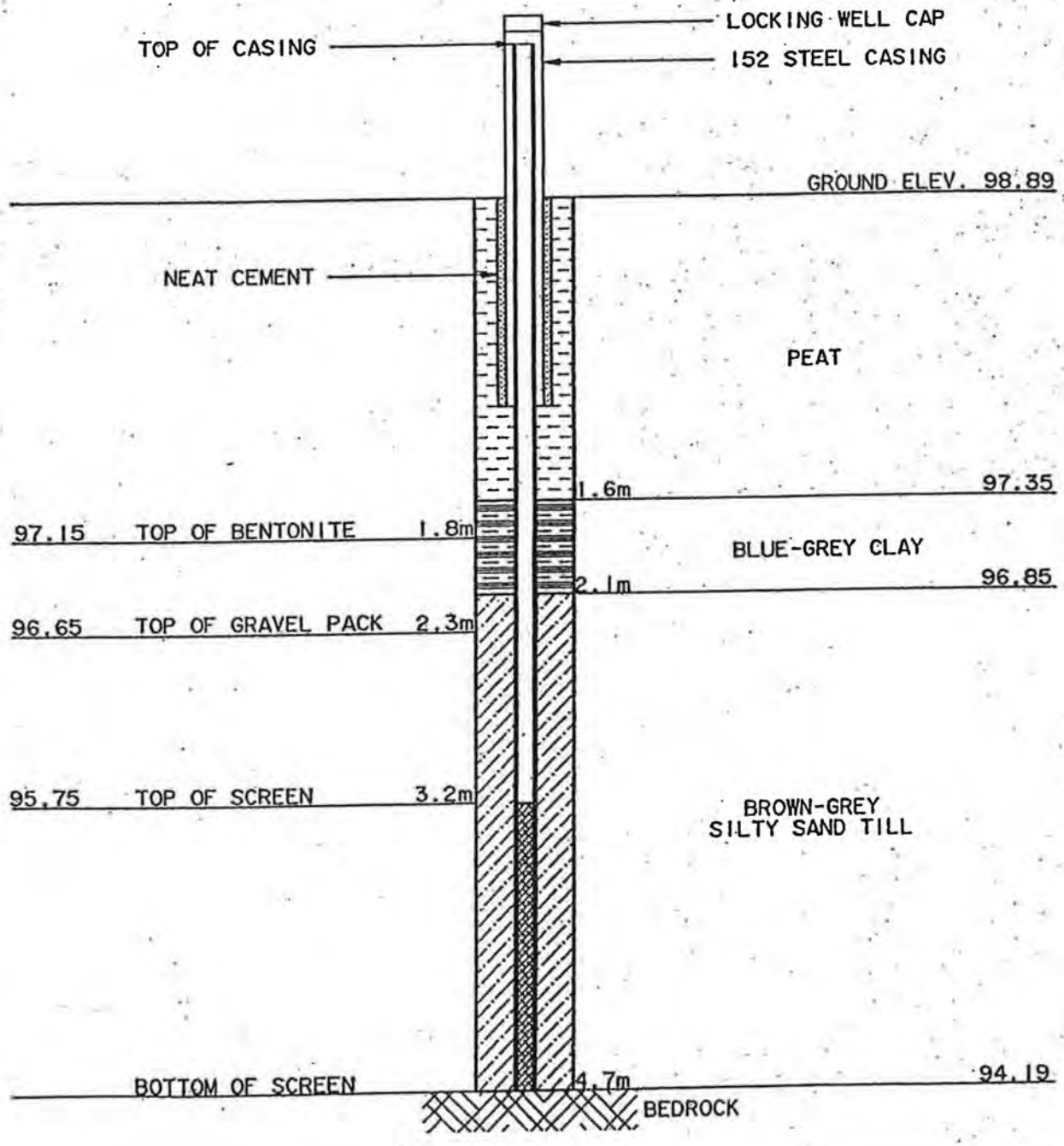
# MONITORING WELL #5 BOREHOLE LOG




OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Nepean, Ontario

| | | |
|---|---|---|
| DATE: MARCH, 1991 | CLIENT: TOWNSHIP OF WINCHESTER LANDFILL | DRAWING NO. 90-7848 |
| SCALE: N.T.S. | TITLE: MONITORING WELL INSTALLATION | |

# MONITORING WELL #6 BOREHOLE LOG




OLIVER MANGIONE McCALLA
& ASSOCIATES LIMITED
Consulting Engineers
Nepean, Ontario

| | | |
|---|---|---|
| DATE: MARCH, 1991 | CLIENT: TOWNSHIP OF WINCHESTER LANDFILL | DRAWING NO. 90-7848 |
| SCALE: N.T.S. | TITLE: MONITORING WELL INSTALLATION | |

STRATIGRAPHIC DESCRIPTION AND OVER-BURDEN MONITORING WELL INSTALLATION

WINCHESTER TOWNSHIP LANDFILL SITE

ONITORING WELL NUMBER: MW 7

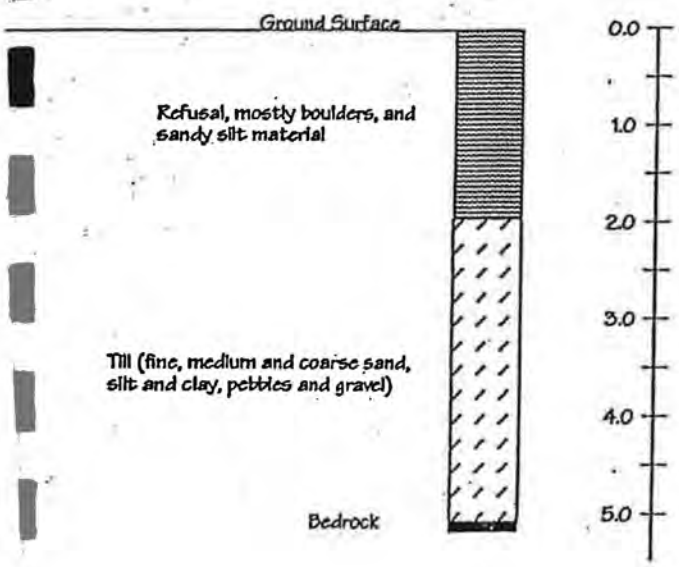
RILL TYPE: CME 55 HOLLOW STEM AUGER

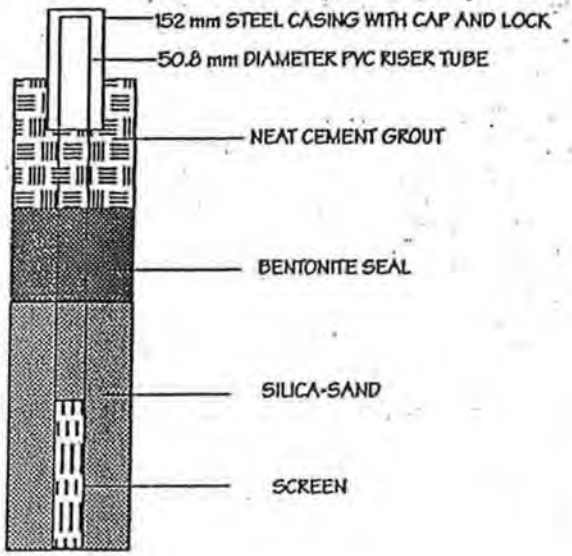
RILLER: MARATHON

LOCATION: CONCESSION VII, LOT 8

DATE: JUNE 9, 1992

| SOIL DESCRIPTION | STRAT. | DEPTH (m) | ELEV. (m) | PIEZOMETER INSTALLATION |
|---|---|---|---|---|




| | | |
|---|---|---|
| I. S. THOMPSON & SSOCIATES LTD. | FIGURE TITLE: SOIL PROFILE AND PIEZOMETER CONSTRUCTION | DATE: JUNE 1992 |
| | | SCALE: AS SHOWN |
| | | DRAWN: MHM |
| NSULTING ENGINEERS | JOB: WINCHESTER TOWNSHIP LANDFILL SITE | JOB No.: 92094 |
| ROSEMOUNT AVE. CORNWALL K6J 3E5 | | FIGURE: |

STRATIGRAPHIC DESCRIPTION AND OVER-BURDEN MONITORING WELL INSTALLATION

WINCHESTER TOWNSHIP LANDFILL SITE

MONITORING WELL NUMBER: MW 8

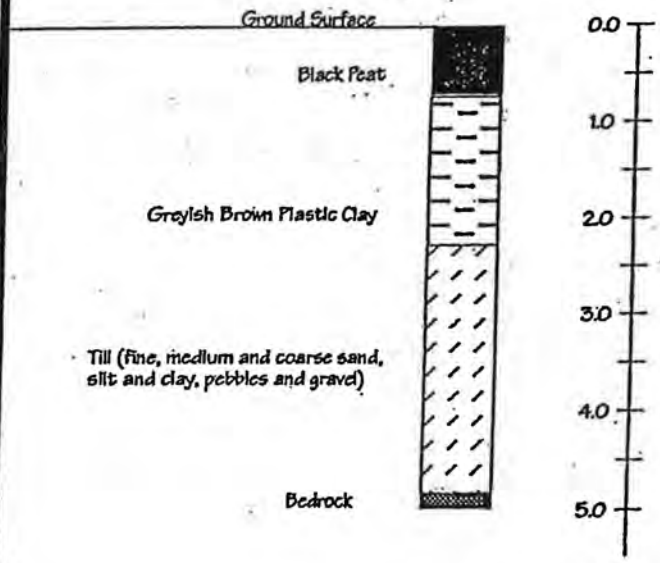
LOCATION: CONCESSION VII, LOT 8

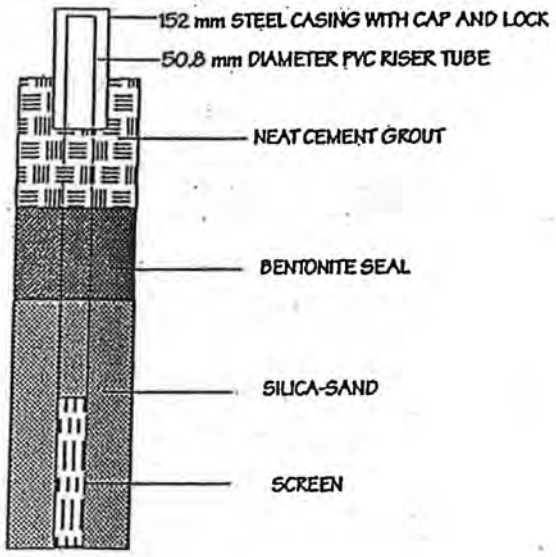
DRILL TYPE: CME 55 HOLLOW STEM AUGER

DATE: JUNE 9, 1992

DRILLER: MARATHON

| SOIL DESCRIPTION | STRAT. | DEPTH (m) | ELEV. (m) | PIEZOMETER INSTALLATION |
|---|---|---|---|---|




M. S. THOMPSON & ASSOCIATES LTD.

CONSULTING ENGINEERS

1345 ROSEMOUNT AVE. CORNWALL K6J 3E5

FIGURE TITLE

SOIL PROFILE AND PIEZOMETER CONSTRUCTION

JOB

WINCHESTER TOWNSHIP LANDFILL SITE

| | |
|---|---|
| DATE | JUNE 1992 |
| SCALE | AS SHOWN |
| DRAWN | MHM |
| JOB No. | 92094 |
| FIGURE: | |

STRATIGRAPHIC DESCRIPTION AND OVER-BURDEN MONITORING WELL INSTALLATION

WINCHESTER TOWNSHIP LANDFILL SITE

MONITORING WELL NUMBER: MW 9

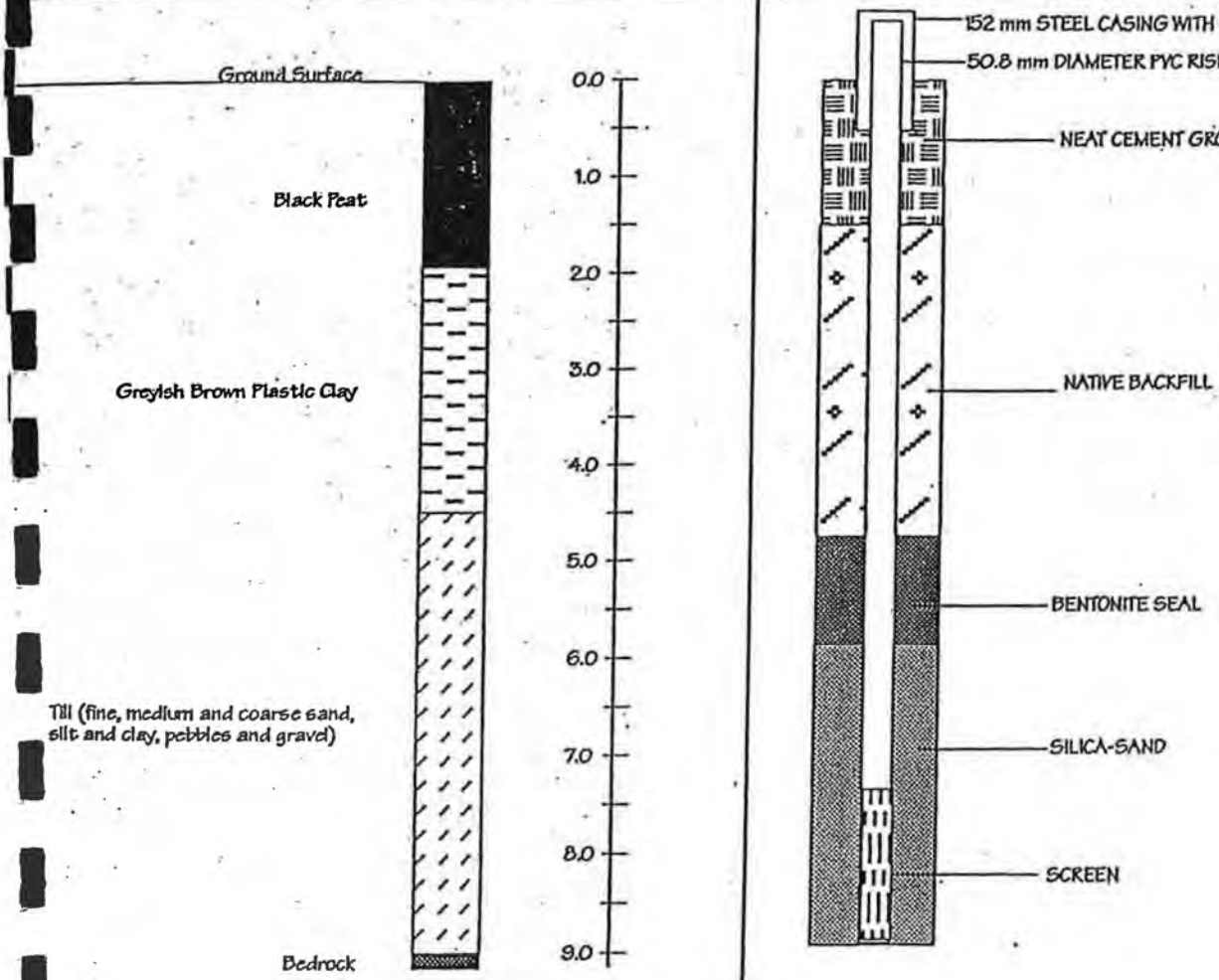
LOCATION: CONCESSION VII, LOT 8

DRILL TYPE: CME 55 HOLLOW STEM AUGER

DATE: JUNE 9, 1992

DRILLER: MARATHON

| SOIL DESCRIPTION | STRAT. | DEPTH (m) | ELEV. (m) | PIEZOMETER INSTALLATION |
|---|---|---|---|---|




M. S. THOMPSON & ASSOCIATES LTD.

CONSULTING ENGINEERS

ROSEMOUNT AVE. CORNWALL K6J 3E5

FIGURE TITLE

SOIL PROFILE AND PIEZOMETER CONSTRUCTION

JOB

WINCHESTER TOWNSHIP LANDFILL SITE

| | |
|---|---|
| DATE | JUNE 1992 |
| SCALE | AS SHOWN |
| DRAWN | MHM |
| JOB No. | 92094 |
| FIGURE: | |

STRATIGRAPHIC DESCRIPTION AND OVER-BURDEN MONITORING WELL INSTALLATION

WINCHESTER TOWNSHIP LANDFILL SITE

MONITORING BEDROCK WELL: BRW-1

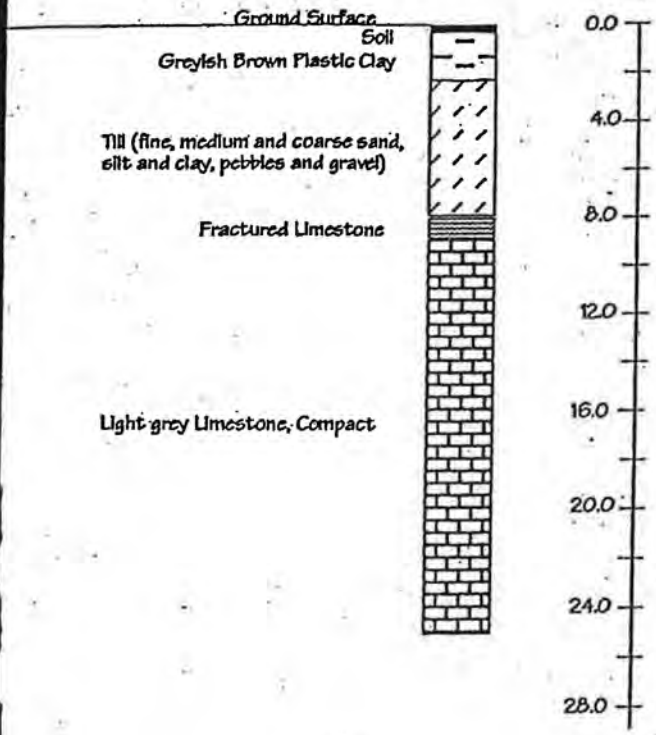
LOCATION: CONCESSION VII, LOT 8

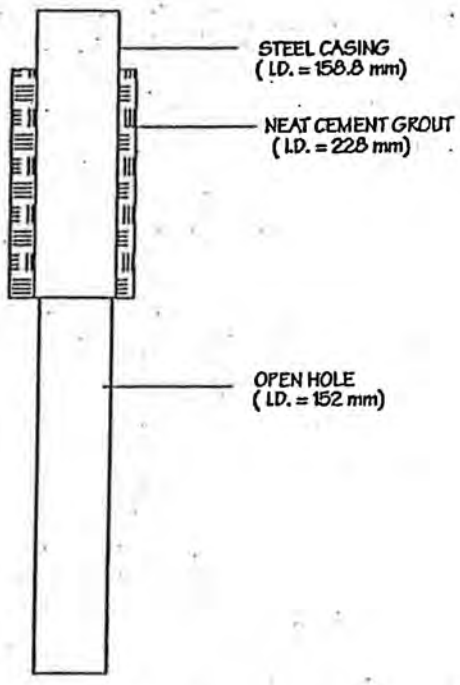
DRILL TYPE: CME 55 HOLLOW STEM AUGER

DATE: JUNE 10, 1992

DRILLER: MARATHON

| SOIL DESCRIPTION | STRAT. | DEPTH (m) | ELEV. (m) | PIEZOMETER INSTALLATION |
|---|---|---|---|---|





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CONSULTING ENGINEERS

1345 ROSEMOUNT AVE. CORNWALL K6J 3E5


FIGURE TITLE

SOIL PROFILE AND PIEZOMETER CONSTRUCTION

JOB

WINCHESTER TOWNSHIP LANDFILL SITE

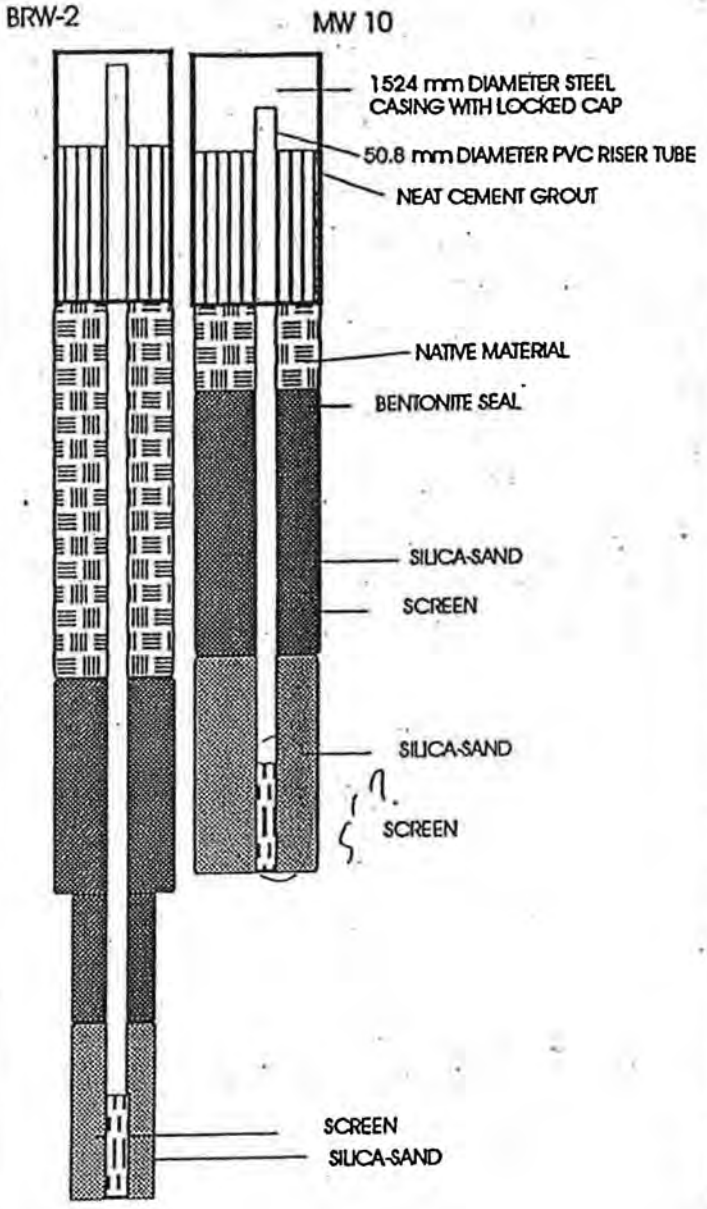
| | |
|---|---|
| DATE | JUNE 1992 |
| SCALE | AS SHOWN |
| DRAWN | MHM |
| JOB No. | 92094 |
| FIGURE: | |

MONITORING WELL NUMBER: MW10 & BRW-1 & 2
DRILL TYPE: CME 55 HOLLOW STEM AUGER
DRILLER: MARATHON

LOCATION: WINCHESTER TOWNSHIP WASTE DISPOSAL SITE
DATE: JULY 1993

| SOIL DESCRIPTION | STRAT. | DEPTH (m) | ELEV. (m) |
|---|---|---|---|
| GROUND SURFACE | | 0.0 | 74.54 |
| DARK, SILTY, ORGANIC SOIL | | | |
| GREYISH TO BLUISH BROWN MOIST, PLASTIC CLAY | | 1.0 | 73.54 |
| | | 2 | 72.54 |
| | | 3.0 | 71.54 |
| GREYISH PURPLE, SANDY SILT WITH CLAY, PEBBLES AND GRAVEL | | 4.0 | 70.54 |
| | | 5.0 | 69.54 |
| FRACTURED LIMESTONE | | 6.0 | 68.54 |
| | | 7.0 | 67.54 |
| | | 8.0 | 66.54 |

PIEZOMETER INSTALLATION

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1345 ROSEMOUNT AVE. CORNWALL K6J 3E5

FIGURE TITLE
SOIL PROFILE AND PIEZOMETER CONSTRUCTION

JOB
WINCHESTER TOWNSHIP WASTE DISPOSAL SITE

| | |
|---|---|
| DATE | MARCH 1993 |
| SCALE | AS SHOWN |
| DRAWN | MHM |
| JOB No. | 92094 |

Project No: MC12684A

# Log of MW 16

Project: North Dundas Landfill - Boyne Rd.

Client: Township of North Dundas

Location: Winchester, ON

Logged by: Matt Prince

Trow

| Depth (ft / m) | Symbol | Description | Elev. | Sample Number | Sample Type | Recovery | Volatile Organic Compounds (ppmv: 25, 75, 125, 175) | Well Data | Lab Analysis |
|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | | Ground Surface | 0 | | | | | | |
| 0–2 / 0 | | ***TOPSOIL*** Topsoil. | -0.76 | AU 1 | | | | | |
| 3–7 / 1–2 | | ***CLAYEY SILT*** Medium grey, moist, soft, fractured clayey silt with traces of sand till. | -2.3 | SS 2, SS 3 | | | | | |
| 8–15 / 3–4 | | ***SILTY SAND*** Medium brown to grey, moist to saturated, silty sand with some coarse gravel till. | -4.6 | SS 4, SS 5, SS 6 | | | | | |
| 15 / 5 | | End of Borehole | | | | | | | |

Drill Method: Hollow Stem Auger

Drill Date: September 26, 2002

Hole Size: 0.15 metres

**Trow Consulting Engineers Ltd.**
154 Colonnade Road South
Nepean, Ontario K2E 7J5

Datum:

Checked by: B.Coons

Sheet: 1 of 1

# Log of MW 17

**Project No:** MC12684A

**Project:** North Dundas Landfill - Boyne Rd.

**Client:** Township of North Dundas

**Location:** Winchester, ON

**Logged by:** Matt Prince

Trow

| Depth (ft) | Depth (m) | Symbol | Description | Elev. | Sample Number | Sample Type | Recovery | Volatile Organic Compounds (ppmv) | Well Data | Lab Analysis |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | | Ground Surface | 0 | | | | | | |
| 0 | 0 | | ***TOPSOIL*** Topsoil. | -0.3 | AU 1 | | | | | |
| 3 | 1 | | ***SILTY GRAVELLY SAND*** Medium brown, dry, hard, silty gravelly sand till. | | SS 2 | | | | | |
| 10 | 3 | | | -3 | AU 3 | | | | | |
| 12 | 4 | | ***SILTY GRAVELLY SAND*** Medium grey, wet, hard, silty gravelly sand till. | | SS 4 | | | | | |
| 15 | 4.6 | | | -4.6 | AU 5 | | | | | |
| 15 | 5 | | End of Borehole | | | | | | | |

Volatile Organic Compounds ppmv: 25 75 125 175

Drill Method: Hollow Stem Auger

Drill Date: September 26, 2002

Hole Size: 0.15 metres

**Trow Consulting Engineers Ltd.**
154 Colonnade Road South
Nepean, Ontario K2E 7J5

Datum:

Checked by: B.Coons

Sheet: 1 of 1

Project No: MC12684A

# Log of MW 18

Project: North Dundas Landfill - Boyne Rd.

Client: Township of North Dundas

Location: Winchester, ON

Logged by: Matt Prince

Trow

| Depth (ft / m) | Symbol | Description | Elev. | Sample Number | Sample Type | Recovery | Volatile Organic Compounds (ppmv, 25 75 125 175) | Well Data | Lab Analysis |
|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | | Ground Surface | 0 | | | | | | |
| 0 / 0 | | ***TOPSOIL*** Topsoil. | -0.3 | AU 1 | | | | | |
| 3 / 1 | | ***SILTY CLAY*** Medium brown, moist, silty fractured clay. | -1.2 | SS 2 | | | | | |
| 6 / 2 | | ***SILTY SAND*** Medium brown, dry, silty sand with some gravel till. | -3 | SS 3 | | | | | |
| 9 / 3 | | | | SS 4 | | | | | |
| 10 / 3 | | ***SILTY SANDY GRAVEL*** Medium grey, wet, silty sandy gravel till. Refusal at 11 feet. | -3.4 | SS 5 | | | | | |
| | | End of Borehole | | | | | | | |
| 20 / 6 | | | | | | | | | |

Drill Method: Hollow Stem Auger

Drill Date: September 26, 2002

Hole Size: 0.15 metres

**Trow Consulting Engineers Ltd.**
154 Colonnade Road South
Nepean, Ontario K2E 7J5

Datum:

Checked by: B.Coons

Sheet: 1 of 1

Project No: MC12684A

# Log of MW 19

Project: North Dundas Landfill - Boyne Rd.

Client: Township of North Dundas

Location: Winchester, ON

Logged by: Matt Prince

Trow

| Depth (ft / m) | Symbol | Description | Elev. | Number | Type | Recovery | Volatile Organic Compounds ppmv (25 75 125 175) | Well Data | Lab Analysis |
|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | | Ground Surface | 0 | | | | | | |
| 0 / 0 | | ***TOPSOIL*** Topsoil. | -0.3 | AU 1 | | | | | |
| 3 / 1 | | | | SS 2 | | | | | |
| 5 / 2 | | ***SILTY CLAY*** Medium brown, dry, hard, silty clay with some gravel till. | | AU 3 | | | | | |
| 8 / 2 | | | | AU 4 | | | | | |
| 10 / 3 | | | -3 | | | | | | |
| 10 / 3 | | ***SILTY SAND*** Medium grey, dry, hard, silty sand with some gravel till. Refusal at 11'2". | -3.4 | SS 5 | | | | | |
| 13 / 4 | | End of Borehole | | | | | | | |
| 20 / 6 | | | | | | | | | |

Drill Method: Hollow Stem Auger

Drill Date: September 26, 2002

Hole Size: 0.15 metres

**Trow Consulting Engineers Ltd.**

154 Colonnade Road South
Nepean, Ontario K2E 7J5

Datum:

Checked by: B.Coons

Sheet: 1 of 1

**ATTACHMENTS – SLOPE/W OUTPUT SECTIONS**

- Figures 1 to 6

| Color | Name | Model | Unit Weight (kN/m³) | Cohesion' (kPa) | Phi' (°) |
|---|---|---|---|---|---|
| | Base Layer | Mohr-Coulomb | 20.5 | 0 | 35 |
| | Bedrock | Bedrock (impenetrable) | | | |
| | Cover Layer | Mohr-Coulomb | 19 | 0 | 32 |
| | Glacial Till | Mohr-Coulomb | 21 | 0 | 35 |
| | Silty Clay (stiff to very stiff) | Mohr-Coulomb | 16 | 7.4 | 28.7 |
| | Topsoil/Peat | Mohr-Coulomb | 11.8 | 0 | 10 |
| | Waste Fill | Mohr-Coulomb | 15 | 0 | 33 |

Title: 1648253 - Boyne Road Landfill
File Name: Section A-A' West Drained.gsz
Description: Section AA' - West Side Slope Drained Analysis
Method: Morgenstern-Price

1.9

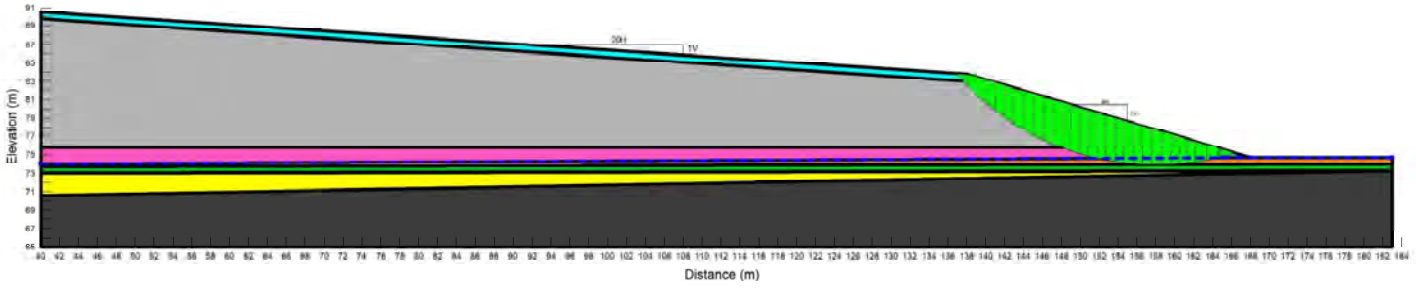


FIGURE 1

| | | | | | |
|---|---|---|---|---|---|
| REVIEW | | | | | |
| CHECK | VK | | | | |
| | 2022-01-28 | | | | |
| CADD | | | | | |
| DESIGN | BB | | | | |
| | 2022-01-28 | | | | |
| REV. 0 | | | | | |
| SCALE AS SHOWN | | | | | |
| FILE No. | | | | | |
| PROJECT No. | 1648253 | | | | |

TITLE

**SECTION A-A' (WEST)**
**STABILITY ANALYSES**
**STATIC DRAINED CONDITION**

PROJECT

**INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN**
**SLOPE STABILITY ASSESSMENT**

GOLDER
MEMBER OF WSP

| Color | Name | Model | Unit Weight (kN/m³) | Cohesion (kPa) | Cohesion' (kPa) | Phi' (°) |
|---|---|---|---|---|---|---|
| | Base Layer | Mohr-Coulomb | 20.5 | | 0 | 36 |
| | Bedrock | Bedrock (Impenetrable) | | | | |
| | Cover Layer | Mohr-Coulomb | 19 | | 0 | 32 |
| | Glacial Till | Mohr-Coulomb | 21 | | 0 | 35 |
| | Silty Clay (stiff to very stiff) | Undrained (Phi=0) | 18 | 50 | | |
| | Topsoil/Peat | Mohr-Coulomb | 13.5 | | 0 | 10 |
| | Waste Fill | Mohr-Coulomb | 13 | | 0 | 32 |

Title: 1648253 - Boyne Road Landfill
File Name: Section A-A' West Undrained.gsz
Description: Section AA' - West Side Slope Undrained Analysis
Method: Morgenstern-Price

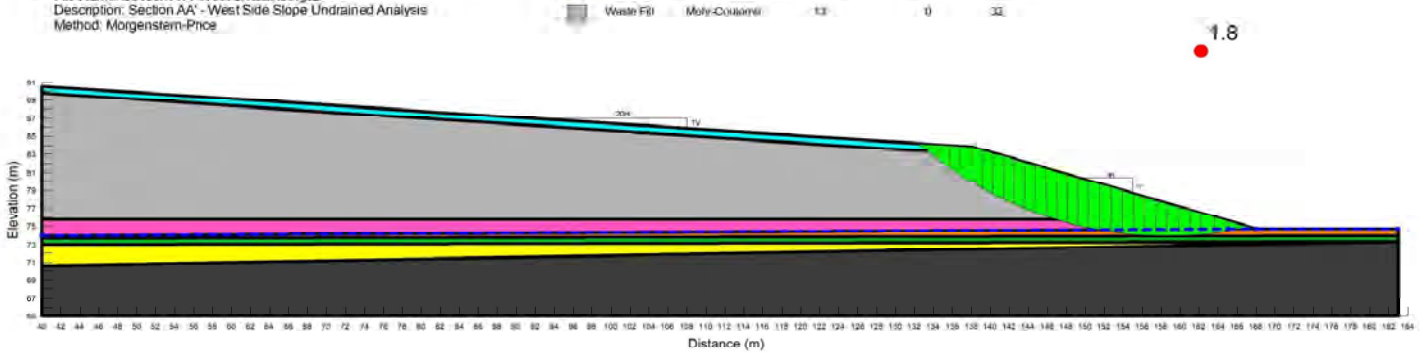


FIGURE 2

| | | | | | |
|---|---|---|---|---|---|
| REVIEW | | | | | |
| CHECK | VK | | | | |
| | 2022-01-28 | | | | |
| CADD | | | | | |
| DESIGN | BB | | | | |
| | 2022-01-28 | | | | |
| REV. 0 | | | | | |
| SCALE AS SHOWN | | | | | |
| FILE No. | 1648276 | | | | |
| PROJECT No. | 1648276 | | | | |

TITLE

**SECTION A-A' (WEST)**
**STABILITY ANALYSES**
**STATIC UNDRAINED CONDITION**

PROJECT

**INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN**
**SLOPE STABILITY ASSESSMENT**

GOLDER
MEMBER OF WSP

| Color | Name | Model | Unit Weight (kN/m³) | Cohesion (kPa) | Cohesion' (kPa) | Phi' (°) |
|---|---|---|---|---|---|---|
| | Base Layer | Mohr-Coulomb | 20.5 | | 0 | 35 |
| | Bedrock | Bedrock (Impenetrable) | | | | |
| | Cover Layer | Mohr-Coulomb | 19 | | 0 | 32 |
| | Glacial Till | Mohr-Coulomb | 21 | | 0 | 35 |
| | Silty Clay (stiff to very stiff) | Undrained (Phi=0) | 18 | 50 | | |
| | Topsoil/Peat | Mohr-Coulomb | 11.5 | | 0 | 10 |
| | Waste Fill | Mohr-Coulomb | 13 | | 0 | 32 |

Title: 1648253 - Boyne Road Landfill
File Name: Section A-A' West Seismic.gsz
Description: Section AA' - West Side Slope Seismic Analysis
Method: Morgenstern-Price

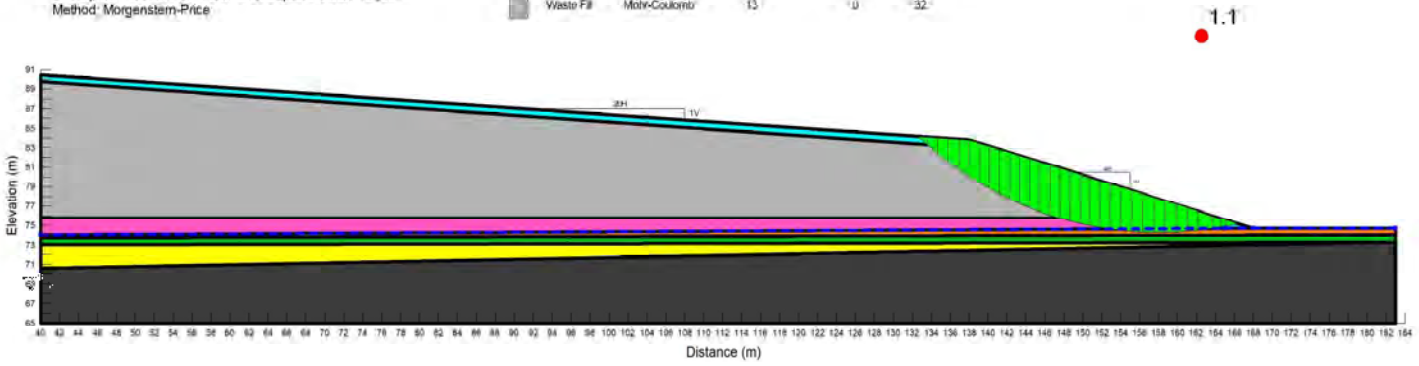


FIGURE 3

| | | | | | |
|---|---|---|---|---|---|
| REVIEW | | | | | |
| CHECK | VK | | | | |
| | 2022/12/8 | | | | |
| CADD | | | | | |
| DESIGN | BB | | | | |
| | 2022/12/8 | | | | |
| REV. 0 | | | | | |
| SCALE AS SHOWN | | | | | |
| FILE No. | 1648253 | | | | |
| PROJECT No. | 1648253 | | | | |

TITLE

**SECTION A-A' (WEST)**
**STABILITY ANALYSES**
**SEISMIC CONDITION**

PROJECT

**INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN**
**SLOPE STABILITY ASSESSMENT**

GOLDER
MEMBER OF WSP

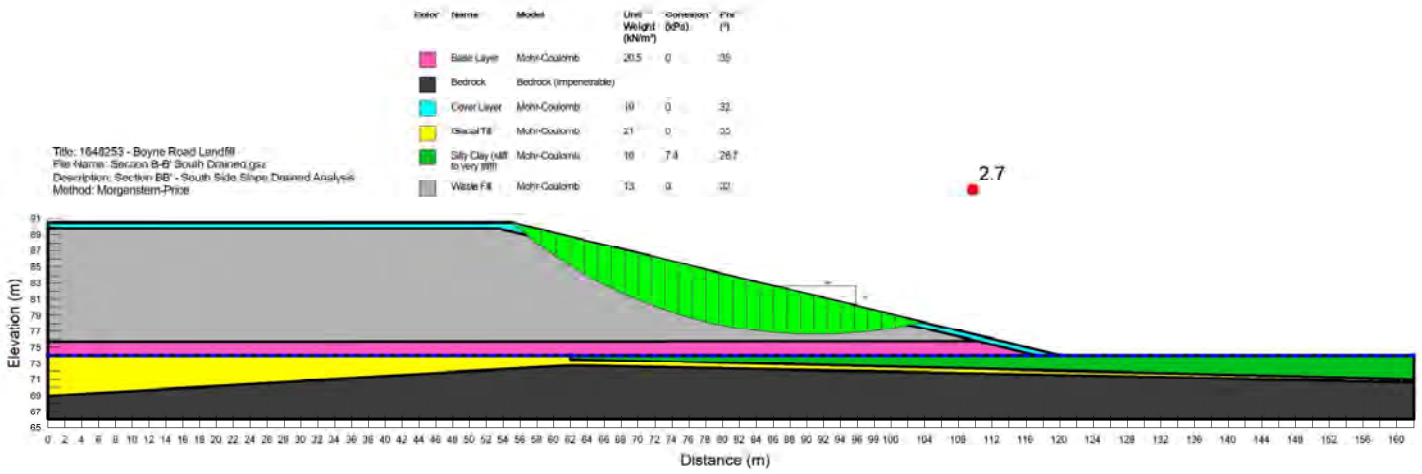


FIGURE 4

| | | | |
|---|---|---|---|
| REVIEW | | | |
| CHECK | VK | | |
| DATE | 2022/01/28 | | |
| DESIGN | BB | | |
| DATE | 2022/01/28 | | |
| REV. # | | | |
| SCALE AS SHOWN | | | |
| FILE No. | 1648253 | | |
| PROJECT No. | 1648253 | | |

TITLE

**SECTION B-B' (SOUTH)**
**STABILITY ANALYSES**
**STATIC DRAINED CONDITION**

PROJECT

**INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN**
**SLOPE STABILITY ASSESSMENT**

GOLDER
MEMBER OF WSP

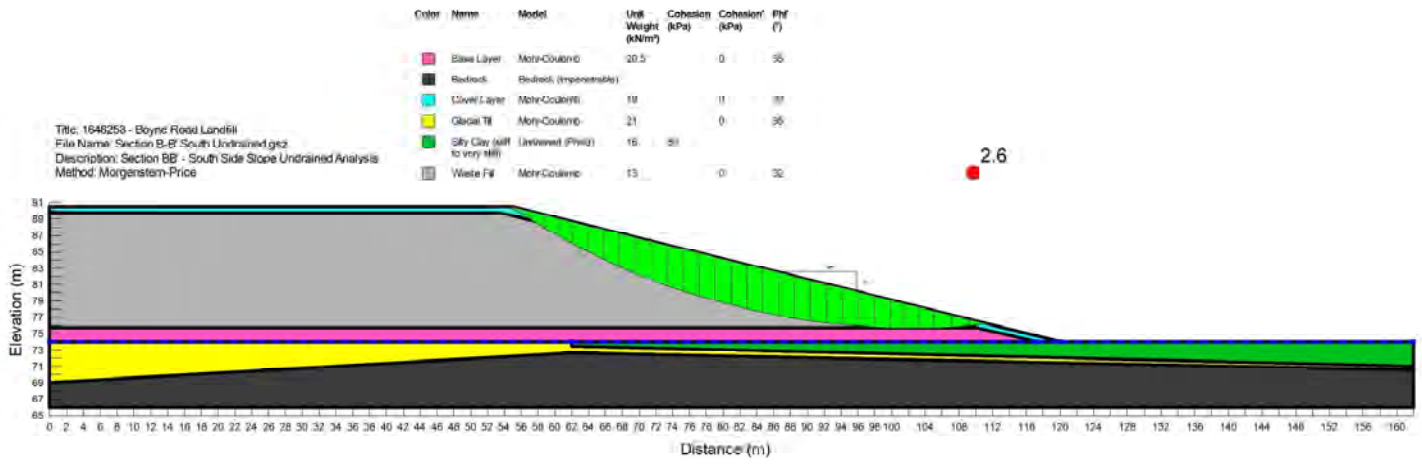


FIGURE 5

| | | | | | | |
|---|---|---|---|---|---|---|
| REVIEW | | | | | | |
| CHECK | VK | 2022-01-28 | | | | |
| CAD | | | | | | |
| DESIGN | BB | 2022-01-28 | | | | |
| REV. 0 | SCALE AS SHOWN | | | | | |
| FILE No. | 1648253 | | | | | |
| PROJECT No. | 1648253 | | | | | |

TITLE

**SECTION B-B' (SOUTH)**
**STABILITY ANALYSES**
**STATIC UNDRAINED CONDITION**

PROJECT

**INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN**
**SLOPE STABILITY ASSESSMENT**

GOLDER
MEMBER OF WSP

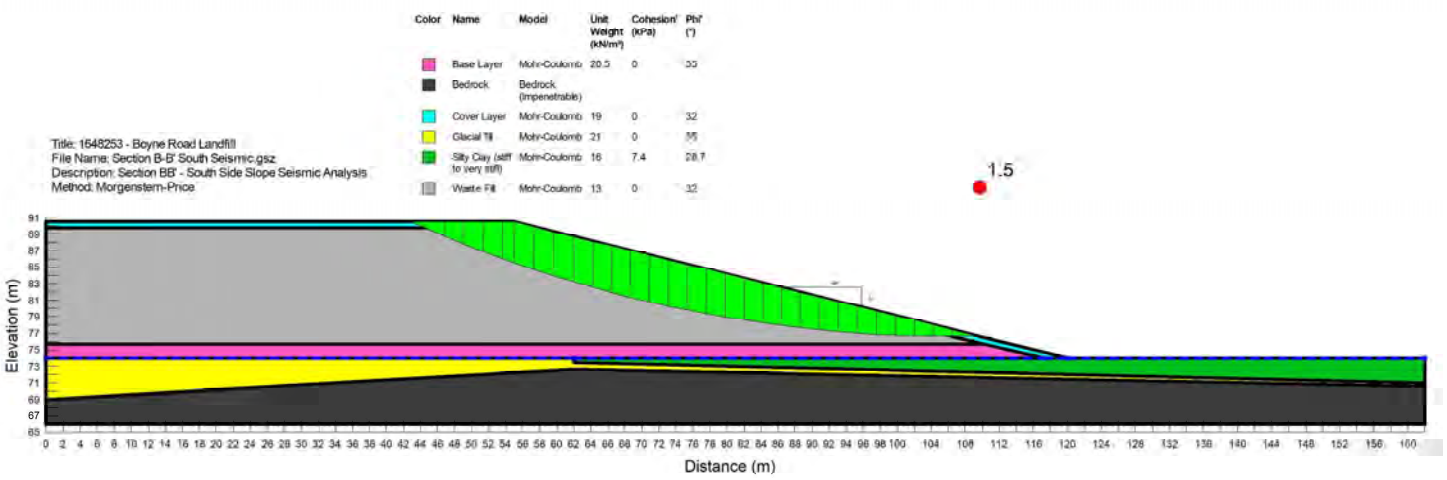


**FIGURE 6**

| | | |
|---|---|---|
| REVIEW | | |
| CHECK | VK | 2022-01-28 |
| CAD | | |
| DESIGN | BB | 2022-01-28 |
| REV. 0 | SCALE AS SHOWN | |
| FILE No. | 1648253 | |
| PROJECT No. | 1648253 | |

TITLE

**SECTION B-B' (SOUTH)**
**STABILITY ANALYSES**
**SEISMIC CONDITION**

PROJECT

**INDIVIDUAL ENVIRONMENTAL ASSESSMENT OF THE TOWNSHIP OF NORTH DUNDAS WASTE MANAGEMENT PLAN**
**SLOPE STABILITY ASSESSMENT**

GOLDER
MEMBER OF WSP

# Appendix D-3 POLLUTE Output

# POLLUTEv7

Version 7.13



## Boyne Source Boron

**THE VARIABLE VELOCITY AND/OR CONCENTRATION OPTION HAS BEEN USED**
**NOTE THAT THE ACCURACY OF THE CALCULATIONS WITH THIS OPTION WILL DEPEND ON THE NUMBER OF SUBLAYERS USED**

## Layer Properties

| Layer | Thickness | Number of Sublayers | Coefficient of Hydrodynamic Dispersion | Matrix Porosity | Distribution Coefficient | Dry Density |
|---|---|---|---|---|---|---|
| Till | 4.4 m | 200 | 0.019 m2/a | 0.35 | 0 mL/g | 1.9 g/cm3 |

## Boundary Conditions

**Finite Mass Top Boundary**

**Fixed Outflow Bottom Boundary**

Landfill Length = 202 m
Landfill Width = 1 m
Base Thickness = 3 m
Base Porosity = 0.35

## VARIATION IN PROPERTIES WITH TIME:

### TIME PERIODS WITH THE SAME SOURCE AND VELOCITY

| Period | Start Time | No. of Steps | Time Step | Source Conc | Rate of Change | Height of Leachate | Volume Collected |
|---|---|---|---|---|---|---|---|
| 1 | 0 year | 15 | 5 year | 5 mg/L | 0 | 10000000 m | 0 m/a |
| 2 | 75 year | 100 | 5 year | 5 mg/L | 0 | 2.54 m | 0 m/a |

| Period | Start Time | End Time | Darcy Velocity | Dispersivity | Base Velocity |
|---|---|---|---|---|---|
| 1 | 0 year | 75 year | 0.33 m/a | 0.1 m | 23.5 m/a |
| 2 | 75 year | 575 year | 0.33 m/a | 0.1 m | 23.5 m/a |

## Laplace Transform Parameters

**TAU =** 7 **N =** 20 **SIG =** 0 **RNU =** 2

## Calculated Concentrations at Selected Times and Depths

| Time<br>year | Depth<br>m | Concentration<br>mg/L |
|---|---|---|
| 5 | 0.000E+00 | 5.000E+00 |
| 10 | 0.000E+00 | 5.000E+00 |
| 15 | 0.000E+00 | 5.000E+00 |
| 20 | 0.000E+00 | 5.000E+00 |
| 25 | 0.000E+00 | 5.000E+00 |
| 30 | 0.000E+00 | 5.000E+00 |
| 35 | 0.000E+00 | 5.000E+00 |
| 40 | 0.000E+00 | 5.000E+00 |
| 45 | 0.000E+00 | 5.000E+00 |
| 50 | 0.000E+00 | 5.000E+00 |
| 55 | 0.000E+00 | 5.000E+00 |
| 60 | 0.000E+00 | 5.000E+00 |
| 65 | 0.000E+00 | 5.000E+00 |
| 70 | 0.000E+00 | 5.000E+00 |
| 75 | 0.000E+00 | 5.000E+00 |

| Time<br>year | Depth<br>m | Concentration<br>mg/L |
|---|---|---|
| 80 | 0.000E+00 | 2.639E+00 |
| 85 | 0.000E+00 | 1.393E+00 |
| 90 | 0.000E+00 | 7.354E-01 |
| 95 | 0.000E+00 | 3.882E-01 |
| 100 | 0.000E+00 | 2.049E-01 |
| 105 | 0.000E+00 | 1.082E-01 |
| 110 | 0.000E+00 | 5.711E-02 |
| 115 | 0.000E+00 | 3.015E-02 |
| 120 | 0.000E+00 | 1.591E-02 |
| 125 | 0.000E+00 | 8.401E-03 |
| 130 | 0.000E+00 | 4.435E-03 |
| 135 | 0.000E+00 | 2.341E-03 |
| 140 | 0.000E+00 | 1.236E-03 |
| 145 | 0.000E+00 | 6.525E-04 |
| 150 | 0.000E+00 | 3.444E-04 |
| 155 | 0.000E+00 | 1.818E-04 |
| 160 | 0.000E+00 | 9.599E-05 |
| 165 | 0.000E+00 | 5.067E-05 |
| 170 | 0.000E+00 | 2.675E-05 |
| 175 | 0.000E+00 | 1.412E-05 |
| 180 | 0.000E+00 | 7.454E-06 |
| 185 | 0.000E+00 | 3.935E-06 |

| Time<br>year | Depth<br>m | Concentration<br>mg/L |
|---|---|---|
| 190 | 0.000E+00 | 2.077E-06 |
| 195 | 0.000E+00 | 1.097E-06 |
| 200 | 0.000E+00 | 5.790E-07 |
| 205 | 0.000E+00 | 3.057E-07 |
| 210 | 0.000E+00 | 1.614E-07 |
| 215 | 0.000E+00 | 8.524E-08 |
| 220 | 0.000E+00 | 4.503E-08 |
| 225 | 0.000E+00 | 2.381E-08 |
| 230 | 0.000E+00 | 1.260E-08 |
| 235 | 0.000E+00 | 6.689E-09 |
| 240 | 0.000E+00 | 3.566E-09 |
| 245 | 0.000E+00 | 1.918E-09 |
| 250 | 0.000E+00 | 1.048E-09 |
| 255 | 0.000E+00 | 5.883E-10 |
| 260 | 0.000E+00 | 3.457E-10 |
| 265 | 0.000E+00 | 2.176E-10 |
| 270 | 0.000E+00 | 1.499E-10 |
| 275 | 0.000E+00 | 1.141E-10 |
| 280 | 0.000E+00 | 9.514E-11 |
| 285 | 0.000E+00 | 8.504E-11 |
| 290 | 0.000E+00 | 7.965E-11 |
| 295 | 0.000E+00 | 7.671E-11 |

| Time<br>year | Depth<br>m | Concentration<br>mg/L |
|---|---|---|
| 300 | 0.000E+00 | 7.508E-11 |
| 305 | 0.000E+00 | 7.413E-11 |
| 310 | 0.000E+00 | 7.353E-11 |
| 315 | 0.000E+00 | 7.311E-11 |
| 320 | 0.000E+00 | 7.279E-11 |
| 325 | 0.000E+00 | 7.252E-11 |
| 330 | 0.000E+00 | 7.225E-11 |
| 335 | 0.000E+00 | 7.201E-11 |
| 340 | 0.000E+00 | 7.176E-11 |
| 345 | 0.000E+00 | 7.152E-11 |
| 350 | 0.000E+00 | 7.126E-11 |
| 355 | 0.000E+00 | 7.100E-11 |
| 360 | 0.000E+00 | 7.074E-11 |
| 365 | 0.000E+00 | 7.047E-11 |
| 370 | 0.000E+00 | 7.020E-11 |
| 375 | 0.000E+00 | 6.992E-11 |
| 380 | 0.000E+00 | 6.964E-11 |
| 385 | 0.000E+00 | 6.935E-11 |
| 390 | 0.000E+00 | 6.906E-11 |
| 395 | 0.000E+00 | 6.876E-11 |
| 400 | 0.000E+00 | 6.846E-11 |
| 405 | 0.000E+00 | 6.816E-11 |