THURBER ENGINEERING LTD.

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North Vancouver School District #44
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[redacted]

CLOVERLEY ELEMENTARY SCHOOL, NORTH VANCOUVER, BC
GEOTECHNICAL REPORT – REVISION 4

Dear [redacted]

As requested, Thurber Engineering Ltd. has completed a supplementary geotechnical investigation for the Cloverley Elementary School project. This report provides our geotechnical recommendations for the design and construction of the proposed school based on the findings from our recent and previous geotechnical investigations. The geotechnical recommendations provided in this report supersede any previously provided by Thurber via reports or emails.

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1. BACKGROUND

NVSD is planning to construct a new elementary school at 440 Hendry Avenue, North Vancouver. Conceptual architectural drawings provided by NVSD indicate that the proposed school will have two stories with no basement. We understand that this project is to be designed per the 2024 British Columbia Building Code (BCBC). Thurber is providing geotechnical services for the project with DA Architects + Planners, Aspect Structural Engineers (Aspect), KM Civil Consultants Ltd., and AMR Systems Ltd. providing architectural, structural engineering, civil engineering, and landscape services, respectively.

The property is about 7.3 acres in area and currently occupied by the decommissioned Cloverley Elementary School at the west side, a gravel field and treed areas at the center, and Cloverley Park at the east side. The site is surrounded by Hendry Avenue to the west, Shavington Street to

the south, Kennard Avenue to the east, and Cloverley Street to the north. The site slopes down at about 20° from Cloverley Street to the current school grade at which point the ground is generally flat for about 50 m before sloping down at about 20° from school grade to Shavington Street. The proposed building footprint is about 30 m by 100 m and trends southwest-northeast from the gravel field to Cloverley Park.

2. SURFICIAL GEOLOGY

Based on the Geological Survey of Canada's surficial geology map 1486A, the surficial sediments in the project area generally comprise Vashon Drift and Capilano Sediments (VCb) which include lodgment and minor flow till, lenses and interbeds of substratified glaciofluvial sand to gravel, and lenses and interbeds of glaciolacustrine laminated stony silt; bedrock is likely more than 10 m below ground surface.

3. SITE RECONNAISSANCE

On September 26, 2023, [redacted] Thurber completed a site reconnaissance of the tennis court area at the west side of Cloverley Park.

An approximately 36 m long cast-in-place (CIP) concrete retaining wall runs along the north side of the tennis court area. The wall retains a 3H:1V treed slope that extends up to Cloverley Street. The CIP wall may be a cantilever base design with an exposed wall height of about 2.75 m. Based on our visual observations the CIP wall appeared to be in fair to good condition. Some signs of fissures and hairline cracks were observed along the wall with signs of minor spalling in the concrete, possibly from poor drainage behind the wall. The wall and slope above had no visual signs of potential instability.

An approximately 37 m long split face lock block retaining wall runs along the south side of the tennis court area, retaining the south portion of the courts. The lock block wall height varies from about 1 m to 2 m high (from west to east). Based on our visual observations, the overall condition of the lock block wall appeared to be good with no visible signs of distress.

4. GEOTECHNICAL INVESTIGATIONS

Thurber completed geotechnical investigations for the project in 2021 and 2023. A summary of the work completed at each test hole location is shown in Table 4.1. The approximate locations of the test holes are shown on Drawing No. 28847-1.

Table 4.1: Test Hole Summary

Test Hole Name	Test Hole Type	DCPT	Final Depth (m)	Monitoring Well
CPT21-01	CPT	N/A	3.0	N/A
TH21-02	Auger	Yes	6.1	No
TH21-03A	Auger	No	2.0	No
TH21-03B	Auger	No	3.1	No
CPT21-03	CPT	N/A	1.2	N/A
TH21-04	Auger	Yes	9.1	No
TH21-05	Auger	Yes	9.1	Yes
TH21-06	Auger	No	9.1	No
CPT21-06	CPT	N/A	6.1	N/A
CPT21-07	CPT	N/A	6.0	N/A
TH21-08	Auger	No	5.5	No
CPT21-08	CPT	N/A	4.5	N/A
TH21-09	Auger	Yes	7.6	No
TH21-10	Auger	No	6.1	No
CPT21-10	CPT	N/A	2.5	N/A
TH21-11	Auger	Yes	9.1	Yes
TH21-12	Auger	Yes	6.3	Yes
TH21-13	Auger	Yes	6.4	No
TH23-01	Sonic	No	29.0	No
TH23-02A	Auger	No	2.7	No
TH23-02B	Auger	Yes	3.4	No
TH23-03	Auger	Yes	4.0	Yes
TH23-04	Auger	Yes	2.7	No
TH23-05	Auger	Yes	5.8	Yes
TH23-06	Auger	Yes	7.2	No

4.1 2021 Investigation

Thurber completed a geotechnical investigation in 2021 as part of a previous phase of the project. The geotechnical investigation consisted of six cone penetration tests (CPTs), 11 solid stem auger test holes, and three monitoring wells. Dynamic cone penetration tests (DCPTs) were completed adjacent to seven of the test holes. The 2021 geotechnical investigation was completed throughout the site. The logs of the 2021 Thurber test holes and the 2021 CPT testing report are attached. Details of the investigation can be found in Thurber's report titled "440 Hendry Avenue, North Vancouver, BC. Geotechnical Report" dated May 25, 2021.

4.2 2023 Investigation

The 2023 investigation consisted of drilling seven test holes at select locations within or near the proposed school building area. One sonic test hole (TH23-01) was drilled to 29.0 m depth on October 5, 2023 using a track-mounted sonic drill rig. Six solid stem auger test holes (TH23-02A, TH23-02B and TH23-3 to TH23-06) were drilled to depths between 2.7 m to 7.2 m on

October 6, 2023 using a track-mounted auger drill rig. The drill rigs were operated by Downrite Drilling Ltd. DCPTs were completed at all auger test hole locations except for TH23-02A.

A 50 mm diameter PVC casing was installed to a depth of 27.6 m at TH23-01 for downhole seismic testing. Due to premature sonic casing refusal on account of soil heaving, installation of the downhole seismic testing casing could not be completed to the target 30 m depth.

Monitoring wells (50 mm diameter) were installed at TH23-03 and TH23-05 with well screen depths of 2.3 m to 3.8 m and 3.7 m to 5.2 m, respectively.

The soil conditions encountered in the test holes were logged in the field by an experienced geotechnical technologist and representative disturbed samples were collected for routine water content and visual classification in our laboratory. Three selected samples were subjected to grain-size distribution testing using the hydrometer analysis method in accordance with ASTM D422; the grain size distribution test results are attached. Selected samples were submitted for environmental analytical testing.

The test holes were sealed in general accordance with groundwater protection regulations. Excess drill cuttings were drummed and removed offsite for disposal.

The test hole coordinates were obtained by Thurber using a handheld GPS.

4.2.1 Downhole Seismic Testing

The downhole seismic testing was completed in a 50 mm diameter PVC pipe grouted in place using a bentonite-cement grout intended to have a stiffness comparable to the in-situ soil stiffness when set. Downhole seismic testing (DST) was completed by Thurber representatives for TH23-01 on October 12, 2023.

The DST was carried out in accordance with ASTM D7400/D7400M-19. It involved lowering the geophone to the desired depth and clamping it to the side of the casing to ensure the geophone is in contact with the PVC casing. A 150 mm x 150 mm x 2.45 m timber beam was placed 0.94 m away from the PVC casing to act as a seismic source. To provide sufficient connectivity between the beam and the ground surface, the beam was weighed down using a Thurber pickup truck parked on top of the beam. Once the geophone was in place, the beam was struck and the time interval for the signal to reach the geophone was recorded. This procedure was repeated at all required depths.

Shear (S) wave tests were conducted on 1.0 m intervals. The maximum depth recorded for TH23-01 was 27 m. At each test depth a minimum of three strikes were conducted on each end of the beam. The multiple strikes allow removal of noise from passing vehicles by filtering the data and plotting the repeated signals facilitates interpretation of the data by making the first arrival time more prominent.

A high frequency filter was used during data processing. This removed the higher frequency vibrations and noise that was recorded. However, some signals remained too noisy and were omitted from the profile. The final profiles have intervals between 1 m and 2 m depth, depending on the quality of the recorded signal.

The full velocity profile is attached in tabular and graphical forms.

4.2.2 Groundwater Level Monitoring

On October 12, 2023, groundwater levels in the monitoring wells at TH23-03 and TH23-05 were read using a water level meter. At the time of reading, the wells were dry.

Automatic water level dataloggers (Solinst Leveloggers) were installed in the monitoring wells at TH23-03 and TH23-05 to record continuous water level readings at 30 minute intervals. An automatic barometric pressure datalogger (Solinst Barologger) was installed in TH23-05 to record continuous barometric pressure readings at 30 minute intervals. The barometric pressure readings will be used to compensate water level readings recorded by the water level data loggers. The dataloggers will remain in the monitoring wells for a period of about one year to assess the seasonal groundwater conditions.

5. SUBSURFACE CONDITIONS

The attached test hole logs provide a complete, detailed description of the conditions encountered and should be used in preference to the generalized description given below.

In general, the soil profile included the following (from top to bottom):

- Surficial soils – This layer comprised topsoil, asphalt, and mixed fill materials ranging from gravel, sand, and silt. The surficial soils extended up to about 1.4 m depth however in most of the test holes the thickness of this layer was less than 0.5 m.
- Silt – Below the surficial soils, a silt layer with variable gravel, sand, clay and organic content was present. The consistency of this material was variable, ranging from soft to hard but can typically be considered firm. This material is potentially compressible.

- Till-like soil – This material generally comprised dense to very dense, silty sand with variable gravel content. In our experience, boulders and cobbles may be present in this layer. Between the overlying silt layer and till-like soil, a weathered zone of till-like soils was encountered in some of the test holes. The interpreted elevation of the top of till-like soil at each test hole location is shown on Drawing No. 28847-2. The contours presented on this drawing were developed for the sole purpose of estimating depth to till-like soil, the plan is not intended to be a topographic contour plan for the site. The top surface of the till-like soil generally appears to be dipping southeast towards Shavington Street which is expected based on the overall site topography.
- Deep deposits – In the deepest test hole, TH23-01, soils generally comprising dense sands interlayered with very stiff silt containing variable gravel content were encountered within and below the till-like soil.

The water levels in the 2021 monitoring wells were measured on May 10, 2021. The depth to water below the ground surface at TH21-05 was 5.55 m, at TH21-11 was 3.85 m, and at TH21-12 was 5.05 m. The water levels in the 2023 monitoring wells were measured on October 12, 2023; the wells were dry at the time of measurement. Groundwater levels are expected to vary in response to seasonal precipitation, infiltration, and drainage conditions. We anticipate that groundwater is likely perched above the low permeability silt and till-like layers.

6. ENVIRONMENTAL ASSESSMENT

As recommended in our Phase I Environmental Site Assessment (P1ESA) report dated June 1, 2020, we completed opportunistic environmental soil sampling during the geotechnical investigations in 2021 and 2023. Select samples were submitted for laboratory analyses for Potential Contaminants of Concern (PCOCs) related to fill material from unknown sources. The objective was to characterize the soil's environmental quality and classify it for potential future soil relocation or disposal requirements.

6.1 Regulatory Context

In British Columbia, environmental matters pertaining to contaminated sites are within the jurisdiction of the Ministry of Environment and Climate Change Strategy (ENV), pursuant to the *Environmental Management Act (EMA)* (SBC 2003, Chapter 53 Assented to October 23, 2003, as amended on July 8, 2004). The key *EMA* regulation relating to the assessment and remediation of contaminated sites is the Contaminated Sites Regulation (CSR), BCC Reg. 375/96 OCC 1480/96, including amendments up to BCC Reg. 133/2022, June 6, 2022. Based on the future use of the site as a school, Residential Low Density (RLD) standards apply to site soils.

To characterize the soil for future excavation and potential off-site relocation purposes, the analytical results were compared to the Agricultural Land Use (AL, generally most stringent), Residential Low-Density Land Use (RLD), Urban Park (PL), Commercial (CL) and Industrial Land Use (IL). The following site-specific exposure pathways were applied:

- Intake of contaminated soil;
- Toxicity to soil invertebrates and plants;
- Livestock ingesting soil and fodder,
- Major microbial functional impairment,
- Groundwater used for drinking water;
- Groundwater used for livestock watering,
- Groundwater used for livestock watering, and,
- Groundwater flow to surface water used by aquatic life (freshwater and marine).

6.2 Soil Sampling and Field Screening

Environmental soil samples were collected from nine of the solid stem auger test holes in 2021 (TH21-02, TH21-05, TH21-06, TH21-08 through TH21-13) and at five of the test holes in 2023 (TH23-02, TH23-03, TH23-04, TH23-05 and TH23-06) at maximum depth intervals of 0.9 m. Each sample was then split into a field screening portion and a laboratory analysis portion.

The field screening portion of the sample was placed into a clean plastic bag and allowed to equilibrate to ambient temperature for at least 20 minutes. The vapour concentration in the headspace above the soil sample in the plastic bag was then measured using a Mini-RAE photoionization detector (PID). The maximum headspace vapour concentration for all soil samples was 13.3 parts per million by volume (ppm/v) measured in TH21-08. The headspace readings are shown on the test hole logs. Based on our observations, no visual or olfactory evidence of hydrocarbon impacts was noted.

The laboratory analysis portion of the sample was placed into clean laboratory provided glass containers and placed into a cooler with ice prior to being submitted to CARO Analytics (CARO). All soil samples and containers were handled wearing disposable nitrile gloves and any sampling tools utilized were cleaned with distilled water between uses. Soil samples were selected for analysis based on field observations, the field screening results and to provide general coverage.

6.3 Soil Analytical Program

One sample from each of TH21-08, TH21-09, TH21-11, TH21-13 and TH23-02 to TH23-06 (nine samples total) were selected for laboratory analytical testing. These test holes were located across the site, both in areas where historical fill material was reported to have been placed and in the planned footprint of the proposed school building. The samples were selected from depths

ranging between 0.2 m and 1.8 m below ground surface and submitted to CARO for laboratory analysis of Light and Heavy Extractable Petroleum Hydrocarbons (LEPH and HEPH), Polycyclic Aromatic Hydrocarbons (PAH), and metals. Based on the field screening results, none of the samples were analyzed for Volatile Organic Compounds (VOC).

The analytical results are tabulated in the tables appended to this report and compared to the applicable CSR standards. Copies of the laboratory analytical certificates are included in the attachments.

6.4 Soil Results Discussion

Based on the analytical results from 2021, there were no PCOC concentrations reported above the AL, RLD, PL, CL or IL land use standards. Analytical results received for 2023 samples indicated one confirmed exceedance:

- TH23-04-03 and duplicate: Iron (maximum 40,800 µg/g) exceeding the RLD/PL standards and applicable background concentration at a depth of 1.4 to 1.5 m bgs.

Re-analysis of sample TH23-04-03 and its duplicate was completed and of the four additional results, half of them exceeded the applicable standard and half were below. It is noted that the sample was collected from the native silt layer. Based on these observations, exceedances may be the result of natural background variation.

A statistical assessment of surficial site soils was completed. When assessed as a population using the highest exceeding value for TH23-04-03, the iron concentrations produce a lognormal distribution which is typical for background concentrations. The concentrations have an upper 90th percentile of 28,740 µg/g and an upper 95% concentration limit of 25,205 µg/g. As both these values are less than the standard and the highest concentration found is less than twice the standard, the site soils as a population are not considered contaminated.

7. ENVIRONMENTAL RECOMMENDATIONS

One iron exceedance of the applicable RLD standards was identified at the Site (location TH23-04). Based on further analysis this is likely to be due to natural variation in background concentrations and Site soils are not considered contaminated. All other samples met the applicable standards for disposal to agricultural or residential lands.

It should be noted that receiving sites may consider soil in the area of TH23-04 to exceed RLD standards. If off-site disposal is required, a targeted removal of soil from this area for disposal at a separate facility may be required prior to bulk excavation with sampling to confirm clean soils around the perimeter. For further certainty, additional drilling or test pitting could be completed to

delineate the iron exceedance prior to beginning work at the site. This soil could also be considered for re-use at the site.

8. GEOTECHNICAL RECOMMENDATIONS

8.1 General

Based on the attached architectural concept plan dated July 14, 2023 provided by NVSD, we understand that the proposed school will include a gravel play field, play areas, school building, parking lot, and driveway. The contemplated main floor elevation of the proposed school building is 50 m. Based on our review of the survey information provided by NVSD soil removal will be required to establish the grade required for the proposed school building. A grade reduction of about 3 m to 4 m and 0 m to 2 m to the west and east of the tennis court area, respectively, will be required.

The till-like soils are considered to be suitable foundation bearing materials. The soils overlying the till-like soil are potentially compressible and not considered suitable foundation bearing materials. The elevation of the till-like soil is likely variable within the proposed building footprint. On average, the top of till-like soil was encountered at about elevation 48 m within the test holes inside the proposed school building footprint. Considering the proposed school building floor elevation of 50 m, conventional pad and strip footings (i.e. shallow foundations) bearing on till-like soil or compacted structural fill overlying till-like soil is considered to be an appropriate foundation design strategy for this project.

During our investigation we were able to characterize the subsurface conditions on either side of the tennis courts. However, the subsurface conditions below the tennis courts are unknown but expected to be similar to those on either side.

The Province of British Columbia anticipates adopting the 2020 edition of the National Building Code of Canada (NBC) on March 8,2024. We understand that the proposed school building will be designed in accordance with the 2024 British Columbia Building Code (BCBC).

8.2 Seismic Assessment

8.2.1 Seismic Hazard

The seismic hazard used in the BCBC is based on the NBC. The 2018 BCBC uses the seismic hazard from the 2015 NBC and the 2024 BCBC uses the seismic hazard from the 2020 NBC.

Per the British Columbia Ministerial Order No. BA 2023 10 dated November 24, 2023, the 2024 BCBC seismic hazard will not be applicable until an effective date of March 10, 2025. Based

on our discussions with Aspect, we understand that the proposed school building is planned to be designed based on the 2018 BCBC seismic hazard. We have included the seismic hazard from both the 2018 and 2024 BCBC in this report.

Based on the shear wave velocity profile obtained from downhole seismic testing at TH23-01, the average shear wave velocity in the upper 30 m (V_{S30}) is interpreted to be 369 m/s. This corresponds to Site Class C from Table 4.1.8.4.-A of the 2018 BCBC and Table 4.1.8.4.-B of the 2024 BCBC. The shear wave velocity from 27 m to 30 m depth could not be measured due to drilling refusal, therefore the shear wave velocity in this depth range was inferred by extrapolating the value from 26 m to 27 m depth. This approach is considered conservative as shear wave velocity typically increases with depth.

8.2.1.1 2018 BCBC Seismic Hazard

The 2018 BCBC seismic hazard was determined using Natural Resource Canada's (NRC's) 2015 NBC seismic hazard calculator. The output from the calculator is attached. Since this site is classified as Site Class C, the seismic hazard from NRC's calculator can be used directly without adjusting them for site-specific properties.

8.2.1.2 2024 BCBC Seismic Hazard

The 2024 BCBC seismic hazard values corresponding to a V_{S30} of 369 m/s for the 1 in 2475-year return period earthquake obtained from NRC's 2020 NBC seismic hazard calculator are provided in Table 8.1.

Table 8.1: 2020 NBC Seismic Hazard Calculator Output

NBC 2020 – 2%/50 Years (0.000404 per annum) Probability							
$S_a(0.2, X_{369})$	$S_a(0.5, X_{369})$	$S_a(1.0, X_{369})$	$S_a(2.0, X_{369})$	$S_a(5.0, X_{369})$	$S_a(10.0, X_{369})$	$PGA(X_{369})$	$PGV(X_{369})$
1.03	0.816	0.474	0.289	0.083	0.0356	0.448	0.496

8.2.2 Liquefaction

Based on the 2021 CPTs, most of the site is considered to have low risk of liquefaction during a seismic event. Potentially liquefiable soils were identified in CPT21-06 and CPT21-07 at about 6 m depth. The post-liquefaction vertical settlements are estimated to be negligible (under 25 mm). If the proposed school building is founded on till-like soils, potentially liquefiable soils will have been removed and the consequences of liquefaction will have been effectively mitigated. Given the density, grain size distribution, and expected age, the soils below till-like deposits are not considered to be liquefiable during a seismic event.

8.3 Slope Stability

The slopes around the property are generally around 3H:1V. Slopes shallower than or equal to 3H:1V are generally stable. In addition, the slopes within the property are covered in vegetation which have a positive influence on slope stability due to root systems that reduce erosion and sloughing potential from surface water. The general topography slopes from the northwest to the southeast.

We completed a pseudo-static slope stability analysis to assess the stability of the 3H:1V slope above the proposed school building. Based on our analysis, the slope is expected to be stable under the 1 in 2475-year return period earthquake.

8.4 Site Preparation

Site preparation should include demolition of the existing structures, removal of existing pavements/fill materials and construction debris, clearing and grubbing of all vegetation, and stripping of all topsoil and deleterious soils from the building area. Utilities and existing trench fill should also be removed from the footprint of the proposed school building. The site should then be excavated to design grades. Any remaining surficial topsoil, fill, and underlying silt should then be removed to expose the till-like soil. Once this is complete, Thurber should review the exposed ground surface and advise on the extent of any additional subexcavation which may be necessary.

All excavations should be undertaken using an excavator equipped with a smooth clean out bucket. Once exposed, the subgrade soils will be vulnerable to moisture. To protect the subgrade, the site should be contoured to promote drainage and traffic/workers should be directed around areas of exposed subgrade. Where work on the exposed subgrade is necessary it should first be covered with a 150 mm lift of compacted structural fill or 75 mm layer of blinding concrete.

8.5 Groundwater Seepage

Groundwater may seep into proposed excavations. We expect that the rate of groundwater flow into excavations during construction will be minimal and that using conventional sumps and pumps should be feasible to manage groundwater.

8.6 Fill Placement

Where necessary, excavations may be backfilled, and site grades raised using structural fill. Structural fill material should comprise clean, well-graded granular soil such as clean (less than

5% passing the #200 sieve) pit run gravel (maximum particle size 75 mm) or select granular sub-base as defined in the Master Municipal Construction Documents (MMCD). Structural fill materials must be free of organics and other deleterious material. Samples or representative gradation curves of any proposed material should be submitted to Thurber for review and approval prior to use.

Structural fill should be placed in maximum loose lifts of 300 mm, compacted to a minimum of 100% standard Proctor maximum dry density (SPMDD) using suitable equipment. Quality assurance field compaction tests should be carried out by Thurber to confirm adequacy of the fill compaction. The contractor will be responsible for completing quality control testing.

The shallow soils on site comprise variable surficial soils, silt, and till-like soil. Due to their generally variable fines content, we do not consider these soils to be suitable for use as structural fill below footings. These soils could likely be re-used in areas of soft landscaping.

8.7 Foundation Design

The proposed school building can be founded on pad and strip footings bearing on till-like soil or on compacted structural fill overlying till-like soil. The serviceability limit state (SLS) and factored ultimate limit state (ULS) bearing resistances for footings founded as discussed are provided in Table 8.2. The SLS bearing resistance is based on less than 25 mm of settlement. The 2024 BCBC allows for a seismic overstrength factor of 1.5 to be applied to the factored ULS bearing resistance under seismic loading conditions.

Table 8.2: SLS and ULS Bearing Resistances

Bearing Material	SLS Bearing Resistance (kPa)	ULS Factored Bearing Resistance (kPa)
Structural Fill	150	200
Till-like soils	230	350

Strip footings for the building should be at least 450 mm wide and pad footings should have a minimum dimension of 600 mm. For confinement and frost protection purposes, all footings should be located a minimum of 450 mm below grade. Footings should be installed on level ground and any loads must be concentrically and vertically applied to the footing.

Footings founded at shallow depths may impart stresses onto adjacent foundations, utilities, etc. Bridging, deepening, or utility relocations may be required to address this. Footings should be located such that the risk of significant stress increase on the adjacent footings or foundation walls is mitigated. Footings should generally be founded below a plane projected up at 2H:1V from any lower footing excavation or load-sensitive structure.

The sliding of foundations should be resisted by friction at the interface between concrete and the foundation soils. We recommend using a factored ULS coefficient of friction of 0.36 for footings founded on structural fill or till-like soils.

From discussions with Aspect, we understand that seismic foundations comprising long, deep, strip footings are being considered for the project with typical footing dimensions of 14 m long by 3 m wide by 1 m thick. For structural design of the seismic foundations, we recommend using a modulus of subgrade reaction (k_v) of 60 MPa/m. This modulus of subgrade reaction should be doubled along the edges of the footings and quadrupled at the corners. The width of this edge zone can be taken as 0.5 m. The modulus of subgrade reaction is not a soil parameter. It is a response of a soil system to load application and is dependent on several factors including the size of the loaded area, the layering of the subgrade soils, the non-linear shear modulus, the direction of loading, the type of loading, and other factors. To assess the sensitivity of the foundation system to variation in the subgrade stiffness, we recommend that the provided modulus of subgrade reaction value be varied by factors of 0.5 and 5. The modulus of subgrade reaction provided is intended for structural modelling of the foundation only and is not suitable for evaluating settlement.

We can improve our estimate of k_v further using 3D finite element method (FEM) analyses if required. To complete 3D FEM analyses, we will require structural footing dimensions and foundation loads.

8.8 Slab-on-Grade

To provide adequate support for slab-on-grade, any soft materials encountered at the subgrade level should be sub-excavated and replaced with well-compacted fill. The subgrade surface should be compacted to at least 100% SPMDD. Groundwater may be encountered during the sub-excavation and replacement process.

A 150 mm thick layer of compacted granular fill should be provided immediately beneath slab-on-grade areas. The compacted layer of granular material will provide under slab drainage and enable final levelling prior to concrete placement.

Granular material such as minus 19 mm crushed gravel and sand with less than 5% passing the #200 sieve (or less than 0.075 mm) is appropriate as base fill beneath the floor slab. A vapour barrier comprising 6-mil (minimum) polyethylene sheeting should be placed on top of the granular fill. The polyethylene sheets should typically be overlapped a minimum of 300 mm. Depending on the angularity of the granular fill used and level of traffic on the sheeting, a lightweight non-woven geotextile could be placed on top of the granular fill, prior to the polyethylene sheeting, to reduce the risk of punctures. Well-graded materials have the potential to allow moisture in the soil to rise to the vapour barrier which could result in a damp top surface of the concrete slab, especially where the vapour barrier is punctured or compromised during construction if a non-woven layer is not provided. The minus 19 mm crushed gravel and sand should be compacted to at least 100% SPMDD.

8.9 Perimeter Drains

Perimeter drains should be installed around the perimeter of the proposed school building at a minimum 300 mm below the finished floor slab level, but not lower than the perimeter foundation elevation. The perimeter drains should be hydraulically connected to the under-slab drainage layer.

The perimeter drains should comprise a minimum 150 mm diameter perforated PVC pipe connected to a suitable point of gravity discharge. The perimeter drains should be surrounded by at least 150 mm of 19 mm clear crushed gravel that is wrapped in non-woven geotextile (filter fabric). Backfill placed above the perimeter drains may consist of structural fill and should be compacted in 300 mm lifts to 100% SPMDD. A low permeability capping fill should be placed above the perimeter drain trench backfill to prevent surface water from infiltrating into the drain. Within 2 m of the building, the yard grade should be sloped to direct surface drainage away from the building.

The purpose of these drainage and backfill provisions is to prevent the buildup of hydrostatic pressures against the floor slab. Any water-proofing and damp-proofing requirements are the responsibility of others.

The contractor should assess the drainage system of CIP retaining wall north of tennis courts during construction. If the CIP wall is to remain in place and the drainage system is not function, then it should be repaired or replaced and connected to the City of North Vancouver (the City) storm system.

8.10 Lateral Earth Pressures

The provided conceptual architectural drawings do not show any retaining walls. We have provided conceptual recommendations below for the project structural engineer if retaining walls are required. If retaining walls are required then Thurber should have the opportunity to update the recommendations provided. CIP walls are typically designed by structural engineers. If other types of retaining walls such as mechanically stabilized earth (MSE), gravity segmental block, anchored shotcrete, or cantilevered walls are required, then Thurber should be contacted to provide a separate retaining wall design memorandum.

Retaining walls should be backfilled using the same materials as recommended for structural fill. The material must be clean (less than 5% passing the #200 sieve) sand and gravel for both drainage considerations and to reduce lateral earth pressures. The backfill should be compacted to 100% SPMDD.

The non-seismic lateral earth pressures can be calculated as an equivalent hydrostatic pressure (triangular distribution) using equivalent fluid densities of 4.9 kN/m^3 for yielding walls (active earth pressures). This value assumes a soil unit weight of 20 kN/m^3 and an active earth pressure coefficient (K_a) of 0.245. The effect of surcharge pressures (e.g. adjacent shallow foundations and slab loads) can be calculated using the provided K_a. The seismic component of the lateral force on yielding walls can be calculated using 3 kPa per meter times the height of the wall. We recommend applying the seismic component of the lateral earth pressure as an inverted triangular distribution.

For laterally restrained walls (at-rest conditions), static lateral earth pressures can be estimated using a hydrostatic pressure distribution with an equivalent fluid density of 8.8 kN/m^3. This value assumes a soil unit weight of 20 kN/m^3 and an at-rest earth pressure coefficient (K_0) of 0.44. To account for compaction and surcharge pressures, the static earth pressures should be taken as the larger of the hydrostatic pressure combined with the lateral surcharge pressure or the hydrostatic pressure combined with the lateral compaction pressure. The lateral surcharge pressure can be calculated by multiplying the vertical surcharge pressure by the provided K_0. The compaction pressure can be applied as a 12 kPa uniform pressure distribution. Surcharge and compaction pressures can be applied as rectangular pressure from ground surface to where it intersects the hydrostatic pressure distribution.

The lateral earth pressures provided assume that free draining backfill is used behind the retaining walls and that the retaining wall has a functional drainage system. It is critical that the retaining wall drainage system is maintained and functional. We recommend that the drainage system

should comprise a 150 mm diameter perforated PVC pipe; the pipe should be encased in a 300 mm wide zone of clear crush gravel and wrapped in non-woven geotextile. The drainage system should drain away from the retaining wall and be connected to a suitable point of gravity discharge.

We recommend that the design of the any cast in place permanent retaining walls using active earth pressures incorporate a battered wall face to accommodate wall rotation. The wall batter can be nominally taken to be 1H:20V.

8.11 Pavement Structure

The pavement structure should be supported on a competent subgrade. Competent subgrade could be compacted existing granular fill, firm silt, till-like soil, or compacted structural fill. The subgrade should be proof rolled and visually observed; any soft spots or areas with deleterious material (poor-quality fill, topsoil etc.) should be subexcavated and replaced with select granular subbase compacted to at least 95% modified proctor maximum dry density. The proof-rolling and subgrade preparation should be reviewed by Thurber prior to placement of any subbase. The subgrade preparation and the granular base and sub-base layer should extend a minimum of 1.5 m beyond the perimeter of all paved areas. Pavement subgrade preparation and supply, placement and compaction of the pavement structure should be in accordance with specifications provided in the MMCD.

The City pavement structure, as shown in Table 8.3, is considered appropriate for this site. The local road pavement structure may be used for the proposed parking lot and driveway.

Table 8.3: City of North Vancouver Road Specifications (from Drawing R2S)

	MILL AND PAVE RESTORATION	UPPER COURSE ASPHALT	LOWER COURSE ASPHALT	BASE COURSE	SUB-BASE COURSE
ARTERIAL	50mm	50mm UPPER COURSE 1	75mm LOWER COURSE 2	100mm 19mm CRUSHED GRANULAR BASE	200mm 75mm CRUSHED GRANULAR SUB-BASE
COLLECTOR	50mm	40mm UPPER COURSE 1	60mm LOWER COURSE 2	100mm 19mm CRUSHED GRANULAR BASE	200mm 75mm CRUSHED GRANULAR SUB-BASE
LOCAL	50mm	40mm UPPER COURSE 1	40mm LOWER COURSE 2	100mm 19mm CRUSHED GRANULAR BASE	200mm 75mm CRUSHED GRANULAR SUB-BASE
TRUCK ROUTE	50mm	50mm UPPER COURSE 1	75mm LOWER COURSE 2	100mm 19mm CRUSHED GRANULAR BASE	200mm 75mm CRUSHED GRANULAR SUB-BASE
COMMERCIAL LANE	50mm	40mm UPPER COURSE 1	60mm LOWER COURSE 2	100mm 19mm CRUSHED GRANULAR BASE	100mm 75mm CRUSHED GRANULAR SUB-BASE
RESIDENTIAL LANE	50mm	35mm UPPER COURSE 1	40mm LOWER COURSE 2	100mm 19mm CRUSHED GRANULAR BASE	100mm 75mm CRUSHED GRANULAR SUB-BASE

To increase pavement life, construction traffic on paved areas should be avoided by delaying paving operations as late as possible in the construction schedule. Designated access and egress routes should be defined to limit potential pavement damage or failure. These routes will be susceptible to premature pavement damage/failure and may have a reduced service life compared with the remainder of the roadways.

8.12 Underground Services and Utilities

Underground services and utilities that run parallel to a footing should be located above a plane projected down at 1H:1V from the bottom edge of the footing. We note that an angle flatter than 1H:1V is preferable where unsupported cuts are used or where future maintenance of the service will be required.

Installation of buried utilities should conform to the MMCD and the City's specifications.

8.13 Hydraulic Conductivity for Groundwater Infiltration Systems

We understand from NVSD that rain gardens are being considered for this project. These features rely on collection of stormwater and infiltration into site soils.

The near surface soils generally comprise sandy silt, clayey silt, sand and silt, and till-like soil. We have estimated the hydraulic conductivity of these soils based on grain size distribution testing results, typical values for these materials, and our local experience. Table 8.4 summarizes the estimated upper and lower bounds in hydraulic conductivity for the near surface soils.

Table 8.4: Estimated Hydraulic Conductivity of Near Surface Soils

Soil Type (USCS)	Lower Bound Hydraulic Conductivity (m/s)	Upper Bound Hydraulic Conductivity (m/s)
Sandy silt (ML)	$1x10^{-08}$	$1x10^{-04}$
Clayey silt (CL)	$1x10^{-10}$	$2x10^{-07}$
Sand and silt (SM/ML)	$1x10^{-08}$	$1x10^{-04}$
Till-like soil (SM/ML)	$1 x10^{-08}$	$1x10^{-07}$

The near surface soils are relatively low permeability materials and would not make a suitable base for an infiltration system. If the designer of any proposed infiltration system decides to proceed with rain garden type designs, we recommend that all designs include an overflow that conveys water into the City stormwater collection system.

8.14 Radon

Based on the online British Columbia Center for Disease Control – British Columbia Radon Map, the risk of encountering high levels of radon are considered low at this site. The site is located within a zone corresponding to typically to between 0 to 200 Bq/m^3 (Becquerels per cubic metre) and possibly higher in 1% of homes. The building envelope consultant should consider radon potential during design.

8.15 Temporary Excavations

All temporary works including excavation, shoring and dewatering should be undertaken in conformance with WorkSafeBC Occupational Health and Safety Regulations (OHSR). However, excavations should be prepared at 1H:1V or flatter in loose to compact granular material and soft to firm fine-grained soils. In order to confirm geotechnical conditions, all excavations must be reviewed by a geotechnical engineer following excavation but prior to worker entry where required by OHSR Part 20.

Extra caution must be used by the contractor when considering any required excavations near existing retaining walls. Detailed information about the existing wall(s) will likely be necessary to assess temporary stability.

Any groundwater encountered during completion of the excavation will need to be controlled by surface ditching, sumps, and pumps. All unsupported slopes should be protected from soil erosion by plastic sheeting or other protective materials.

Excavations more than 1.2 m deep will need to be designed and reviewed by Thurber in accordance with the WorkSafeBC OSHR.

9. ADDITIONAL COMMENTS

Thurber was asked to review the claims of the possible presence of underground streams within the project area. Our review was limited to available information which included review of a 2014 surficial geology map of North Vancouver, and air photos dating back to 1926. Based on this limited review of available information, it appears that underground streams are not present on site.

10. CONSTRUCTION PHASE SERVICES

In accordance with EGBC requirements, Thurber should be contacted to undertake geotechnical field reviews during construction. The purpose of our field reviews would be to assess whether

the soil and groundwater conditions are consistent with our interpretations, and to assess whether the contractor is completing the work in general accordance with our recommendations. Geotechnical field reviews will be necessary for us to provide the Letters of Assurance required under the BCBC. Our construction field review services should consist of the following:

- Review and laboratory testing of proposed fill materials to be used for construction;
- Review of exposed subgrade preparation;
- Review footing excavations and advise of any necessary sub-excavation required;
- Review of contractor submittals; and
- Compaction, visual review and testing of backfill materials

11. CLOSURE

We trust that this information is sufficient for your needs. Should you require clarification of any item or additional information, please contact us at your convenience.

Yours truly,
Thurber Engineering Ltd.

[redacted]
Review Engineer

[redacted]
Geotechnical Engineer

[redacted]
Environmental Engineer

Attachments
- Statement of Limitations and Conditions
- Architectural Concept Plan dated July 14, 2023
- Drawing No. 28847-1: Test Hole Location Plan
- Drawing No. 28847-2: Site Plan with Till-like Soil Elevations Marked

Thurber Engineering Ltd.
Permit #1001319

- Symbols and Terms
- Appendix A - 2021 Test Hole Logs
- Appendix B - 2021 CPT Report
- Appendix C - 2023 Test Hole Logs
- Appendix D - 2023 Grain Size Distribution Testing Results
- Appendix E - Downhole Seismic Testing Results
- Appendix F - Environmental Analytical Results
- Appendix G - Laboratory Analytical Certificates
- Appendix H - NRC 2015 NBC Seismic Hazard Calculator Output

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

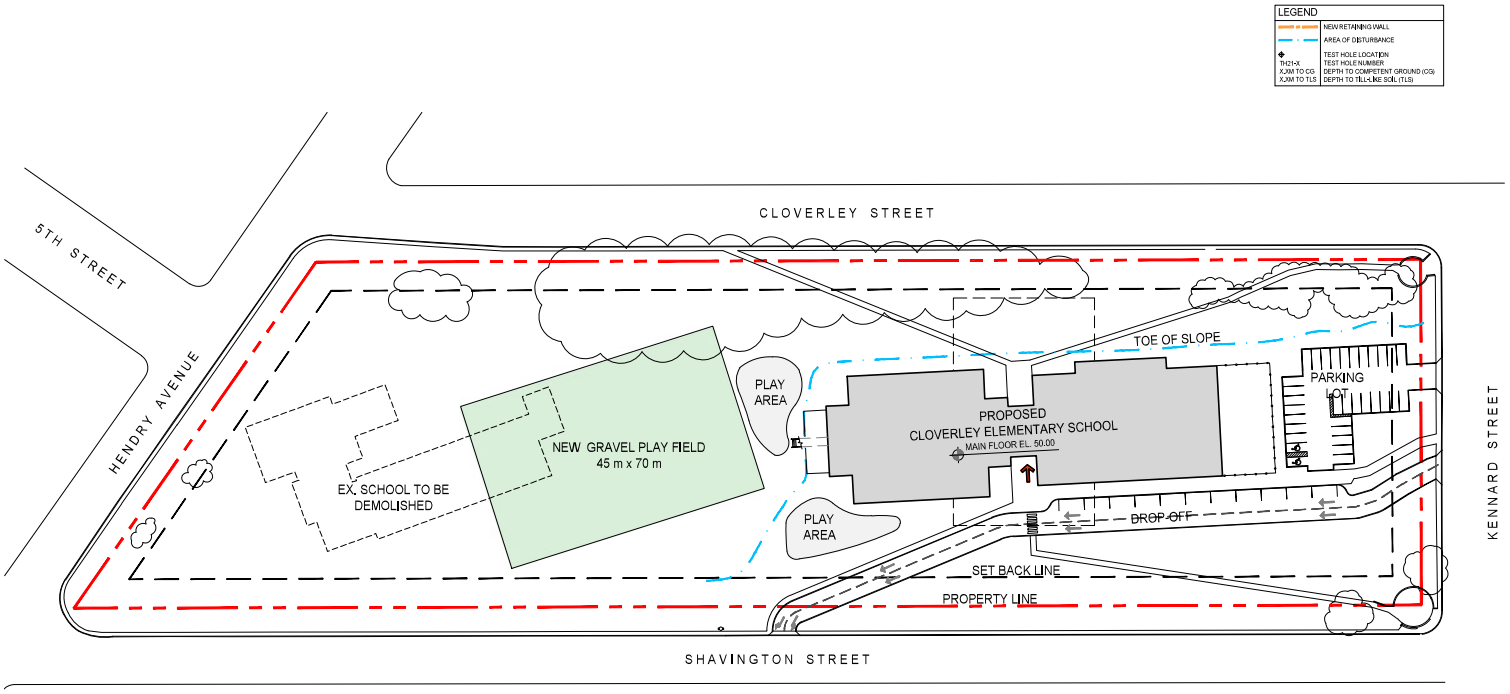
d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.



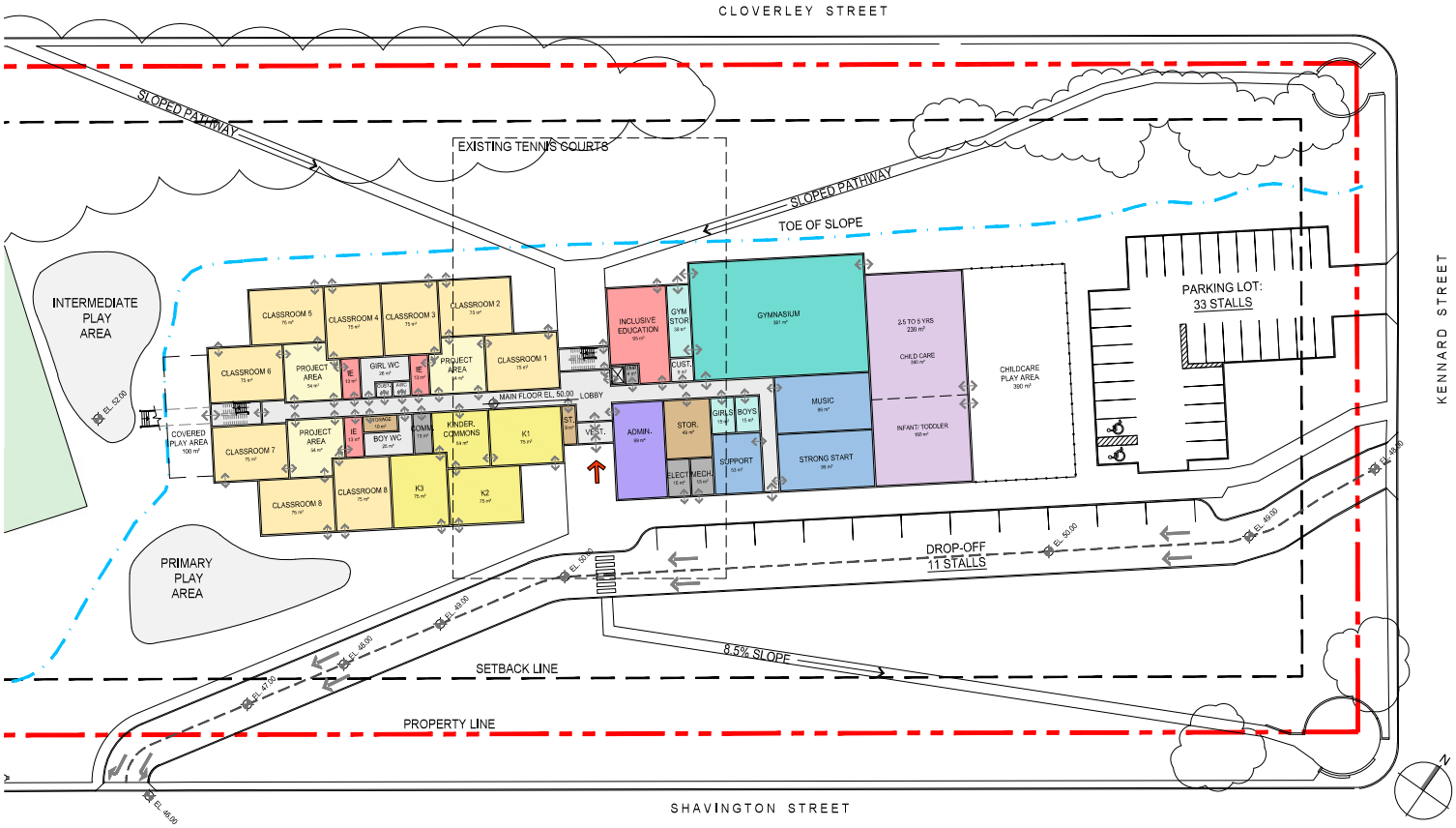
CONCEPT PLAN - PROPOSED SITE PLAN

CLOVERLEY ELEMENTARY SCHOOL

1:1000 2023.07.14

DA Architects + Planners

North Vancouver School District
the natural place to learn!



CONCEPT PLAN - ENLARGED PROPOSED SITE PLAN

CLOVERLEY ELEMENTARY SCHOOL

1:500 2023.07.14

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CONCEPT PLAN - LEVEL 01 FLOOR PLAN

CLOVERLEY ELEMENTARY SCHOOL

1:300 2023.07.14

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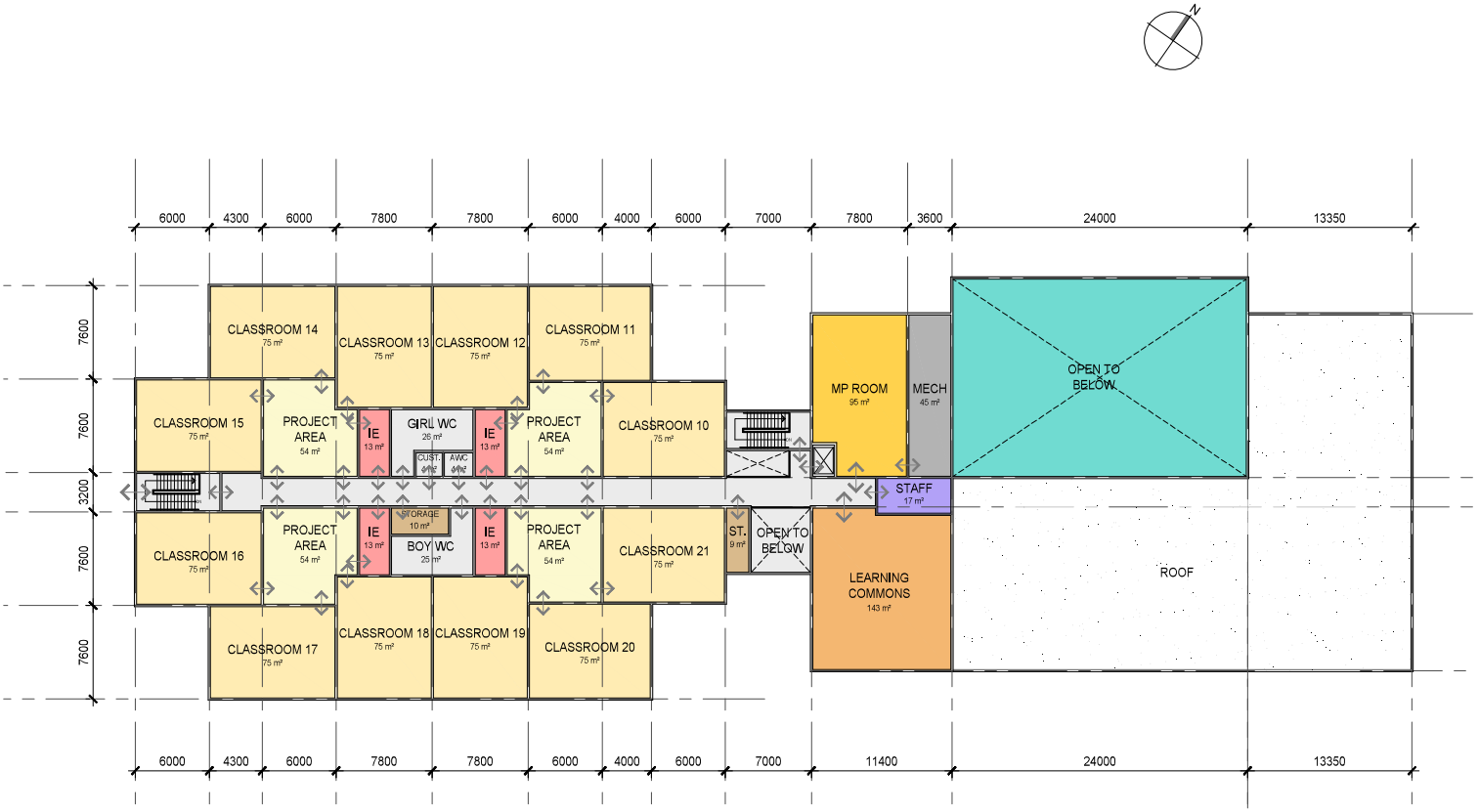

CONCEPT PLAN - LEVEL 02 FLOOR PLAN

CLOVERLEY ELEMENTARY SCHOOL

1:300 2023.07.14

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PROGRAM	DAS (m²)	ACTUAL (m²)	COMMENTS
REPLACEMENT SCHOOL PROGRAM			
ADMIN/ HEALTH	110	106	
GENERAL INSTRUCTION	1680	1572	
PROJECT AREA		378	Area taken from: 108 sm from General Instruction 57 sm from Media/ Tech. 54 sm from Inclusive Ed.
GENERAL STORAGE	80	88	
GYM ACTIVITY	380	381	
GYM ANCILLARY	65	60	
MEDIA/ TECH.	200	143	
MULTIPURPOSE	100	95	
INCLUSIVE ED.	240	186	
MECHANICAL	105	93	
KINDERGARTEN	270	278	
DESIGN SPACE	890	738	
SUBTOTAL:	4120	**4119**	
NEIGHBOURHOOD LEARNING CENTRE (NLC)			
MUSIC		99	
STRONG START		99	
SUPPORT SPACE		53	
DESIGN SPACE		79	
SUBTOTAL:	330	330	
CHILD CARE	390	390	
TOTAL AREA	**4840**	**4839**	

TOTAL FLOOR AREA	DAS (m²)	ACTUAL (m²)
LEVEL 01 FLOOR AREA		2298
LEVEL 02 FLOOR AREA		1821
TOTAL AREA:	**4120**	**4119**
ADDITIONAL PROGRAMS		
NLC	330	330
CHILD CARE	390	390
TOTAL AREA:	**4840**	**4839**

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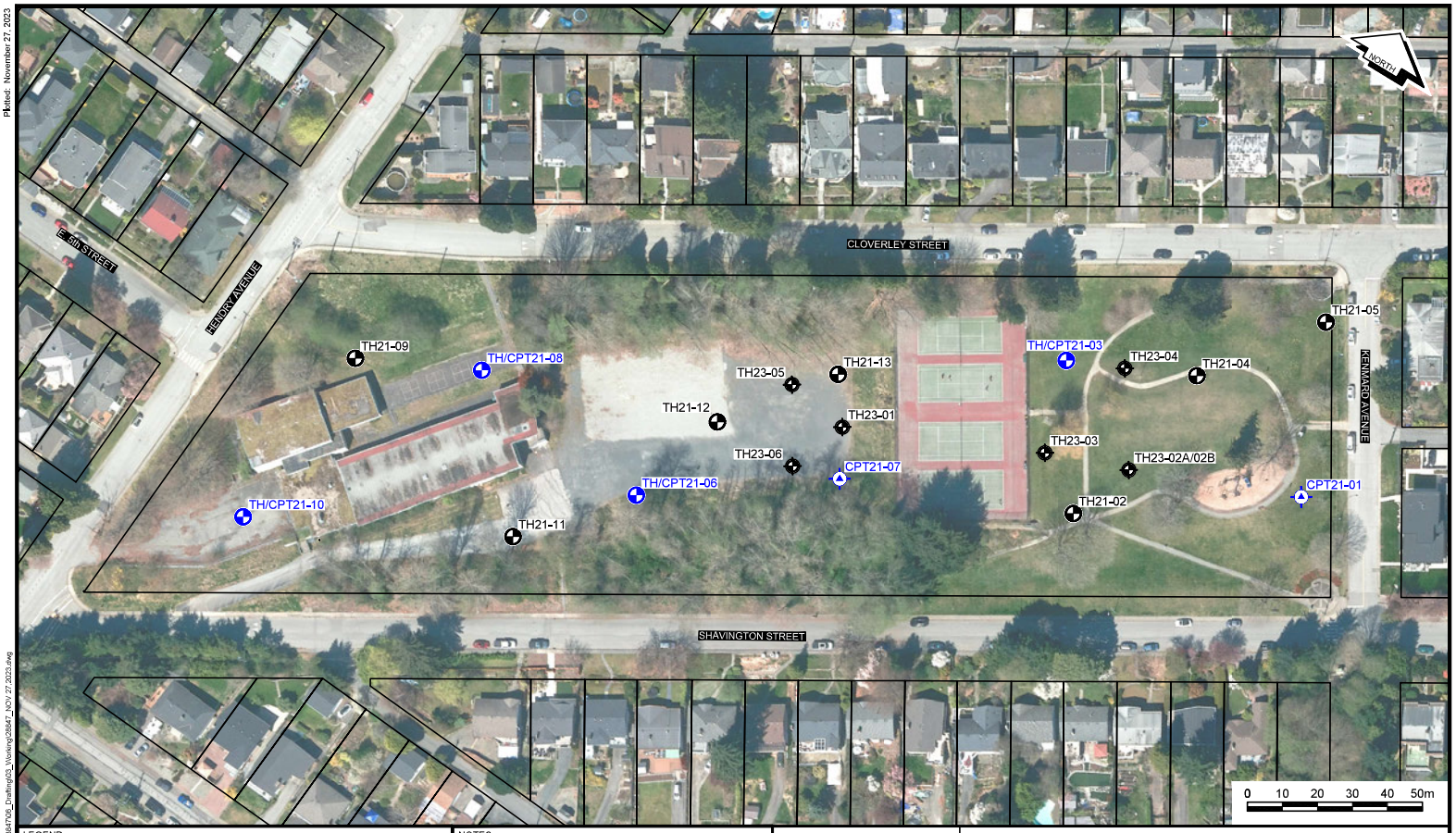
CONCEPT PLAN - AREA SUMMARY
CLOVERLEY ELEMENTARY SCHOOL
2023.07.14

Plotted: November 27, 2023



LEGEND:

- TEST HOLE (2021)
- TEST HOLE (2023)
- TEST HOLE / CPT (2021)
- CPT (2021)

NOTES:

1. 2021 AERIAL IMAGE TAKEN FROM THE WORLD IMAGERY SERVER.
2. PARCEL LINES TAKEN FROM IMAP BC.
3. TEST HOLE LOCATIONS ARE APPROXIMATE.

THURBER ENGINEERING LTD.

NORTH VANCOUVER SCHOOL DISTRICT No. 44

TEST HOLE LOCATION PLAN

CLOVERLEY ELEMENTARY SCHOOL — NORTH VANCOUVER, BC

DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	DWG. NO.	REV.
KTD / IFA	MOM	LP	NOV. 27, 2023	1:1000	28847 - 1		1

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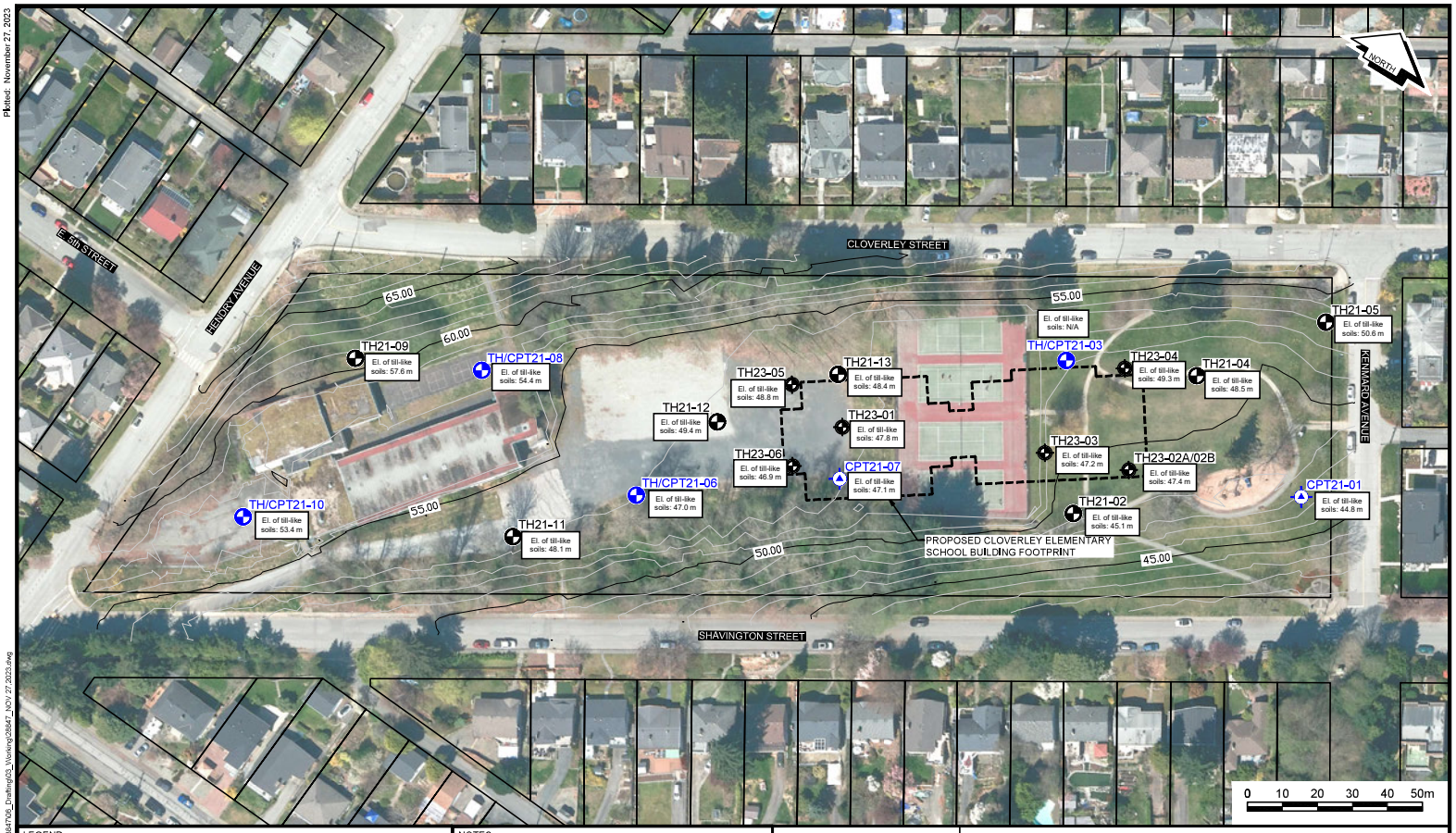
Plotted: November 27, 2023



LEGEND:

- TEST HOLE (2021)
- TEST HOLE (2023)
- TEST HOLE / CPT (2021)
- CPT (2021)

NOTES:

1. 2021 AERIAL IMAGE TAKEN FROM THE WORLD IMAGERY SERVER.
2. PARCEL LINES TAKEN FROM IMAP BC.
3. TEST HOLE LOCATIONS ARE APPROXIMATE.
4. CONTOURS DERIVED FROM SURVEY FILE "ACAD-V09031-TOP-01-M-MRS-MODEL.DWG."
5. CONTOURS ARE 1 m INTERVALS.

THURBER ENGINEERING LTD.

NORTH VANCOUVER SCHOOL DISTRICT No. 44

SITE PLAN

CLOVERLEY ELEMENTARY SCHOOL — NORTH VANCOUVER, BC

DESIGNED	DRAWN	APPROVED	DATE	SCALE	PROJECT No.	DWG. NO.	REV.
KTD / IFA	MOM	LP	NOV. 27, 2023	1:1000	28847 - 2		1

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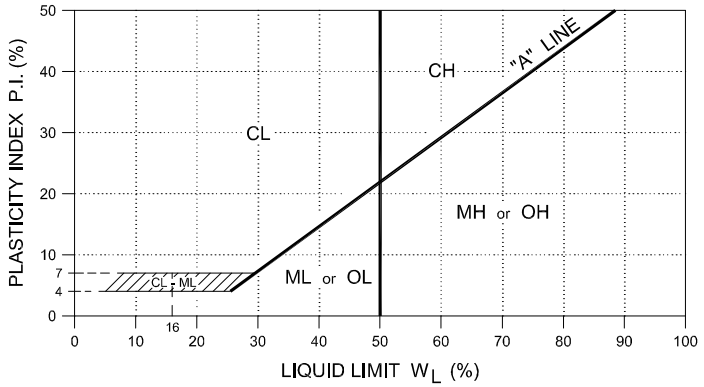
THURBER

UNIFIED CLASSIFICATION SYSTEM FOR SOILS (ASTM D2487)

MAJOR DIVISION			SYMBOLS GROUP	SYMBOLS GRAPH	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE-GRAINED SOILS (MORE THAN 50% BY WEIGHT RETAINED ON No. 200 SIEVE)	GRAVELS MORE THAN 50% COARSE FRACTION RETAINED ON No. 4 SIEVE	CLEAN GRAVELS (< 5% FINES)	GW		WELL GRADED GRAVEL and WELL GRADED GRAVEL with SAND.	$C_U = \frac{D_{60}}{D_{10}} \geq 4 \quad C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$
			GP		POORLY GRADED GRAVEL and POORLY GRADED GRAVEL with SAND.	NOT MEETING ABOVE REQUIREMENTS
		GRAVELS WITH FINES (> 12% FINES)	GM		SILTY GRAVEL, GRAVEL - SAND - SILT MIXTURES.	FINES CLASSIFY AS ML or MH (3)
			GC		CLAYEY GRAVEL, GRAVEL - SAND - CLAY MIXTURES.	FINES CLASSIFY AS CL or CH (3)
	SANDS MORE THAN 50% COARSE FRACTION PASSES No. 4 SIEVE	CLEAN SANDS (< 5% FINES)	SW		WELL GRADED SAND and WELL GRADED SAND with GRAVEL	$C_U = \frac{D_{60}}{D_{10}} \geq 6 \quad C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$
			SP		POORLY GRADED SAND and POORLY GRADED SAND with GRAVEL.	NOT MEETING ABOVE REQUIREMENTS
		SANDS WITH FINES (> 12% FINES)	SM		SILTY SAND, SAND - SILT MIXTURES.	FINES CLASSIFY AS ML or MH (3)
			SC		CLAYEY SAND, SAND - CLAY MIXTURES.	FINES CLASSIFY AS CL or CH (3)
FINE-GRAINED SOILS (MORE THAN 50% BY WEIGHT PASSES No. 200 SIEVE)	SILTS BELOW "A" LINE NEGLIGIBLE ORGANIC CONTENT	W_L < 50%	ML		INORGANIC SILTS, SILTS with SAND and SILTS with GRAVEL and SANDY or GRAVELLY SILTS.	P.I. < 4 or PLOTS BELOW THE "A" LINE
		W_L > 50%	MH		INORGANIC SILTS, SILTS with SAND & SILTS with GRAVEL & SANDY or GRAVELLY SILTS, FINE SANDY or SILTY SOILS.	P.I. PLOTS BELOW THE "A" LINE
	CLAYS ABOVE "A" LINE ON PLASTICITY CHART NEGLIGIBLE ORGANIC CONTENT	W_L < 50%	CL		INORGANIC CLAYS of LOW PLASTICITY, GRAVELLY, SANDY, or SILTY CLAYS, LEAN CLAYS.	P.I. > 7 and PLOTS ON OR ABOVE THE "A" LINE
		W_L near 50%	CL-CH		BORDERLINE INORGANIC CLAYS and SILTY CLAYS with LIQUID LIMITS NEAR 50%.	(only used for visual identification)
		W_L > 50%	CH		INORGANIC CLAYS of HIGH PLASTICITY, FAT CLAYS.	P.I. PLOTS ON OR ABOVE THE "A" LINE
	ORGANIC SILTS and CLAYS	W_L < 50%	OL		ORGANIC SILTS and ORGANIC SILTY CLAYS of LOW PLASTICITY.	$\frac{W_L \text{ (oven dried)}}{W_L \text{ (not dried)}} < 0.75$
		W_L > 50%	OH		ORGANIC CLAYS OF HIGH PLASTICITY.	$\frac{W_L \text{ (oven dried)}}{W_L \text{ (not dried)}} < 0.75$
HIGHLY ORGANIC SOILS			PT		PEAT and other HIGHLY ORGANIC SOILS.	STRONG COLOR OR ODOR, AND OFTEN FIBROUS TEXTURE.

PLASTICITY CHART FOR SOILS PASSING No. 40 SIEVE



NOTES:

1. ALL SIEVE SIZES ARE U.S. STANDARD, A.S.T.M. E11-04.
2. COARSE GRAINED SOILS WITH 5 TO 12% FINES REQUIRE DUAL SYMBOLS (GW-GM, GW-GC, GP-GM, GP-GC, SW-SM, SW-SC, SP-SM, SP-SC).
3. IF FINES CLASSIFY CL-ML USE DUAL SYMBOL (GC-GM or SC-SM).
4. WHERE TESTING IS NOT CARRIED OUT, THE IDENTIFICATIONS ARE DETERMINED BY VISUAL-MANUAL PROCEDURES DESCRIBED IN ASTM D2488-06.

THURBER

SYMBOLS AND TERMS USED ON TEST LOGS

1. PARTICLE SIZE CLASSIFICATION OF MINERAL SOILS

DESCRIPTION		APPARENT PARTICLE SIZE
BOULDERS		> 200 mm
COBBLES		75 mm to 200 mm
GRAVEL	coarse	19 mm to 75 mm
	fine	4.75 mm to 19 mm
SAND	coarse	2 mm to 4.75 mm
	medium	0.475 mm to 2 mm
	fine	0.075 mm to 0.475 mm
SILT		Non-plastic particles, not visible to the naked eye
CLAY		Plastic particles, not visible to the naked eye

NOTE: Metric Conversion is approximate only

2. TERMS DESCRIBING CONSISTENCY (Cohesive Soils Only)

DESCRIPTION	APPROXIMATE UNDRAINED SHEAR STRENGTH
Very Soft	Less than 10 kPa (250 psf)
Soft	10 to 25 kPa (250 - 500 psf)
Firm	25 to 50 kPa (500 - 1000 psf)
Stiff	50 to 100 kPa (1000 - 2000 psf)
Very Stiff	100 to 200 kPa (2000 - 4000 psf)
Hard	Greater than 200 kPa (4000 psf)

NOTE: Metric Conversion is approximate only

3. TERMS DESCRIBING DENSITY (Cohesionless Soils Only)

DESCRIPTION	STANDARD PENETRATION TEST Number of blows per foot (300 mm) *
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	over 50

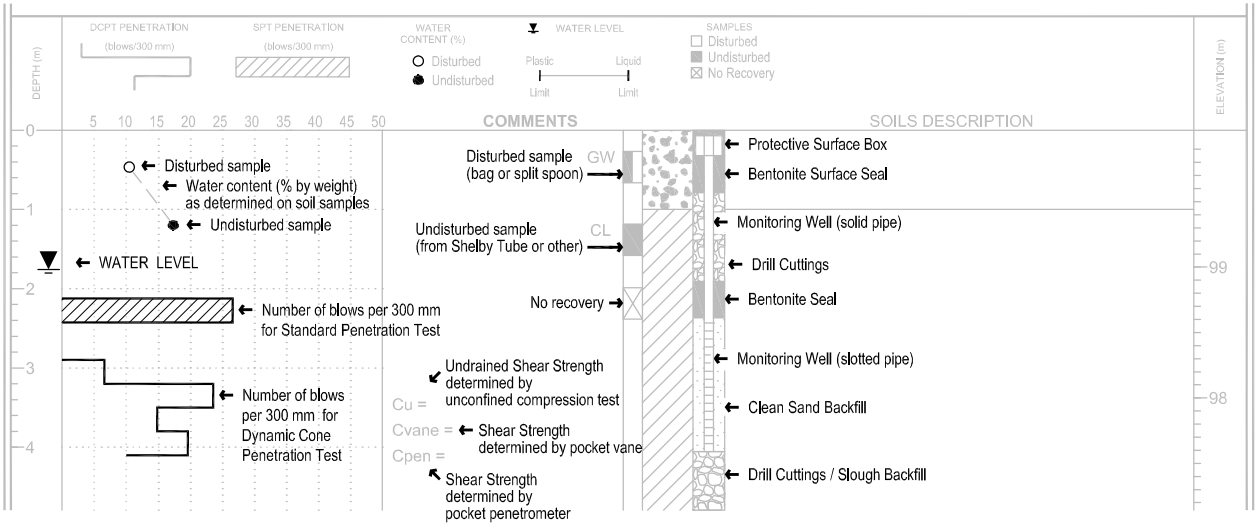
** Directly applicable to sands and, with interpretation, to gravels*

4. PROPORTION OF MINOR COMPONENTS BY WEIGHT

DESCRIPTION	PERCENT BY WEIGHT
and	35 to 50 %
y / ey	20 to 35 %
some	10 to 20 %
trace	less than 10 %

EXAMPLE: Silty SAND, trace of gravel = Sand with 20 to 35% silt and up to 10% gravel, by dry weight. (Percentages of secondary materials are estimates based on visual and tactile assessment of samples).

5. LEGEND FOR TEST HOLE LOGS *(Typical only showing commonly included elements)*



Client: TEL Standard Detail
File No.: n/a
E-File: UCSFS-20140807.dwg

Revised: August 07, 2014

THURBER

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-02

LOCATION: See DWG. 28847-1
N 5462069, E 496447 (Est.)

TOP OF HOLE ELEV: 49.2 m (Est.)
METHOD: Solid Stem Auger / DCPT
DRILLING CO.: On-Track Drilling Inc.
INSPECTOR: MM

THURBER

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 19, 2021
FILE NO.: 28847
REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0			TOPSOIL.	49
		ML	Firm to stiff, grey-brown with some mottling SILT with traces of sand, clay, gravel, asphalt fragments and organics (FILL).	
1				48
		OL/ML	Soft to firm, grey with dark brown zones and some mottling, SILT with some organics and mottling, a trace to some organic silt and traces of asphalt fragments, sand and clay (FILL).	
2		OL	Soft, dark brown SILT with some sand and a trace to some organic silt and organics.	47
		ML	Stiff to very stiff, grey with some mottling SILT with some sand to sandy and a trace of clay.	
3				46
		SM & CL	Compact, mixed zones of brown SAND with some silt and grey-brown SILT with some clay to clayey. - very dense below 3.7 m depth	
4	DCPT Refusal >50 blows for 200 mm penetration	SM	Grey, gravelly SAND with some silt to silty and some zones of silt with a trace to some clay and sand (TILL-like).	45
			Grey, silty SAND with some gravel and cobbles (TILL-like).	
5		SM		44
			Mixed zones of grey-brown SAND with some silt to silty and brown-grey SILT with some gravel, a trace to some sand and clay (TILL-like).	
6		SM & ML/CL		
			Irrigation pipe observed in the side wall of test hole at 1.0 m depth. End of hole when irrigation piping was observed. Hole open to 6.0 m depth. No water observed upon completion of drilling.	43
7				42
8				41
9				40
10				

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-03A

LOCATION: See DWG. 28847-1
N 5462104, E 496421 (Est.)

TOP OF HOLE ELEV: 51.1 m (Est.)

METHOD: Solid Stem Auger / DCPT / CPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

THURBER

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 19, 2021

FILE NO.: 28847

REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS	SOILS DESCRIPTION	ELEVATION (m)
0	○		Brown, gravelly SILT with some sand and traces of clay and organics.	51
1	○		Soft to firm, grey-brown, SILT with some clay to clayey and some oxidation and traces of gravel and organics.	50
2	○		Mixed zones of grey-brown, silty SAND with some gravel and soft to firm SILT with some clay to clayey and traces of sand.	49
3			End of hole due to refusal. Hole open to 2.0 m depth. No water observed upon completion of drilling.	48
4				47
5				46
6				45
7				44
8				43
9				42
10				

ML
CL
SM & CL

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-03B

LOCATION: See DWG. 28847-1
N 5462104, E 496423 (Est.)

TOP OF HOLE ELEV: 51.1 m (Est.)

METHOD: Solid Stem Auger / DCPT / CPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

THURBER

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 19, 2021

FILE NO.: 28847

REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0	○	Moved approximately 2 m east from TH21-03A.	CL	Firm, brown-grey, clayey SILT with a trace to some sand and traces of gravel and organics.	51
1				Soft to firm, grey-brown with some oxidation SILT with some clay to clayey and traces of gravel and organics.	50
2	○		CL		49
3	○		SM	Grey-brown, gravelly SAND with some silt to silty and some zones of firm to soft silt with a trace to some clay and sand.	48
				End of hole due to refusal. Hole open to 3.0 m depth. No water observed upon completion of drilling.	
4					47
5					46
6					45
7					44
8					43
9					42
10					

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-04

LOCATION: See DWG. 28847-1
N 5462122, E 496454 (Est.)

TOP OF HOLE ELEV: 50.4 m (Est.)

METHOD: Solid Stem Auger / DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

THURBER

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 19, 2021

FILE NO.: 28847

REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS	SOILS DESCRIPTION	ELEVATION (m)
0		TOPSOIL.	50
1	DCPT Refusal 60 blows for 200 mm penetration	Firm to stiff, grey with some oxidation SILT with traces of sand, organics and clay. (ML)	49
2		Grey-brown, gravelly SAND and SILT with a trace of clay. (ML, SM/ML)	48
3		Grey-brown, sandy GRAVEL with some cobbles and silt and a trace of clay (TILL-like). (GM)	47
4		Grey SAND with some silt and gravel (TILL-like). (SM)	46
5		Grey, silty, gravelly SAND with a trace of cobbles (TILL-like). (SM)	45
6			44
7			43
8		Grey, gravelly SILT and SAND with a trace of clay (TILL-like). (SM)	42
9			41
10		End of hole at required depth. Hole open to 1.6 m depth. Water observed at 1.8 m depth upon completion of drilling. (ML/SM)	

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-05

LOCATION: See DWG. 28847-1
N 5462155, E 496476 (Est.)

TOP OF HOLE ELEV: 53.0 m (Est.)
METHOD: Solid Stem Auger / DCPT
DRILLING CO.: On-Track Drilling Inc.
INSPECTOR: MM

THURBER

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 19, 2021
FILE NO.: 28847
REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0			OL/ML	Firm, brown SILT and SAND with traces of organics, clay and organic silt.	
1			ML	Very stiff to hard, grey-brown SILT with some sand and gravel and traces of clay and organics.	52
2			CL CL	Very stiff to hard, grey with some mottling, clayey SILT with a trace to some gravel and traces of sand and organics.	51
3		DCPT Refusal 56 blows for 250 mm penetration	ML & SM	Very dense, zones of grey-brown, silty SAND with a trace to some gravel and firm-soft, grey-brown SILT with a trace to some sand and clay (TILL-like).	50
4			SM SM	Grey, silty SAND with some gravel to gravelly and a trace of cobbles (TILL-like). - zones of mottled, sandy silt with a trace of clay between 3.1 and 3.7 m depth - no cobbles below 4.0 m depth	49
5			SM		48
6					47
7			ML/SM		46
8			ML/SM		45
9				No recovery.	44
10				End of hole at required depth. Hole open to 6.1 m depth. Water observed at 7.9 m depth upon completion of drilling.	

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-06

LOCATION: See DWG. 28847-1
N 5462003, E 496341 (Est.)

TOP OF HOLE ELEV: 54.0 m (Est.)
METHOD: Solid Stem Auger / CPT
DRILLING CO.: On-Track Drilling Inc.
INSPECTOR: MM

THURBER

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 20, 2021
FILE NO.: 28847
REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0				ROAD BASE.	
			ML/SM	Brown with some oxidation SAND and SILT with a trace to some gravel and traces of organics and organic silt.	
1			ML/OL	Soft, dark brown, sandy SILT with some gravel and organics, a trace to some organic silt and a trace of cobbles.	53
			ML	Firm, grey with some oxidation, sandy SILT. - a trace of organic silt in between 1.5 m and 3.1 m depth	
2			ML	- sand content increases below 2.4 m depth	52
3					51
4			M/SM		50
5			ML/SM		49
			ML	Very soft, grey SILT with some sand and a trace to some clay.	
6					48
			ML		
7				Grey, silty GRAVEL and SAND (TILL-like).	47
8			GM/SM		46
9					45
				End of hole at required depth. Hole open to 6.0 m depth.	
10					

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-08

LOCATION: See DWG. 28847-1
N 5462007, E 496285 (Est.)

TOP OF HOLE ELEV: 53.1 m (Est.)
METHOD: Solid Stem Auger / CPT
DRILLING CO.: On-Track Drilling Inc.
INSPECTOR: MM

THURBER

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 20, 2021
FILE NO.: 28847
REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0	○		SP-SM & PAV	ASPHALT (50 mm thick).	53
				Loose, brown-black, SAND with a trace of silt and asphalt fragments (FILL).	
1	⊠ ○		SM/ML	Firm, grey-brown with some oxidation, sandy SILT with a trace of organics.	52
2	⊠ ○		ML	- seams of sand with some gravel below 2.0 m depth	51
	⊠ ○		ML	Compact, grey-brown SILT with some sand and a trace of clay.	
	⊠ ○		ML	- a trace of sand below 2.6 m	
3					50
				- sandy and some clay below 3.2 m	
	⊠ ○		ML/CL		
4					49
	⊠		ML/SM	Dense, grey, gravelly SAND and SILT (TILL-like).	
5	⊠ ○		ML/SM		48
				End of hole due to auger refusal.	
6				Hole open to 5.2 m depth.	47
				No water observed upon completion of drilling.	
7					46
8					45
9					44
10					

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-09

LOCATION: See DWG. 28847-1
N 5461990, E 496253 (Est.)

TOP OF HOLE ELEV: 58.5 m (Est.)

METHOD: Solid Stem Auger / DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

THURBER

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 20, 2021

FILE NO.: 28847

REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0		SM/GM	Loose to compact, brown SAND and GRAVEL with some silt and a trace of organics.	
		ML	Loose, dark brown with zones of oxidation, gravelly SAND and SILT with traces of organics and organic silt.	58
1		ML	Firm, grey with orange staining SILT with traces of sand, clay and organics.	
				57
2			- seams of sand and gravel below 2.1 m depth	
	DCPT Refusal 56 blows for 125 mm penetration	ML/CL ML/CL		
		SM	Brown with some oxidation, gravelly SILT and SAND with some clay. - a trace of clay below 2.7 m depth	56
3			Grey-brown, gravelly, silty SAND with a trace of clay (TILL-like).	
				55
4		SM		
				54
5				
		SM	- some gravel below 5.2 m depth	
				53
6				
				52
7		ML/SM		
				51
8			End of hole due to auger refusal. Hole open to 4.6 m depth. Water observed 7.6 m depth upon completion of drilling.	
				50
9				
				49
10				

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-10

LOCATION: See DWG. 28847-1
N 5461934, E 496252 (Est.)

TOP OF HOLE ELEV: 60.6 m (Est.)
METHOD: Solid Stem Auger / CPT
DRILLING CO.: On-Track Drilling Inc.
INSPECTOR: MM

THURBER

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 20, 2021
FILE NO.: 28847
REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS	SOILS DESCRIPTION	ELEVATION (m)
0	ML	ASPHALT (75 mm thick).	
	ML	Loose, brown, sandy SILT with some gravel and traces of organics and asphaltic concrete fragments (FILL).	60
	ML/OL	Firm, dark brown with some oxidation SILT, sandy to some sand, some gravel, clay in zones and zones of soft, grey silt.	
1	SM/ML	Soft, black-brown, sandy SILT with some gravel and organic silt and a trace of organics.	
		Compact to dense, grey-brown SILT and SAND with some gravel.	59
2	ML/SM		
	ML/SM & ML	- a trace of clay below 2.3 m depth - sandy to some sand and a trace to some clay below 2.6 m depth	58
3	CL/ML		57
4	SM	Dense, grey-brown, silty SAND with some gravel and a trace of clay (TILL-like).	56
5			
6	SM	End of hole at required depth. Hole open to 1.8 m depth.	55
			54
7			
			53
8			
			52
9			
			51
10			

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-11

LOCATION: See DWG. 28847-1
N 5461973, E 496319 (Est.)

TOP OF HOLE ELEV: 57.4 m (Est.)
METHOD: Solid Stem Auger / DCPT
DRILLING CO.: On-Track Drilling Inc.
INSPECTOR: MM

THURBER

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 21, 2021
FILE NO.: 28847
REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS	SOILS DESCRIPTION	ELEVATION (m)
0		ASPHALT (88 mm thick).	
		Firm, brown SILT with some sand and gravel and traces of organic silt and asphalt fragments and organics (FILL).	57
1		Firm, dark brown, sandy SILT with traces of organics, gravel and organic silt.	
		- wood pieces and garbage below 1.5 m depth	56
2			
		Very stiff, grey with zones of oxidation, sandy SILT to SAND and SILT with a trace of organics.	55
3			
			54
4			
		- some silt and sand zones below 4.6 m depth	53
5			
			52
6		- some sand and a trace of clay below 5.9 m depth	
		Compact, grey, silty SAND with some gravel and cobbles (TILL-like).	51
7	DCPT Refusal 55 blows for 250 mm penetration	- very dense below 6.7 m depth	
			50
8			
			49
9			
		End of hole due to auger refusal. Hole open to 6.1 m depth. Water observed 7.9 m depth upon completion of drilling.	48
10			

ML ML ML OL/ML ML ML ML ML SM SM

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-12

LOCATION: See DWG. 28847-1
N 5462033, E 496348 (Est.)

TOP OF HOLE ELEV: 54.1 m (Est.)

METHOD: Solid Stem Auger / DCPT

DRILLING CO.: On-Track Drilling Inc.

INSPECTOR: MM

THURBER

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 21, 2021

FILE NO.: 28847

REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0			Crushed GRAVEL (No recovery).	54
		SW-SM	Compact, grey SAND with some gravel and a trace of silt.	
1		SM/ML	Very stiff to hard, black with some orange staining SILT and SAND with some organics and traces of clay and asphalt fragments (FILL).	53
		ML	Very stiff to hard, grey-brown with orange staining SILT and SAND.	
2		ML	- seams of grey sand between 1.5 and 2.4 m depth	52
		SM/ML	- some clay between 2.4 and 2.7 m depth	
3		ML		51
		ML	Firm, brown SILT with a trace to some clay and sand.	
4		ML		50
		SM	Very dense, grey, silty SAND with some gravel (TILL-like).	
5 ▼	DCPT Refusal 50 blows for 100 mm penetration		- some cobbles below 5.0 m depth	49
		SM		
6			End of hole due to auger refusal. Hole open to 2.7 m depth. Water observed at 0.5 m depth upon completion of drilling.	48
7				47
8				46
9				45
10				

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH21-13

LOCATION: See DWG. 28847-1
N 5462064, E 496369 (Est.)

TOP OF HOLE ELEV: 53.9 m (Est.)
METHOD: Solid Stem Auger / DCPT
DRILLING CO.: On-Track Drilling Inc.
INSPECTOR: MM

THURBER

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: April 21, 2021
FILE NO.: 28847
REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0		SM	Compact, grey with some orange staining, gravelly SAND with some silt and a trace of organics.	
		ML	Very stiff, grey-brown with some orange staining SILT with some sand to sandy and traces of clay and organics.	
1			- firm below 0.9 m depth	53
		ML	- a trace to some sand and clay below 1.2 m depth	
			Firm, grey with some orange staining SILT with some clay, a trace to some sand and a trace of organics.	
2		CL/ML		52
		CL	- clayey below 2.4 m depth	
3				51
			Very dense, grey with some orange staining, silty SAND with some gravel.	
	DCPT Refusal 51 blows for 200 mm penetration	SM		
4				50
		SM		
		SM	Grey, silty SAND.	
5		ML/SM		49
		SM	Grey, silty, gravelly SAND (TILL-like).	
6				48
		ML/SM	Brown SILT and SAND with some gravel (TILL-like).	
			End of hole due to auger refusal. Hole open to 6.1 m depth. Water observed 5.8 m depth upon completion of drilling.	
7				47
8				46
9				45
10				44

THURBER

CONE PENETRATION TEST REPORT

Prepared for:

THURBER ENGINEERING LTD.

Site: 440 Hendry Avenue, North Vancouver, BC
Date Drilled: April 19 – 20, 2021

Prepared by:

On Track Drilling
20626 Mufford Crescent
Langley, BC
V2Y 1N8

[redacted]

www.ontrackdrilling.com

ON TRACK
An earth DRILLING Company
SAFETY IS OUR CORE

Cone Penetration Testing (CPT) Equipment & Calculated Geotechnical Parameters

On Track Drilling Inc. owns and operates a cone penetration test (CPT) system, supplied by Vertek – A Division of Applied Research and Associates. The Hogentogler electronic system is used with a 10 cm^2, 10 ton cone that records tip resistance, sleeve friction, pore pressure, inclination and temperature at desired intervals chosen by the operator. The cone penetrometers are designed with equal end area friction sleeves, a net end area ratio 0.8 and 60° apex angle on the tip. The cone consists of two strain gauge transducers, with the cone electronics packaged directly behind the transducers. The cone can be stopped at desired depths and dissipation tests can be completed to determine the groundwater pressures.

All testing is performed in accordance with the current ASTM D5778 standards.

The CPT calculations displayed on the plots are based on the measured tip resistance, sleeve friction and pore water pressure recorded at each specified data point. The recorded tip resistance (qc) is corrected for pore pressure effects (qt) and is used for all the calculations.

The following empirical correlations have been used to calculate the geotechnical parameters used in the CPT plots:

Corrected cone tip resistance:

$$q_t = q_c + (1\text{-}a) \bullet u2$$

where: q_c = the recorded tip resistance
a = net area ratio for cone (0.8)
u2 = the recorded dynamic pore pressure

Soil Behavior Type (Normalized): based on SBTn Robertson (1990) (Linear normalization)

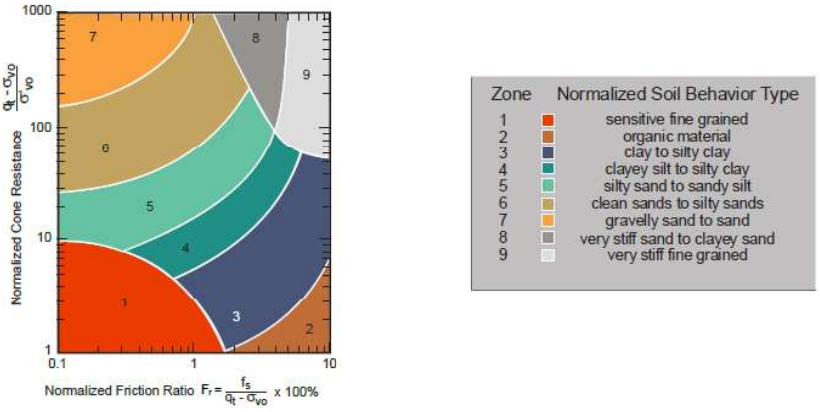


Figure 1: Normalized Soil Behavior Type (SBTn) Classification Chart

On Track Drilling Inc.
20626 Mufford Crescent
Langley, BC, V2Y 1N8
Phone: 604 523 1200
Website: www.ontrackdrilling.com

Undrained Shear Strength (Su):

$$Su = \frac{(q_t - \sigma_v)}{N_{kt}}$$

where: q_t = the corrected tip resistance
σ_v = the effective overburden stress
N_{kt} = cone constant (user selectable)

Standard Penetration Test Correlation $N_{1(60)}$:

$$(N_1)_{60} = C_n N_{60}$$

The SPT N_{60} value corrected for overburden pressure (C_n)

Equivalent SPT N_{60}, (blows/30cm) Lunne et al. (1997) :

$$\frac{\left(\frac{q_t}{p_a}\right)}{N_{60}} = 8.5\left(1 - \frac{I_c}{4.6}\right)$$

Over Consolidation Ratio (OCR):

$$OCR = k_{OCR}\, Q_{t1}$$

Only SBTn 1, 2, 3, 4, & 9 (see Lunne et al., 1997)

Shear Wave Velocity (Vs) Testing:

Shear wave velocity measurements can be recorded at desired intervals in conjunction with the cone penetrometer test. The shear waves are typically generated by using a heavy hammer to horizontally strike a beam that is held in place on the ground by a normal force, in this case the outriggers of the drill rig. Two accelerometers mounted directly to the source are used as the contact triggers to initiate the recording of the seismic wave traces. The seismic source is oriented parallel to the axis of the active geophone being used.

The geophones are located 0.2 meters behind the cone tip and the source offset to the cone is recorded for each test.

The velocities of each interval are calculated by choosing a first arrival feature of each recorded wave set and taking the difference in ray path, divided by the time difference between subsequent first arrival times.

All testing is performed in accordance with the current ASTM D7400 standards.

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All calculations have been carried out automatically using the software program CPeT-IT v.3.0.3.2. supplied by Geologismiki. The parameters selected are based on current published CPT correlations and are subject to change to reflect the current state of practice. On Track Drilling does not warrant the correctness or the applicability of any of the calculations carried out by the software and does not assume liability for the use of the data in any design or review.

References:

ASTM D5778-12, 2012, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils", ASTM International, West Conshohocken, PA. DOI: 10.1520/D5778-12.

ASTM D7400/D7400M-19, 2019, "Standard Test Methods for Downhole Seismic Testing", ASTM International, West Conshohocken, PA. DOI: 10.1520/D7400_D7400M-19.

Lunne, T., Robertson, P.K. and Powell, J. J. M., 1997, “Cone Penetration Testing in Geotechnical Practice”, Blackie Academic and Professional.

Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J., 1986, “Use of Piezometer Cone Data”, Proceedings of InSitu 86, ASCE Specialty Conference, Blacksburg, Virginia.

Robertson, P.K., 1990, “Soil Classification Using the Cone Penetration Test”, Canadian Geotechnical Journal, Volume 27: 151-158. DOI: 10.1139/T90-014.

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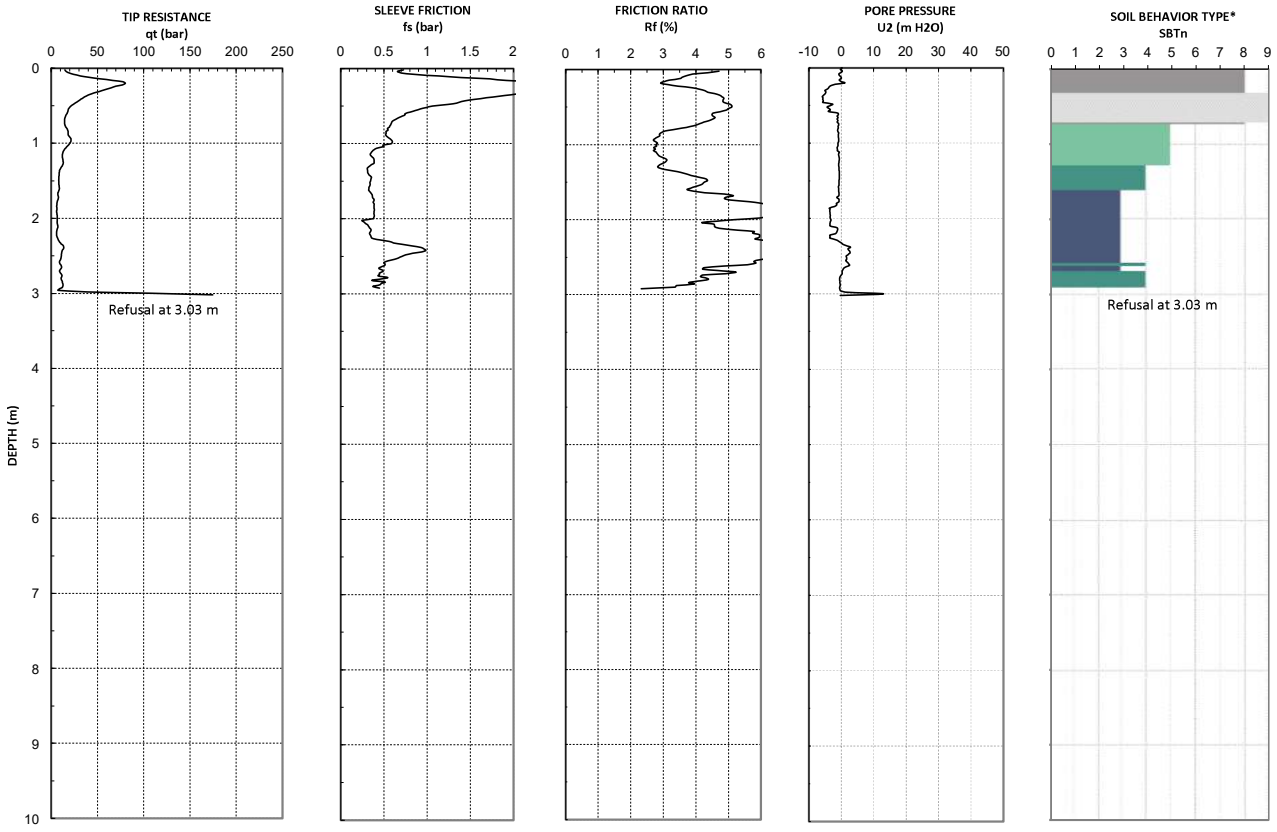
Phone: 604 523 1200
Website: www.ontrackdrilling.com

ON TRACK
An earth DRILLING Company
SAFETY IS OUR CORE

Sounding: CPT21-01	Client: Thurber Engineering Ltd.
19-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



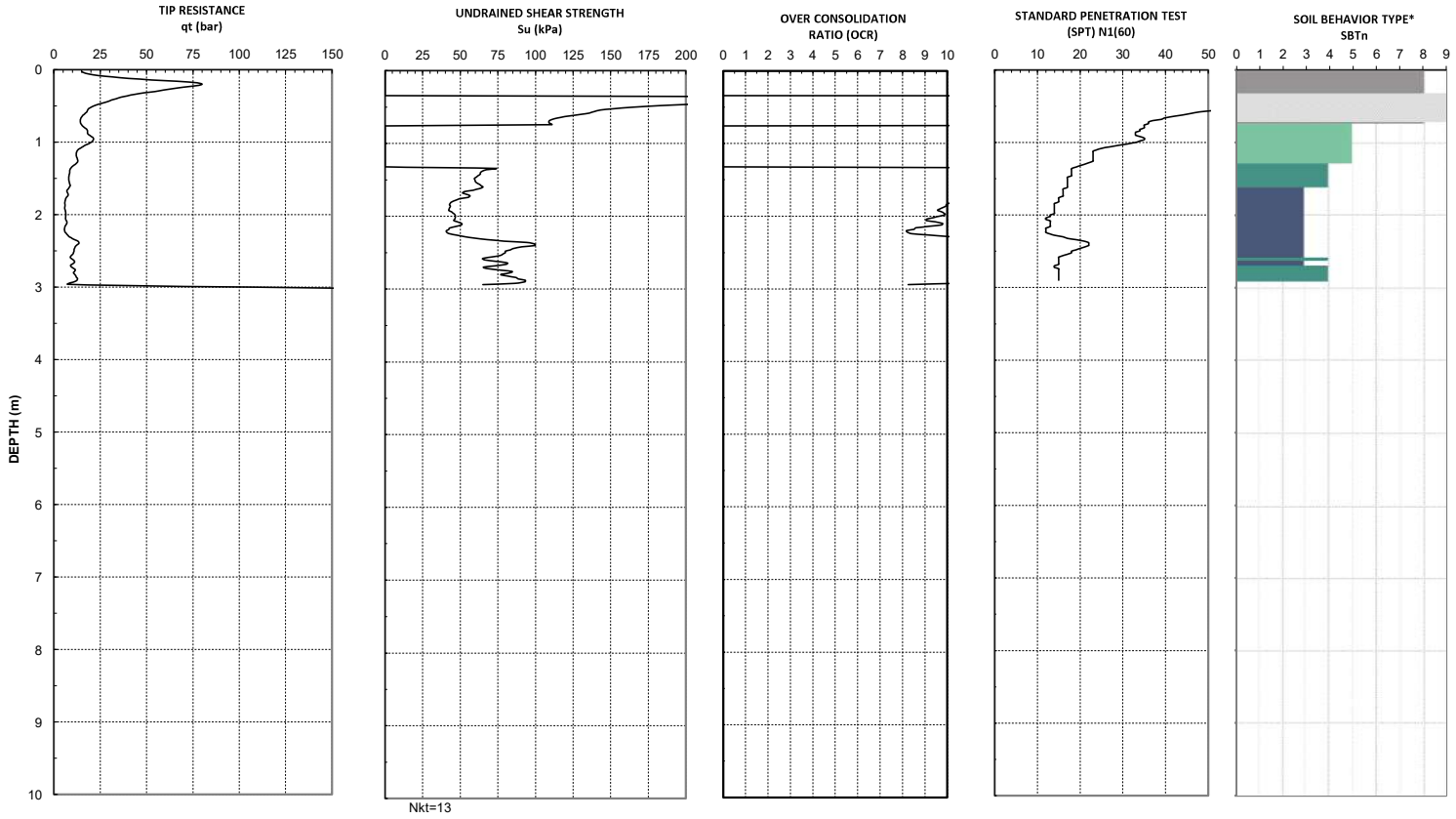
* Based on Robertson et. al 1990

1. Sensitive Fine Grained
2. Organic Material
3. Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sand to Silty Sand
7. Gravely Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

Depth Increment: 0.02 m
Geodetic Elevation: N/A
Maximum Depth: 3.03 m

Cone ID: DDG1522
Operator: ZH

Sounding: CPT21-01	Client: Thurber Engineering Ltd.
19-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

1. Sensitive Fine Grained
2. Organic Material
3. Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sand to Silty Sand
7. Gravely Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

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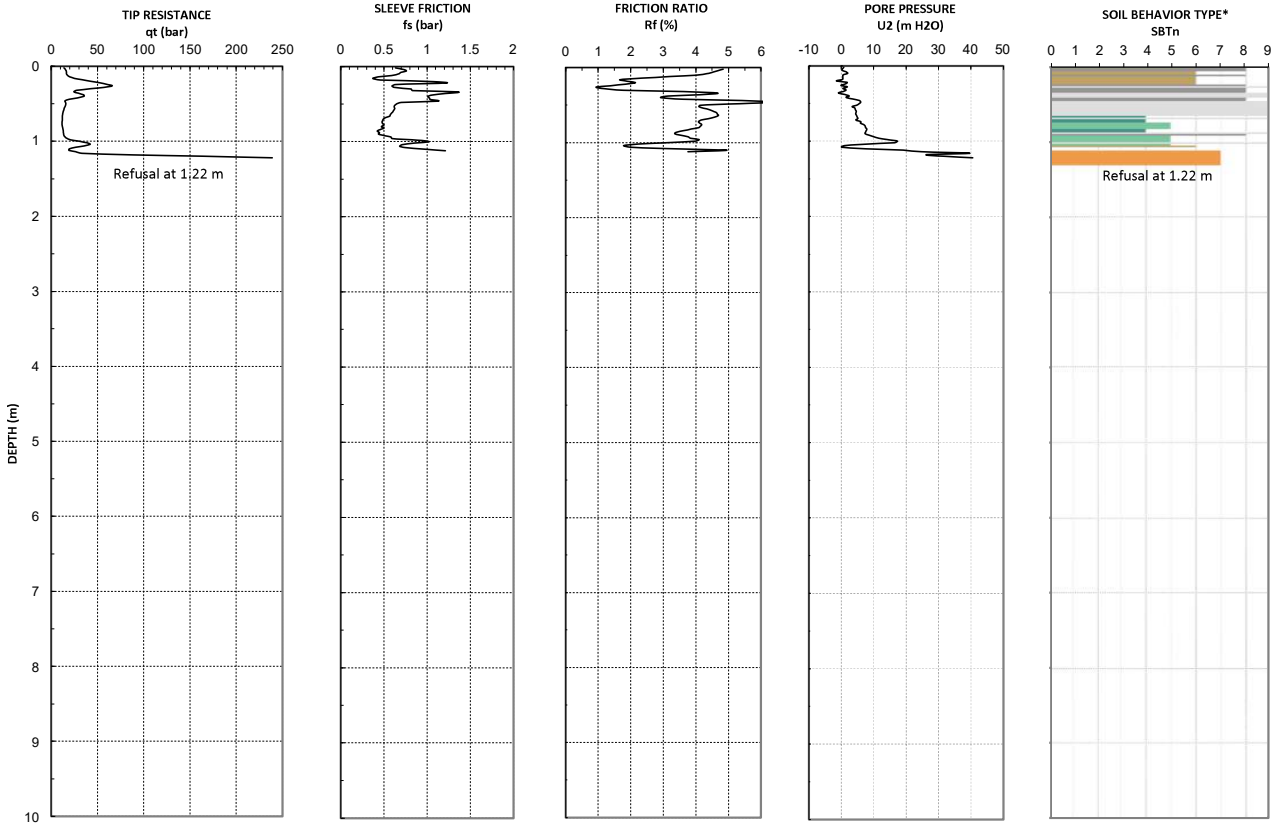
Sounding: CPT21-03	Client: Thurber Engineering Ltd.
19-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



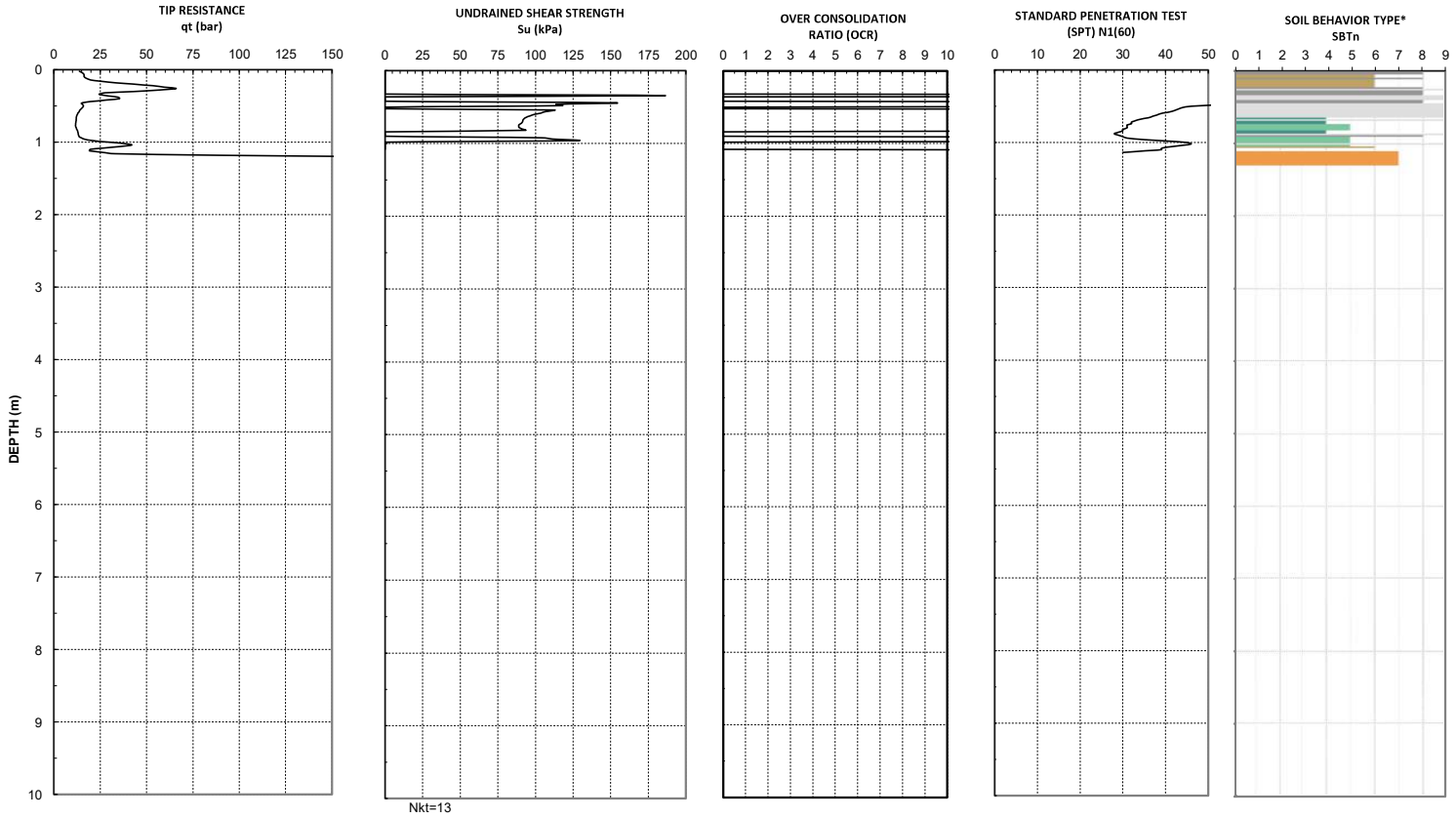
* Based on Robertson et. al 1990

1. Sensitive Fine Grained
2. Organic Material
3. Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sand to Silty Sand
7. Gravely Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

Depth Increment: 0.02 m
Geodetic Elevation: N/A
Maximum Depth: 1.22 m

Cone ID: DDG1522
Operator: ZH

Sounding: CPT21-03	Client: Thurber Engineering Ltd.
19-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

1. Sensitive Fine Grained
2. Organic Material
3. Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sand to Silty Sand
7. Gravely Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

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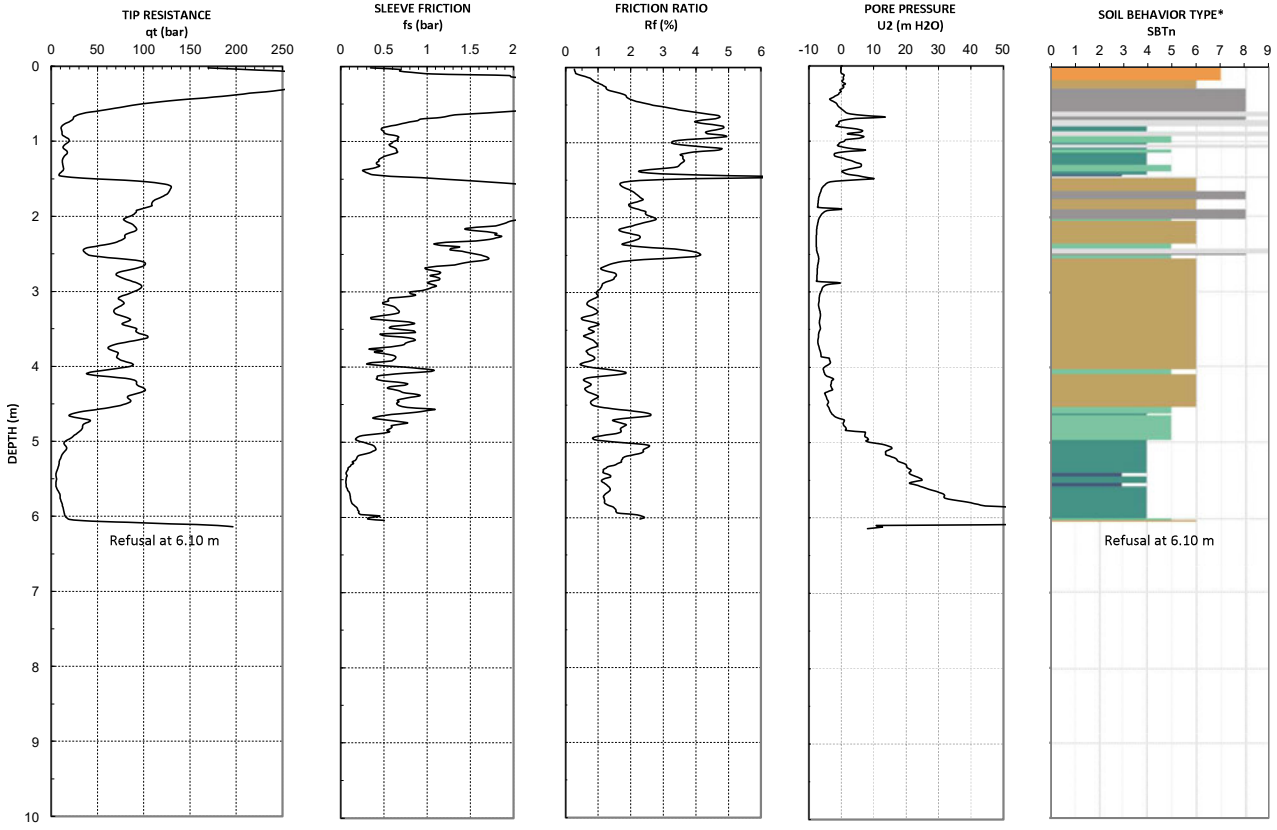
Sounding: CPT21-06	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



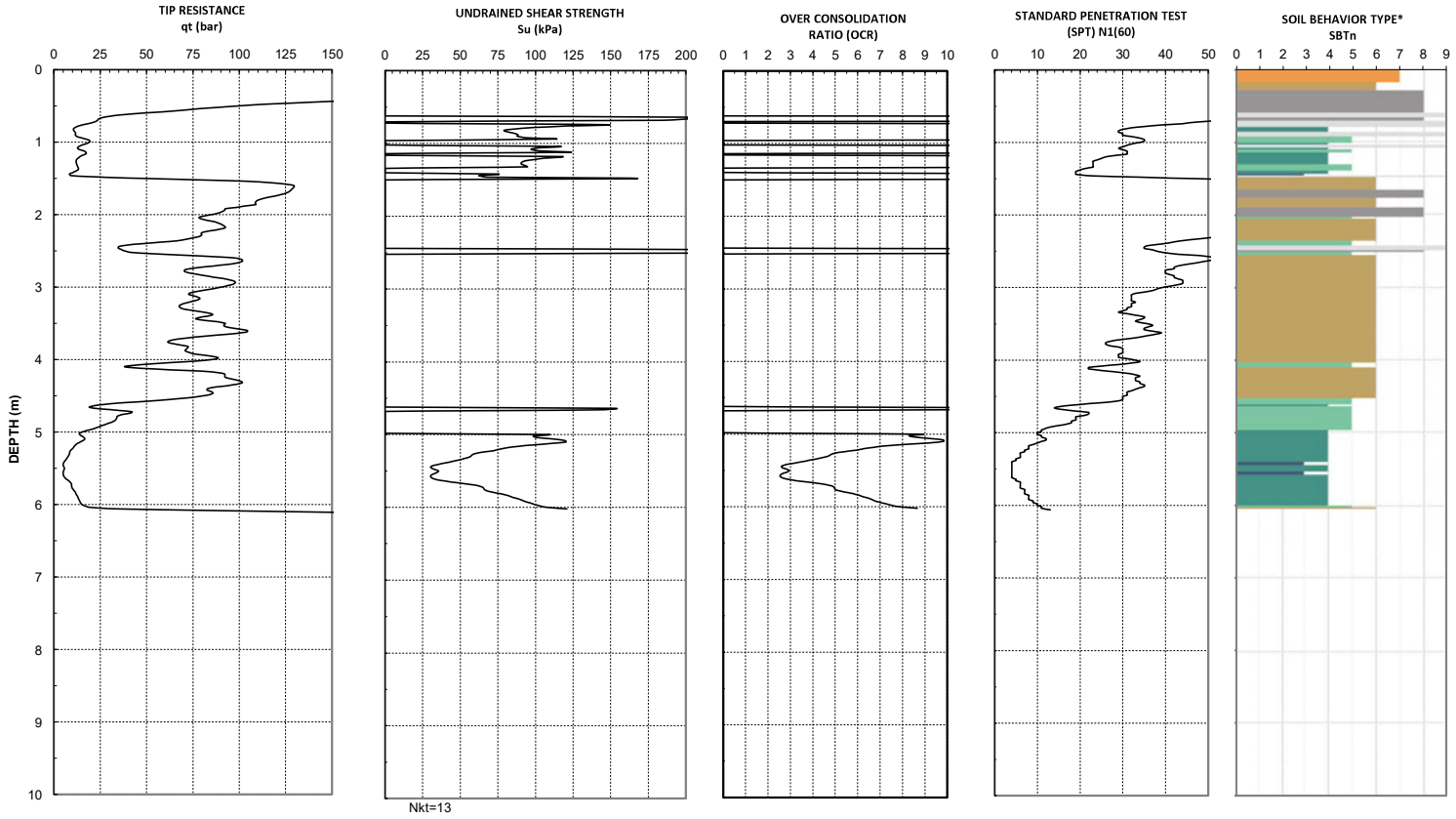
* Based on Robertson et. al 1990

1. Sensitive Fine Grained
2. Organic Material
3. Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sand to Silty Sand
7. Gravely Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

Depth Increment: 0.02 m
Geodetic Elevation: N/A
Maximum Depth: 6.10 m

Cone ID: DDG1522
Operator: ZH

Sounding: CPT21-06	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

1. Sensitive Fine Grained
2. Organic Material
3. Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sand to Silty Sand
7. Gravely Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

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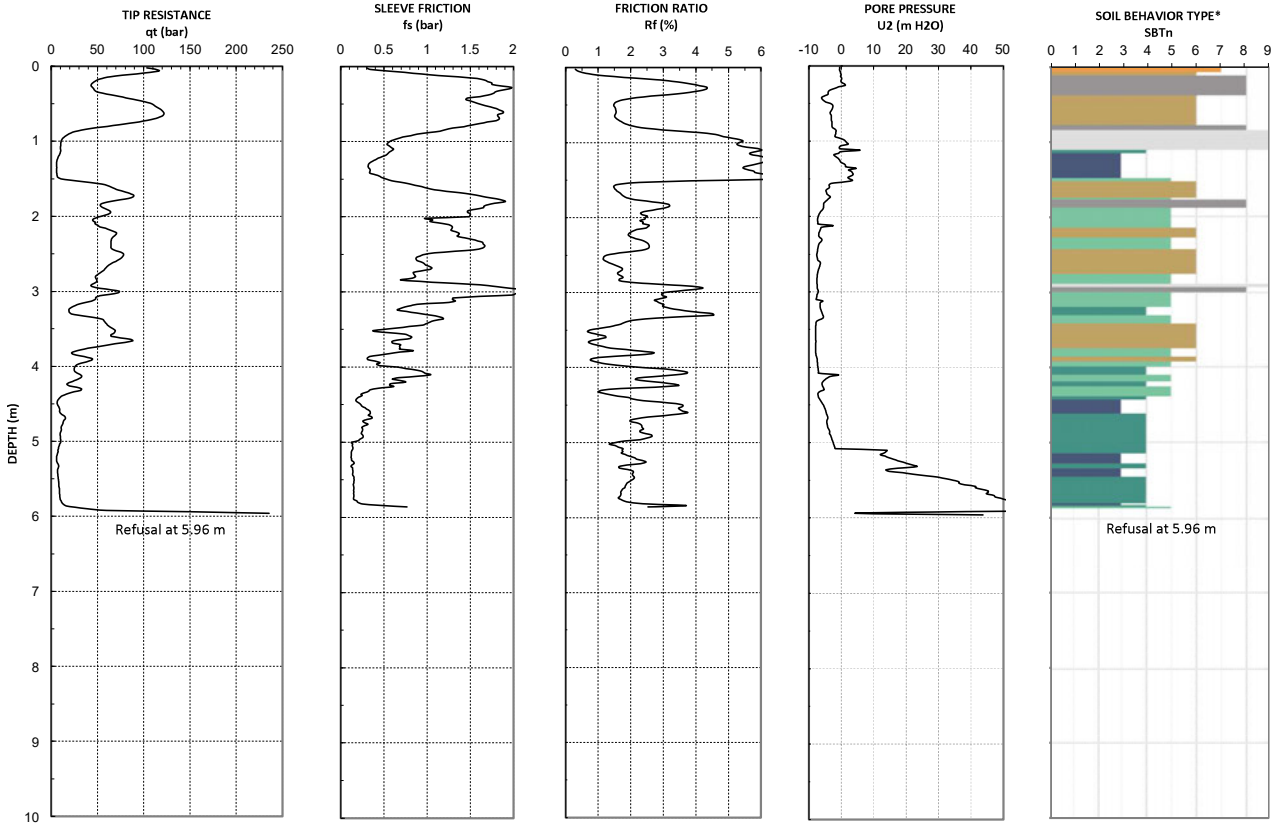
Sounding: CPT21-07	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



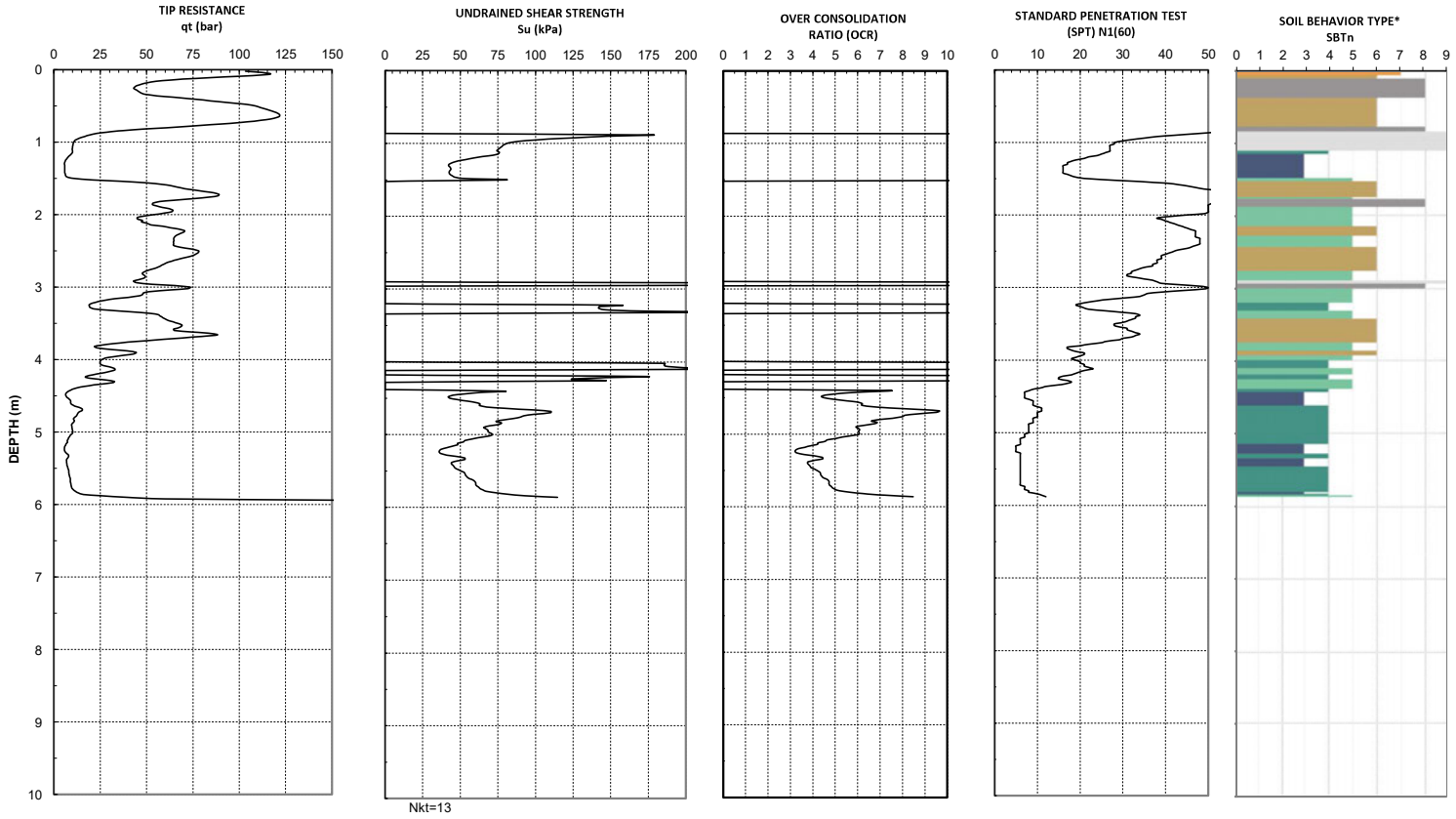
* Based on Robertson et. al 1990

1. Sensitive Fine Grained
2. Organic Material
3. Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sand to Silty Sand
7. Gravely Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

Depth Increment: 0.02 m
Geodetic Elevation: N/A
Maximum Depth: 5.96 m

Cone ID: DDG1522
Operator: ZH

Sounding: CPT21-07	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

1. Sensitive Fine Grained
2. Organic Material
3. Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sand to Silty Sand
7. Gravely Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

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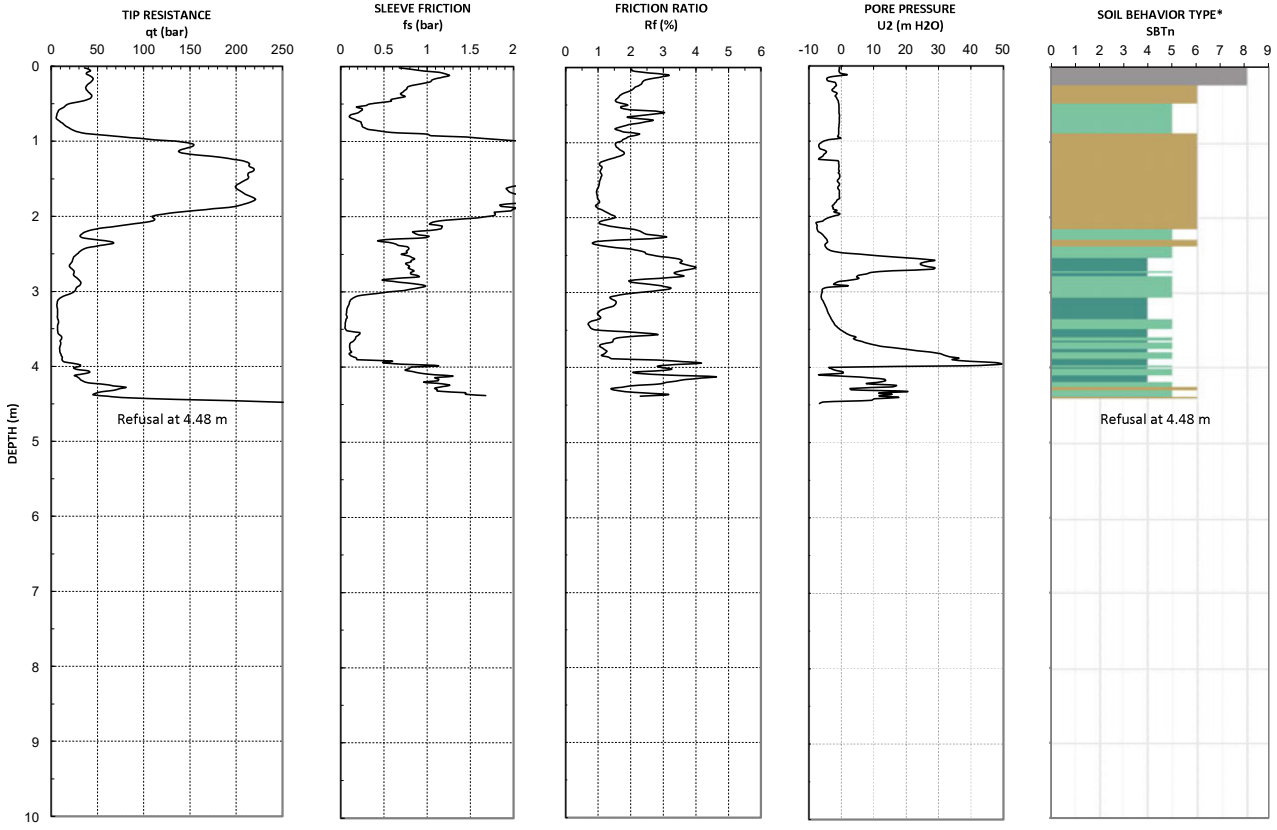
Sounding: CPT21-08	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



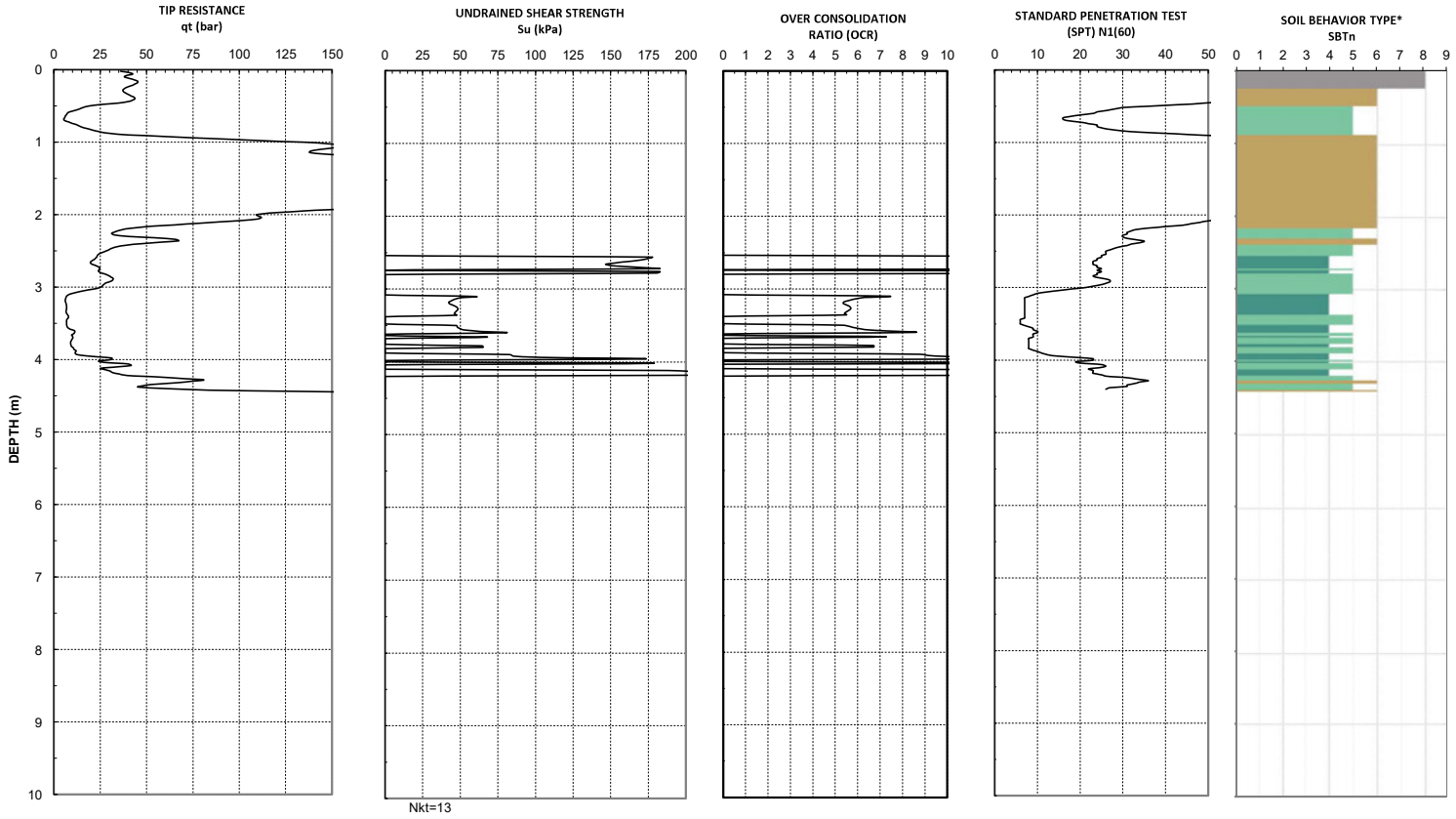
* Based on Robertson et. al 1990

1. Sensitive Fine Grained
2. Organic Material
3. Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sand to Silty Sand
7. Gravely Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

Depth Increment: 0.02 m
Geodetic Elevation: N/A
Maximum Depth: 4.48 m

Cone ID: DDG1522
Operator: ZH

Sounding: CPT21-08	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

1. Sensitive Fine Grained
2. Organic Material
3. Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sand to Silty Sand
7. Gravely Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

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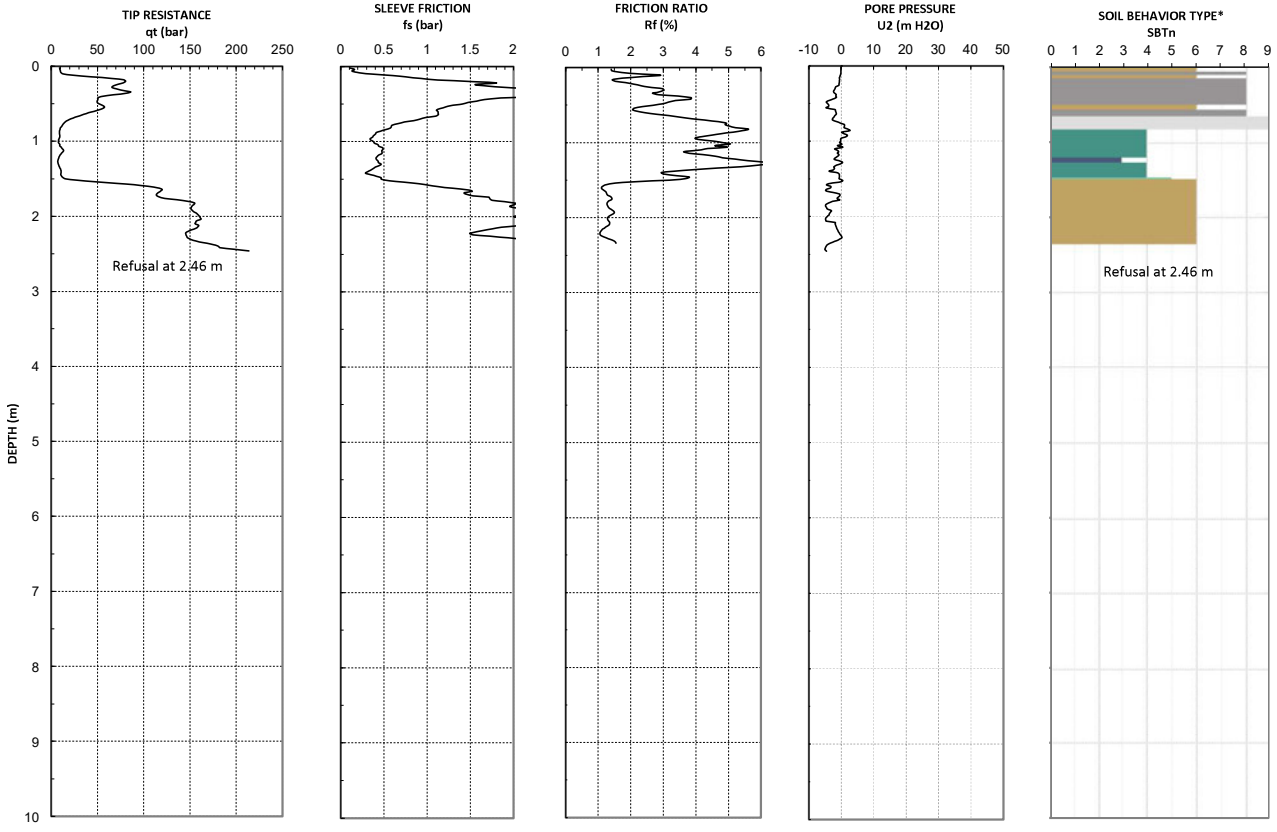
Sounding: CPT21-10	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



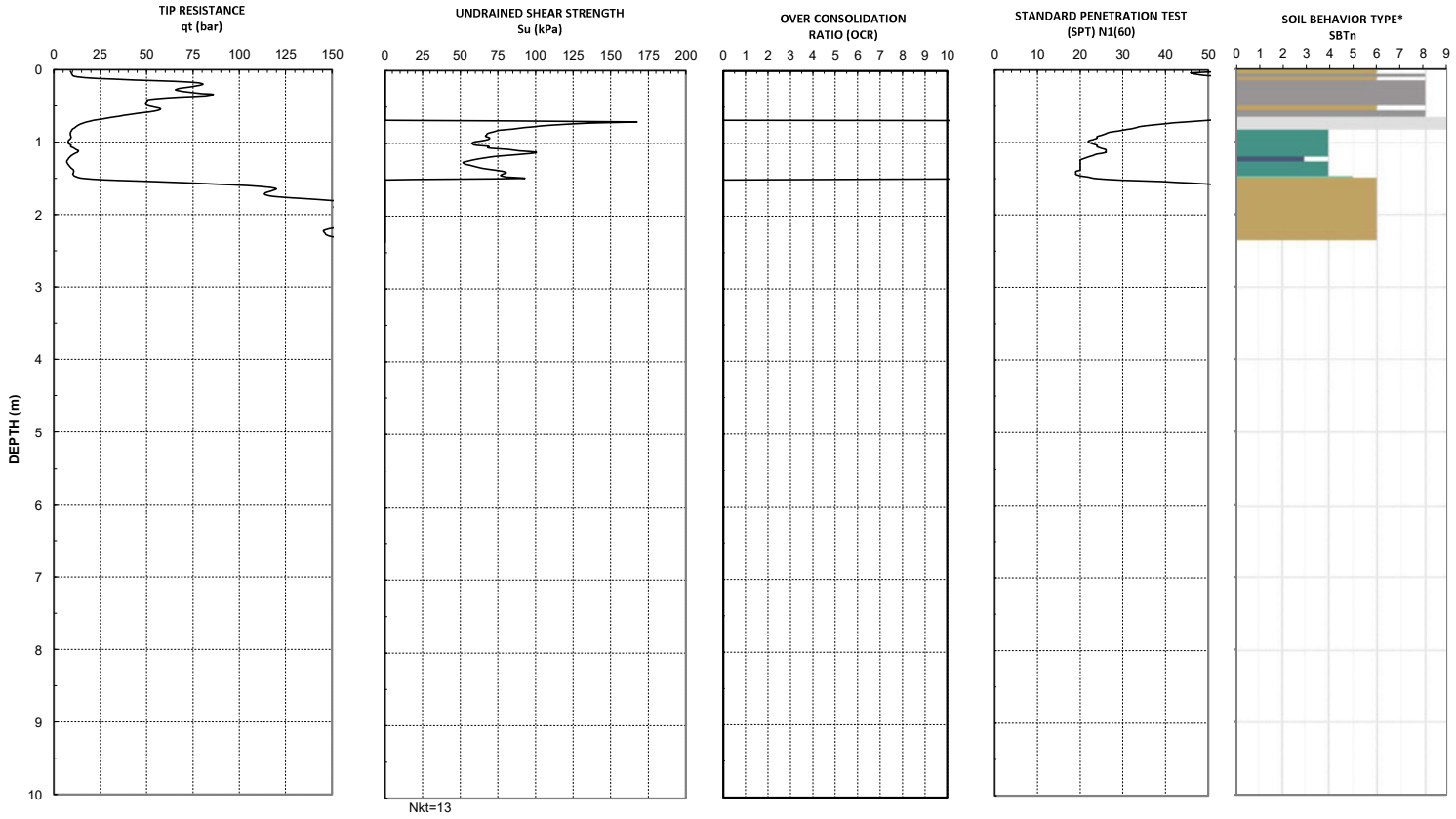
* Based on Robertson et. al 1990

1. Sensitive Fine Grained
2. Organic Material
3. Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sand to Silty Sand
7. Gravely Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

Depth Increment: 0.02 m
Geodetic Elevation: N/A
Maximum Depth: 2.46 m

Cone ID: DDG1522
Operator: ZH

Sounding: CPT21-10	Client: Thurber Engineering Ltd.
20-Apr-2021	Site: 440 Hendry Avenue, North Vancouver, BC



* Based on Robertson et. al 1990

1. Sensitive Fine Grained
2. Organic Material
3. Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sand to Silty Sand
7. Gravely Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

THURBER

Sheet 1 of 3

LOG OF TEST HOLE

TEST HOLE NO.
TH23-01

LOCATION: See DWG. 28847-1
N 5462052, E 496380 (Est.)

TOP OF HOLE ELEV: 53.5 m (Est.)
METHOD: Sonic
DRILLING CO.: Downrite Drilling Ltd.
INSPECTOR: KTD

THURBER

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: October 5, 2023
FILE NO.: 28847
REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0	Densities inferred from drilling action.		Loose, grey GRAVEL (FILL).	
			No recovery.	53
1				
			Stiff, brown, sandy SILT to silty SAND.	52
2		ML		
			Stiff, brown SILT with some sand.	51
3		ML		
			Stiff, grey, clayey SILT with a trace of sand.	50
4		CL		
			Dense, grey, silty SAND with some gravel.	49
5		ML/SM		
			Dense, grey-brown SAND with a trace of gravel.	48
6		SP	Dense, grey-brown SAND and SILT with some gravel (TILL-like).	
				47
7		ML		
		ROCK	BOULDER.	
		SP-SM	Dense, brown SAND with a trace to some gravel and a trace of silt.	46
8				
			Brown SAND with a trace of silt.	45
9		SP-SM/GP-GM		
				44
10		SP-SM	- 150 mm thick silty SAND layer at 9.8 m depth	

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

LOG OF TEST HOLE

TEST HOLE NO. **TH23-01**

LOCATION: See DWG. 28847-1
N 5462052, E 496380 (Est.)

TOP OF HOLE ELEV: 53.5 m (Est.)

METHOD: Sonic

DRILLING CO.: Downrite Drilling Ltd.

INSPECTOR: KTD

THURBER

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: October 5, 2023

FILE NO.: 28847

REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
10		SP-SM	Brown SAND with a trace of silt.	43
11		SM/ML	Very stiff, brown, sandy SILT with some gravel (TILL-like).	
			Dense / very stiff, interlayered brown-grey silty SAND to sandy SILT with a trace of gravel.	42
12		ML/SM		
			Dense, brown-grey SAND.	41
13		ML	Very stiff, brown SILT with traces of clay and sand.	40
14			Brown-grey SAND with a trace of silt.	
		ML	Grey with trace mottling SILT with some clay and a trace of sand.	39
15			Dense / very stiff, interlayered brown-grey silty SAND to sandy SILT with a trace of gravel.	38
16		ML/SM		
		ML		37
17				
		SM/ML		36
18				
			Dense, grey, silty SAND with some gravel (TILL-like).	35
19		ML/SM	- 300 mm thick gravel layer at 18.9 m depth	
				34
20				

Sheet 3 of 3

LOG OF TEST HOLE

TEST HOLE NO.
TH23-01

LOCATION: See DWG. 28847-1
N 5462052, E 496380 (Est.)

TOP OF HOLE ELEV: 53.5 m (Est.)
METHOD: Sonic
DRILLING CO.: Downrite Drilling Ltd.
INSPECTOR: KTD

THURBER

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: October 5, 2023
FILE NO.: 28847
REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
20				Dense, grey, silty SAND with some gravel (TILL-like).	
			SP	Very dense, brown SAND with a trace of gravel.	33
21					
					32
22					
					31
			SP	Very dense, gravelly SAND.	
23					
			ML	Very stiff, grey, wey SILT with traces of clay and sand.	30
24			SP-SM	Dense, grey SAND with a trace of silt.	
				- some silt lenses at 24.4 m depth	29
				Very stiff, brown SILT with some sand.	
25			SP	Dense to very dense grey-brown SAND with traces of gravel and silt.	
					28
26					
					27
27					
			ML/SM	- 150 mm thick silty SAND seam at 27.3 m depth	26
28					
			SM		25
29				End of hole due to refusal at 29.0 m depth. Hole open to 27.6 m depth.	
				50 mm diameter PVC pipe installed to 27.6 m depth for downhole seismic testing.	24
30					

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH23-02A

LOCATION: See DWG. 28847-1
N 5462089, E 496453 (Est.)

TOP OF HOLE ELEV: 53.3 m (Est.)
METHOD: Solid Stem Auger
DRILLING CO.: Downrite Drilling Ltd.
INSPECTOR: KTD

THURBER

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: October 6, 2023
FILE NO.: 28847
REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0			ML	TOPSOIL / SOD.	53
				Stiff, brown SILT with some gravel.	
1			OL/ML	Firm, dark brown SILT with some organics and a trace of sand.	
			OL/ML	Stiff, grey-brown with some mottling, clayey SILT with a trace of gravel.	52
2					
			ML	Very hard, grey-brown, sandy SILT with a trace of gravel.	51
			SM/ML	Hard, brown, sandy SILT with some gravel and cobbles (TILL-like).	
3				End of hole due to auger refusal at 2.7 m depth. Hole open to 2.7 m depth. No water observed upon completion of drilling.	50
4					49
5					48
6					47
7					46
8					45
9					44
10					

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH23-02B

LOCATION: See DWG. 28847-1
N 5462089, E 496453 (Est.)

TOP OF HOLE ELEV: 49.8 m (Est.)

METHOD: Solid Stem Auger / DCPT

DRILLING CO.: Downrite Drilling Ltd.

INSPECTOR: KTD

THURBER

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: October 6, 2023

FILE NO.: 28847

REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	10 20 30 40 50 60 70 80 90 100	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0			ML	TOPSOIL / SOD. Stiff, brown SILT with some gravel.	
1			OL/ML	Firm, dark brown SILT with some organics and a trace of sand.	49
2			ML	Firm to stiff, brown mottled, clayey SILT.	48
3			SM SM	Stiff to very stiff, grey, sandy SILT with some gravel.	47
4		DCPT Refusal 40 blows for 50 mm penetration		End of hole due to auger refusal at 3.4 m depth. Hole open to 3.1 m depth. No water observed upon completion of drilling.	46
5					45
6					44
7					43
8					42
9					41
10					40

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH23-03

LOCATION: See DWG. 28847-1
N 5462080, E 496432 (Est.)

TOP OF HOLE ELEV: 50.7 m (Est.)

METHOD: Solid Stem Auger / DCPT

DRILLING CO.: Downrite Drilling Ltd.

INSPECTOR: KTD

THURBER

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: October 6, 2023

FILE NO.: 28847

REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0		ML	TOPSOIL / SOD.	
			Firm, brown SILT with some sand and a trace of rootlets.	50
1		ML	Stiff, brown, sandy SILT with a trace of clay.	
		ML	Very stiff, brown with some mottling, clayey SILT with a trace of sand.	49
2		ML	Very stiff, brown, sandy SILT with some clay.	
		ML		48
3		SM		
	Levelogger installed at 3.6 m depth. DCPT Refusal 100 blows for 200 mm penetration		Very dense, grey, silty SAND with some gravel and cobbles (TILL-like).	47
4			End of hole due to auger refusal at 4.0 m depth. Hole open to 4.0 m depth.	
			No water observed in standpipe piezometer on October 12, 2023.	46
5				
				45
6				
				44
7				
				43
8				
				42
9				
				41
10				

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH23-04

LOCATION: See DWG. 28847-1
N 5462109, E 496439 (Est.)

TOP OF HOLE ELEV: 51.7 m (Est.)

METHOD: Solid Stem Auger / DCPT

DRILLING CO.: Downrite Drilling Ltd.

INSPECTOR: KTD

THURBER

CLIENT: North Vancouver School District No. 44

PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: October 6, 2023

FILE NO.: 28847

REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS	SOILS DESCRIPTION	ELEVATION (m)
0		TOPSOIL / SOD.	
		Firm, brown SILT with some gravel and a trace of sand (FILL).	
1		Stiff, grey, clayey SILT with traces of gravel and sand.	51
2	DCPT Refusal 60 blows for 100 mm penetration	Compact to dense, grey, silty SAND with some gravel.	50
		Very stiff, grey, sandy SILT with some gravel and clay.	
3		Very dense,grey, silty SAND with some clay and gravel (TILL-like).	49
		End of hole due to auger refusal at 2.7 m depth. Hole open to 2.7 m depth. No water observed upon completion of drilling.	
4			48
5			47
6			46
7			45
8			44
9			43
10			42

ML/SM (E) CL (E) ML/SM CL/ML SM

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH23-05

LOCATION: See DWG. 28847-1
N 5462054, E 496360 (Est.)

TOP OF HOLE ELEV: 53.7 m (Est.)
METHOD: Solid Stem Auger / DCPT
DRILLING CO.: Downrite Drilling Ltd.
INSPECTOR: KTD

THURBER

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue

DATE: October 6, 2023
FILE NO.: 28847
REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0			Loose, grey GRAVEL (FILL).	
		ML	Very stiff, mottled brown, sandy SILT with some sand.	53
1		SM	Compact, brown, silty SAND with a trace of gravel.	52
2		ML	Stiff, brown with trace mottling, sandy SILT with some sand.	
		ML	Firm to stiff, grey SILT with some clay and sand.	51
3			Soft, grey, clayey SILT.	
		CL/ML	Soft, grey, sandy SILT with some gravel and a trace of clay.	50
4		SM	Loose, brown, silty SAND with some gravel and a trace of cobbles. - very dense below 4.2 m depth	49
5	DCPT Refusal 100 blows for 225 mm penetration Levelogger installed at 3.6 m depth.	SM	Very dense, grey, silty SAND with some gravel and cobbles (TILL-like).	48
6			End of hole due to auger refusal at 5.8 m depth. Hole open to 5.5 m depth. No water observed in standpipe piezometer on October 12, 2023.	47
7				46
8				45
9				44
10				

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

Sheet 1 of 1

LOG OF TEST HOLE

TEST HOLE NO.
TH23-06

LOCATION: See DWG. 28847-1
N 5462035, E 496373 (Est.)

TOP OF HOLE ELEV: 53.3 m (Est.)
METHOD: Solid Stem Auger / DCPT
DRILLING CO.: Downrite Drilling Ltd.
INSPECTOR: KTD

THURBER

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue

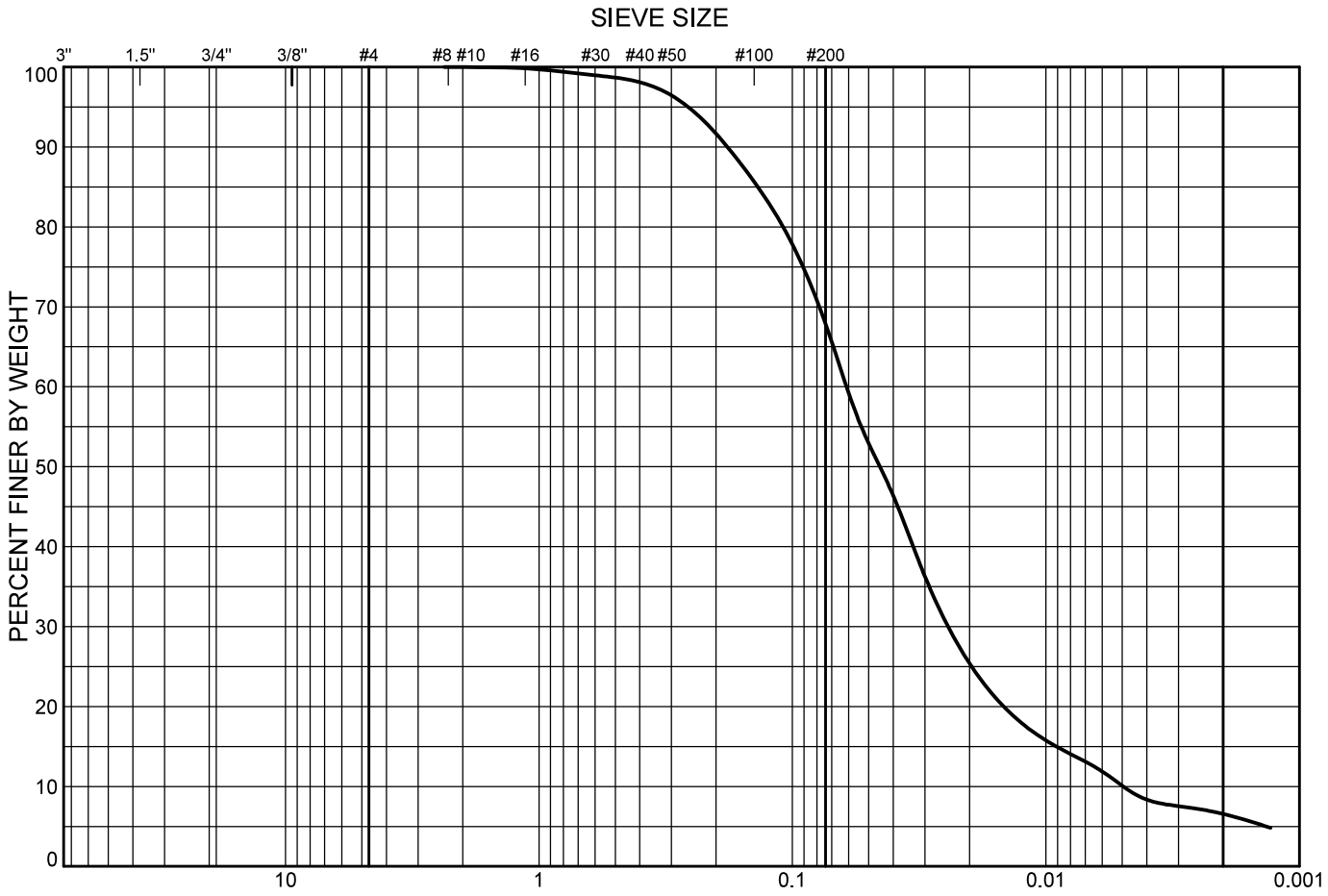
DATE: October 6, 2023
FILE NO.: 28847
REVIEWED BY: IFA

DCPT PENETRATION (blows/300 mm) | SPT PENETRATION (blows/300 mm) | WATER CONTENT (%): ○ Disturbed ● Undisturbed | WATER LEVEL: Plastic Limit — Liquid Limit | SAMPLES: Disturbed, Undisturbed, No Recovery | GRAIN SIZE (%): ▲ Passing #200 sieve, △ Passing #4 sieve | SOIL HEADSPACE READING (ppm): GASTECH reading, PID reading

DEPTH (m)	COMMENTS		SOILS DESCRIPTION	ELEVATION (m)
0			Loose, grey GRAVEL (FILL).	53
		ML/SM	Compact, brown, silty SAND with a trace of gravel.	
1		SM/ML	Stiff, brown, sandy SILT to SAND and SILT with traces of gravel, clay and organics.	52
2		ML	Firm to stiff grey-brown, sandy SILT with traces of gravel and silt.	51
		ML		
3				50
4		ML		49
5		CL-ML	Soft to firm, grey SILT with some clay and a trace of sand.	48
6			Firm to stiff, grey SILT with some clay and traces of sand and gravel.	47
7	DCPT Refusal 40 blows for 50 mm penetration	ML/SM	Dense to very dense, grey, silty SAND with some gravel. - TILL-like below 6.7 m depth	
8			End of hole due to auger refusal at 7.2 m depth. Hole open to 6.7 m depth. Water observed at 5.2 m depth upon completion of drilling.	46
9				45
10				44

LOG OF TEST HOLE (COORDS+EL. EST.) 28847.GPJ THURBER_MOM.GDT 11/22/23- THURBER - BC OPERATIONS_2024.GLB

THURBER



GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

Sample Location: **TH23-03**
Sample: 2
Sample Depth: 1.07 - 1.22 m
Date Sampled: October 4-5, 2023
Sampled By: KTD
Date Received: October 11, 2023
Date Tested: October 20, 2023
Tested By: KM
Test Method: ASTM D422 & C136
Specification:

Gravel	**0.0%**
Sand	**31.6%**
Silt	**61.9%**
Clay	**6.5%**
Moisture Content	**21.6%**

LL	
PL	
PI	

Description: Sandy SILT, trace of clay (ML).
Comments:

THURBER ENGINEERING LTD.

GRAIN SIZE DISTRIBUTION

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue
FILE NO.: 28847

GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

Sample Location: **TH23-04**
Sample: 2
Sample Depth: 0.76 - 0.91 m
Date Sampled: October 4-5, 2023
Sampled By: KTD
Date Received: October 11, 2023
Date Tested: October 20, 2023
Tested By: KM
Test Method: ASTM D422 & C136
Specification:

Gravel	**1.9%**
Sand	**6.6%**
Silt	**61.4%**
Clay	**30.2%**
Moisture Content	**29.5%**

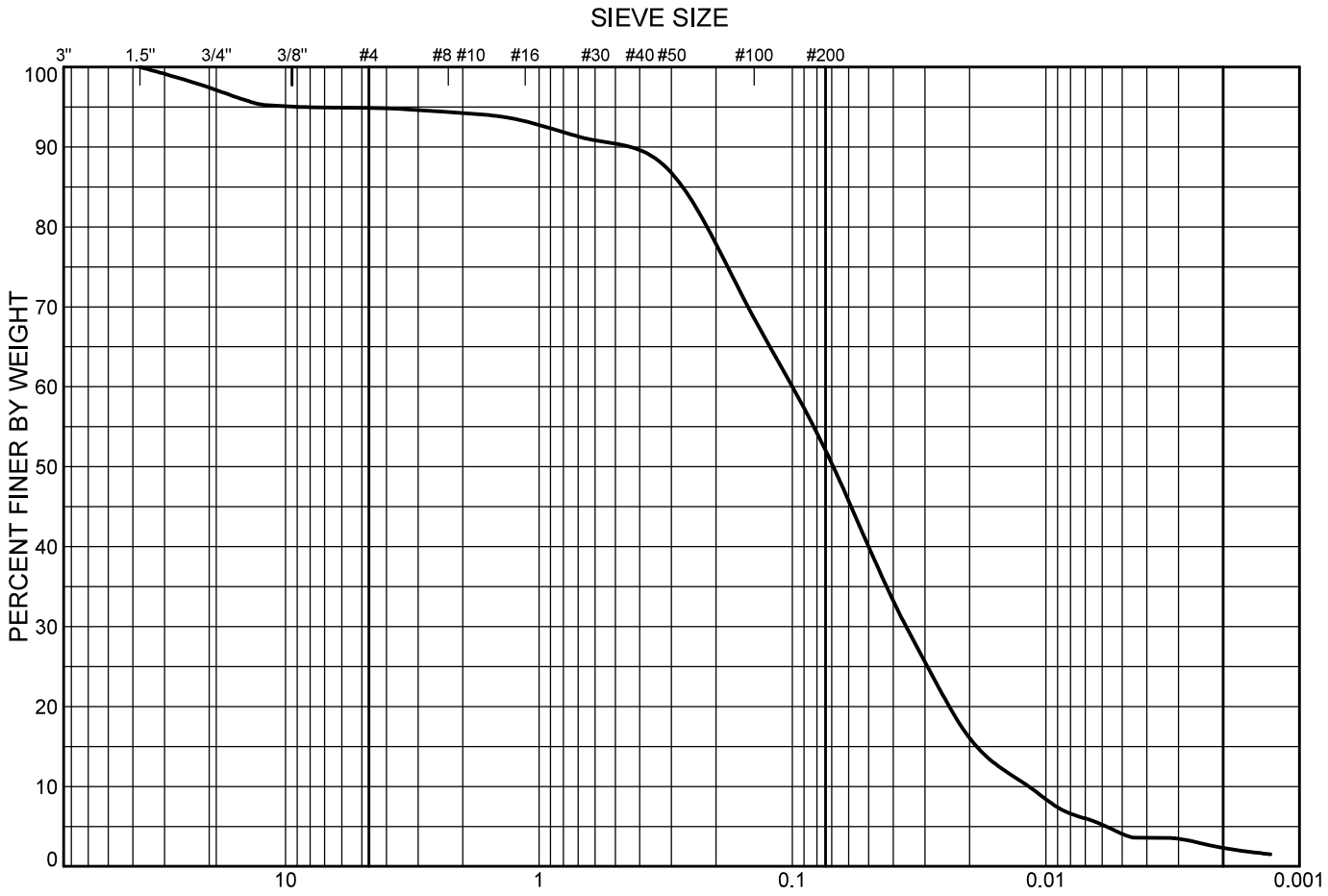
LL	
PL	
PI	

Description: Clayey SILT, traces of gravel and sand (CL).
Comments:

THURBER ENGINEERING LTD.

GRAIN SIZE DISTRIBUTION

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue
FILE NO.: 28847



GRAVEL		SAND			SILT	CLAY
coarse	fine	coarse	medium	fine		

Sample Location: **TH23-06**
Sample: 2
Sample Depth: 0.76 - 0.91 m
Date Sampled: October 4-5, 2023
Sampled By: KTD
Date Received: October 11, 2023
Date Tested: October 20, 2023
Tested By: KM
Test Method: ASTM D422 & C136
Specification:

Gravel	**5.1%**
Sand	**42.5%**
Silt	**50.0%**
Clay	**2.4%**
Moisture Content	**26.9%**

LL	
PL	
PI	

Description: SAND and SILT, traces of clay and gravel (SM/ML).
Comments:

THURBER ENGINEERING LTD.

GRAIN SIZE DISTRIBUTION

CLIENT: North Vancouver School District No. 44
PROJECT: Cloverley Elementary School
440 Hendry Avenue
FILE NO.: 28847

THURBER

THURBER

DOWNHOLE SEISMIC TEST DATA

Client: School District 44
Test Hole ID TH23-01
Site: Cloverley Elementary School

Job Number: 28847
Date: 12-Oct-23
Source Offset: 0.94
Source: Wood Beam

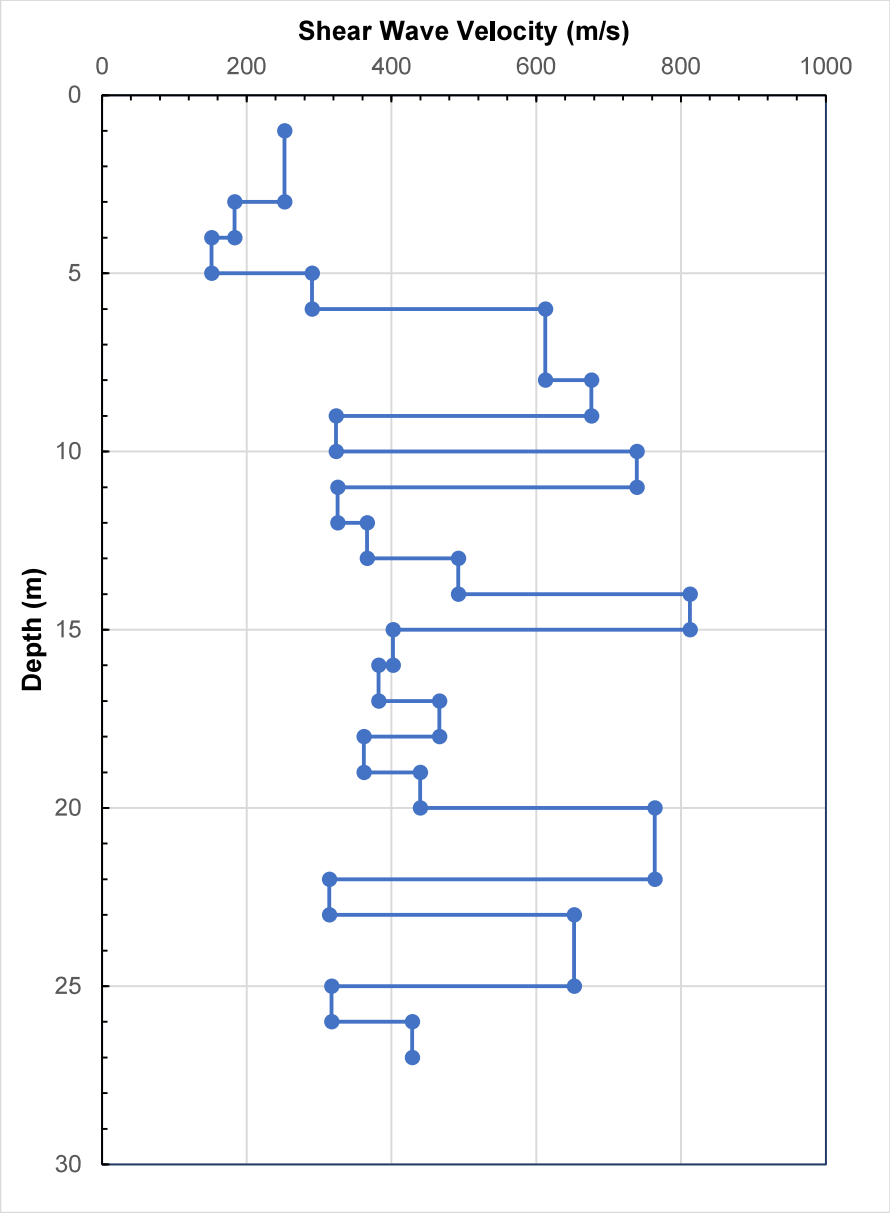
Geophone Depth (m)	Measured Travel Time from Source (ms)	Vertical Component of Travel Time (ms)	Incremental Shear Wave Velocity (m/s)
1.00	8.3	-	-
3.00	14.6	14.0	252
4.00	20.0	19.4	183
5.00	26.5	26.0	151
6.00	29.8	29.5	290
8.00	33.0	32.7	613
9.00	34.4	34.2	676
10.00	37.5	37.3	323
11.00	38.8	38.7	739
12.00	41.9	41.7	325
13.00	44.6	44.5	366
14.00	46.6	46.5	492
15.00	47.8	47.7	812
16.00	50.3	50.2	402
17.00	52.9	52.8	382
18.00	55.1	55.0	466
19.00	57.8	57.7	362
20.00	60.1	60.0	440
22.00	62.7	62.6	764
23.00	65.9	65.8	314
25.00	68.9	68.9	652
26.00	72.1	72.0	317
27.00	74.4	74.4	429

Shear wave travel time measurements by Thurber Engineering Ltd.

THURBER

VELOCITY PROFILE

Client:	**School District 44**	**Job Number:**	**28847**
Test ID:	**TH23-01**	**Date:**	**12-Oct-23**
Site:	**Cloverley Elementary School**	**Source Offset:**	**0.94**
		Source:	**Wood Beam**



Shear wave velocity measurements by Thurber Engineering Ltd.

THURBER

Table 1: Hydrocarbons in Soil
Job Number: 28847
Site Address: 440 Hendry Avenue, North Vancouver, BC
Client: North Vancouver School District #44

Sample ID	Soil Standards (µg/g)*					TH21-08-02	TH21-09-02	TH21-11-03	TH21-13-04	TH23-02-02	TH23-03-01
Certificate of Analysis						21D2772	21D2772	21D2772	21D2772	23J2230	23J2230
Sample Date	Agricultural (AL)	Residential Low Density (RLD)	Urban Park (PL)	Commercial (CL)	Industrial (IL)	20-Apr-21	20-Apr-21	21-Apr-21	21-Apr-21	6/Oct/23	6/Oct/23
Depth of Sample (m)						1.1 - 1.2	0.2 - 0.3	0.8 - 0.9	1.7 - 1.8	0.61-0.91	0.31-0.61
Parameters											
Photoionization Detector (ppm)	ns	ns	ns	ns	ns	13.3	0.8	7.1	1.2	1.1	0.6
EPH (C10-C19)	ns	ns	ns	ns	ns	<50	<50	<50	<50	<50	<50
EPH (C19-C32)	ns	ns	ns	ns	ns	<50	<50	<50	<50	85	76
LEPH (C10-C19)	1000	1000	1000	2000	2000	<50	<50	<50	<50	<50	<50
HEPH (C19-C32)	1000	1000	1000	5000	5000	<50	<50	<50	<50	85	76
1-Methylnaphthalene	250	250	500	1000	1000	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
2-Methylnaphthalene	60	60	100	950	950	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Acenaphthene	950	950	2000	15000	15000	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Acenaphthylene	ns	ns	ns	ns	ns	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Anthracene	2.5	2.5	2.5	30	30	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benz(a)anthracene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene	5	5	10	30	50	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(b+j)fluoranthene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(g,h,i)perylene	ns	ns	ns	ns	ns	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzo(k)fluoranthene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chrysene	200	200	400	4500	4500	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Dibenz(a,h)anthracene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Fluoranthene	50	50	50	200	200	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Fluorene	600	600	1000	9500	9500	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Naphthalene	0.6	0.6	0.6	20	20	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Phenanthrene	0.1	5	5	50	50	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Pyrene	0.1	10	10	100	100	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Quinoline	2.5	2.5	4.5	10	10	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

Notes:
Values in µg/g unless otherwise stated.
ns = no standard

XXX.XX = Exceeds Applicable AL Soil Standard
XXX.XX = Exceeds Applicable RLD Soil Standard
XXX.XX = Exceeds Applicable PL Soil Standard
XXX.XX = Exceeds Applicable CL Soil Standard
XXX.XX = Exceeds Applicable IL Soil Standard (> 3 m bgs)

* Standards provided in Schedule 3.1 of the BC Contaminated Sites Regulation. Site specific factors include intake of contaminated soil, toxicity to soil invertebrates and plants, livestock ingesting soil and fodder, major microbial functional impairment, groundwater used for drinking water, livestock watering, irrigation, and groundwater flow to surface water used by aquatic life (freshwater and marine).

PAH = Polycyclic Aromatic Hydrocarbons
EPH_{10-19} = LEPH, uncorrected for PAH
EPH_{19-32} = HEPH, uncorrected for PAH
LEPH = Light Extractable Petroleum Hydrocarbons, corrected for PAH
HEPH = Heavy Extractable Petroleum Hydrocarbons, corrected for PAH

Table 1: Hydrocarbons in Soil
Job Number: 28847
Site Address: 440 Hendry Avenue, North Vancouver, BC
Client: North Vancouver School District #44

Sample ID						TH23-04-03	TH23-B	TH23-05-01	TH23-06-01
Certificate of Analysis	Soil Standards (µg/g)*					23J2230	23J2230	23J2230	23J2230
Sample Date	Agricultural (AL)	Residential Low Density (RLD)	Urban Park (PL)	Commercial (CL)	Industrial (IL)	6/Oct/23	6/Oct/23	6/Oct/23	6/Oct/23
Depth of Sample (m)						1.37-1.52	1.37-1.52	0.15-0.31	0.31-0.46
Parameters									
Photoionization Detector (ppm)	ns	ns	ns	ns	ns	0.2	0.2	2.8	2.5
EPH (C10-C19)	ns	ns	ns	ns	ns	<50	<50	<50	<50
EPH (C19-C32)	ns	ns	ns	ns	ns	<50	<50	<50	<50
LEPH (C10-C19)	1000	1000	1000	2000	2000	<50	<50	<50	<50
HEPH (C19-C32)	1000	1000	1000	5000	5000	<50	<50	<50	<50
1-Methylnaphthalene	250	250	500	1000	1000	<0.050	<0.050	<0.050	<0.050
2-Methylnaphthalene	60	60	100	950	950	<0.050	<0.050	<0.050	<0.050
Acenaphthene	950	950	2000	15000	15000	<0.050	<0.050	<0.050	<0.050
Acenaphthylene	ns	ns	ns	ns	ns	<0.050	<0.050	<0.050	<0.050
Anthracene	2.5	2.5	2.5	30	30	<0.050	<0.050	<0.050	<0.050
Benz(a)anthracene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050
Benzo(a)pyrene	5	5	10	30	50	<0.050	<0.050	<0.050	<0.050
Benzo(b+j)fluoranthene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050
Benzo(g,h,i)perylene	ns	ns	ns	ns	ns	<0.050	<0.050	<0.050	<0.050
Benzo(k)fluoranthene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050
Chrysene	200	200	400	4500	4500	<0.050	<0.050	<0.050	<0.050
Dibenz(a,h)anthracene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050
Fluoranthene	50	50	50	200	200	<0.050	<0.050	<0.050	<0.050
Fluorene	600	600	1000	9500	9500	<0.050	<0.050	<0.050	<0.050
Indeno(1,2,3-c,d)pyrene	0.1	1	1	10	10	<0.050	<0.050	<0.050	<0.050
Naphthalene	0.6	0.6	0.6	20	20	<0.050	<0.050	<0.050	<0.050
Phenanthrene	0.1	5	5	50	50	<0.050	<0.050	<0.050	<0.050
Pyrene	0.1	10	10	100	100	<0.050	<0.050	<0.050	<0.050
Quinoline	2.5	2.5	4.5	10	10	<0.050	<0.050	<0.050	<0.050

Notes:
Values in µg/g unless otherwise stated.
ns = no standard

XXX.XX = Exceeds Applicable AL Soil Standard
XXX.XX = Exceeds Applicable RLD Soil Standard
XXX.XX = Exceeds Applicable PL Soil Standard
XXX.XX = Exceeds Applicable CL Soil Standard
XXX.XX = Exceeds Applicable IL Soil Standard (> 3 m bgs)

* Standards provided in Schedule 3.1 of the BC Contaminated Sites Regulation. Site specific factors include intake of contaminated soil, toxicity to soil invertebrates and plants, livestock ingesting soil and fodder, major microbial functional impairment, groundwater used for drinking water, livestock watering, irrigation, and groundwater flow to surface water used by aquatic life (freshwater and marine).

PAH = Polycyclic Aromatic Hydrocarbons
EPH_{10-19} = LEPH, uncorrected for PAH
EPH_{19-32} = HEPH, uncorrected for PAH
LEPH = Light Extractable Petroleum Hydrocarbons, corrected for PAH
HEPH = Heavy Extractable Petroleum Hydrocarbons, corrected for PAH

Table 2: Metals in Soil
Job Number: 28847
Site Address: 440 Hendry Avenue, North Vancouver, BC
Client: North Vancouver School District #44

Sample ID						TH21-08-02	TH21-09-02	TH21-11-03	TH21-13-04	TH23-02-02	TH23-02-02 Reanalysis	TH23-02-02 Reanalysis
Certificate of Analysis	Soil Standards (µg/g)*					21D2772	21D2772	21D2772	21D2772	23J2230	23J2230	23J2230
Sample Date	Agricultural (AL)	Residential Low Density (RLD)	Urban Park (PL)	Commercial (CL)	Industrial (IL)	20-Apr-21	20-Apr-21	21-Apr-21	21-Apr-21	6/Oct/23	6/Oct/23	6/Oct/23
Depth of Sample (m)						1.1 - 1.2	0.2 - 0.3	0.8 - 0.9	1.7 - 1.8	0.61-0.91	0.61-0.91	0.61-0.91
Parameters												
pH	ns	ns	ns	ns	ns	5.96	6.18	5.86	6.51	5.98	5.28	5.3
Aluminum (Al)	40000	40000	40000	250000	250000	11900	18800	17700	20000	22800	-	22300
Antimony (Sb)	20	20	20	40	40	0.11	0.18	0.19	0.17	0.45		0.5
Arsenic (As)	10	10	10	10	10	2.39	2.54	2.83	3.21	4.24	-	4.21
Barium (Ba)	350	350	350	350	350	63.1	47.5	38.9	82.7	39.1	-	42.8
Beryllium (Be)	1-85**	1-85**	1-150**	1-350**	1-350**	0.13	0.25	0.22	0.25	0.3	-	0.28
Boron (B)	8500	8500	15000	50000	1000000	<2.0	<2.0	2	<2.0	2.2	-	2.5
Cadmium (Cd)	1-10**	1-20**	1-30**	1-50**	1-50**	<0.040	0.092	0.096	0.099	0.181	0.181	0.152
Chromium (Cr)	60	60	60	60	60	18.3	15.4	14.2	20.4	14.6	-	13.7
Cobalt (Co)	25	25	25	25	25	4.71	5.29	4.81	10	5.62	-	5.4
Copper (Cu)	75-150**	75-150**	75-150**	75-300**	75-300**	13.7	14.4	12.1	32.2	32.3	-	32.3
Iron (Fe)	35000	35000	35000	150000	150000	14200	16100	13000	22600	17700	-	16900
Lead (Pb)	120	120	120	120-150**	120-1000**	1.99	5.76	7.63	5.07	26.6	-	29
Lithium (Li)	30	30	65	450	450	7.95	6.72	5.76	7.74	6.38	-	5.68
Manganese (Mn)	2000	2000	2000	2000	2000	166	274	179	483	231	-	233
Mercury (Hg)	0.6	10	25	75	75	<0.040	0.055	0.059	<0.040	0.125	-	0.125
Molybdenum (Mo)	3	15	15	15	15	0.32	0.46	0.51	0.65	0.81	-	0.86
Nickel (Ni)	70-150**	70-150**	70-150**	70-250**	70-250**	8.38	8.39	7.61	13.5	12.3	-	11.7
Selenium (Se)	1	1	1	1	1	<0.20	0.34	0.34	<0.20	0.56	-	0.52
Silver (Ag)	20	20	20	40	40	<0.10	0.12	<0.10	<0.10	0.17	-	0.15
Strontium (Sr)	9500	9500	20000	150000	150000	26.5	25.2	19.8	48.8	17.6	-	17.3
Thallium (Tl)	2	9	9	25	25	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10
Tin (Sn)	5	50	50	300	300	<0.20	0.37	0.36	0.34	0.52	-	0.54
Tungsten (W)	15	15	25	200	200	<0.20	<0.20	<0.20	<0.20	0.24	-	0.31
Uranium (U)	15	30	30	30	30	0.31	0.468	0.456	0.673	0.46	-	0.481
Vanadium (V)	100	100	100	100	100	49.1	48.4	49.5	62	48	-	47.2
Zinc (Zn)	150-200**	150-200**	150-200**	150-200**	150-200**	20	31.8	33.9	49.8	47	-	43

Notes:
Values in µg/g unless otherwise stated.
ns = no standard

XXX.XX	= Exceeds Applicable AL Soil Standard
XXX.XX	= Exceeds Applicable RLD Soil Standard
XXX.XX	= Exceeds Applicable PL Soil Standard
XXX.XX	= Exceeds Applicable CL Soil Standard
XXX.XX	= Exceeds Applicable IL Soil Standard (> 3 m bgs)

* Standards provided in Schedule 3.1 of the BC Contaminated Sites Regulation. Site specific factors include intake of contaminated soil, toxicity to soil invertebrates and plants, livestock ingesting soil and fodder, major microbial functional impairment, groundwater used for drinking water, livestock watering, irrigation, and groundwater flow to surface water used by aquatic life (freshwater and marine).

** Standard is pH dependent

Table 2: Metals in Soil
Job Number: 28847
Site Address: 440 Hendry Avenue, North Vancouver, BC
Client: North Vancouver School District #44

Sample ID						TH23-03-01	TH23-04-03	TH23-04-03 Reanalysis	TH23-04-03 Reanalysis	TH23-B	TH23-B Reanalysis
Certificate of Analysis	Soil Standards (µg/g)*					23J2230	23J2230	23J2230	23J2230	Dup. of TH23-04-03	Dup. of TH23-04-03
Sample Date	Agricultural (AL)	Residential Low Density (RLD)	Urban Park (PL)	Commercial (CL)	Industrial (IL)	6/Oct/23	6/Oct/23	6/Oct/23	6/Oct/23	6/Oct/23	6/Oct/23
Depth of Sample (m)						0.31-0.61	1.37-1.52	1.37-1.52	1.37-1.52	1.37-1.52	1.37-1.52
Parameters											
pH	ns	ns	ns	ns	ns	6.15	7.03	-	-	7.55	-
Aluminum (Al)	40000	40000	40000	250000	250000	23800	38400	-	-	33100	-
Antimony (Sb)	20	20	20	40	40	0.74	0.32	-	-	0.35	-
Arsenic (As)	10	10	10	10	10	5.45	7.92	-	-	7.58	-
Barium (Ba)	350	350	350	350	350	56.3	161	-	-	137	-
Beryllium (Be)	1-85**	1-85**	1-150**	1-350**	1-350**	0.33	0.63	-	-	0.57	-
Boron (B)	8500	8500	15000	50000	1000000	2.2	2.3	-	-	<2.0	-
Cadmium (Cd)	1-10**	1-20**	1-30**	1-50**	1-50**	0.228	0.131	-	-	0.111	-
Chromium (Cr)	60	60	60	60	60	15.2	31.9	-	-	27.9	-
Cobalt (Co)	25	25	25	25	25	6.93	15.5	-	-	14.7	-
Copper (Cu)	75-150**	75-150**	75-150**	75-300**	75-300**	26.2	60.9	-	-	50.7	-
Iron (Fe)	35000	35000	35000	150000	150000	19500	40000	34600	33100	35600	40800
Lead (Pb)	120	120	120	120-150**	120-1000**	36.6	9.51	-	-	8.2	-
Lithium (Li)	30	30	65	450	450	6.62	12.9	-	-	11	-
Manganese (Mn)	2000	2000	2000	2000	2000	580	744	-	-	628	-
Mercury (Hg)	0.6	10	25	75	75	0.17	<0.040	-	-	<0.040	-
Molybdenum (Mo)	3	15	15	15	15	0.79	0.89	-	-	1.11	-
Nickel (Ni)	70-150**	70-150**	70-150**	70-250**	70-250**	13.6	24.1	-	-	21.6	-
Selenium (Se)	1	1	1	1	1	0.63	<0.20	-	-	<0.20	-
Silver (Ag)	20	20	20	40	40	0.16	<0.10	-	-	<0.10	-
Strontium (Sr)	9500	9500	20000	150000	150000	21.5	59.7	-	-	54.8	-
Thallium (Tl)	2	9	9	25	25	<0.10	0.14	-	-	0.13	-
Tin (Sn)	5	50	50	300	300	0.7	0.5	-	-	0.54	-
Tungsten (W)	15	15	25	200	200	0.43	<0.20	-	-	<0.20	-
Uranium (U)	15	30	30	30	30	0.471	0.961	-	-	0.899	-
Vanadium (V)	100	100	100	100	100	52.2	99.3	-	-	93.4	-
Zinc (Zn)	150-200**	150-200**	150-200**	150-200**	150-200**	57.6	86.9	-	-	73.9	-

Notes:
Values in µg/g unless otherwise stated.
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XXX.XX = Exceeds Applicable PL Soil Standard
XXX.XX = Exceeds Applicable CL Soil Standard
XXX.XX = Exceeds Applicable IL Soil Standard (> 3 m bgs)

* Standards provided in Schedule 3.1 of the BC Contaminated Sites Regulation. Site specific factors include intake of contaminated soil, toxicity to soil invertebrates and plants, livestock ingesting soil and fodder, major microbial functional impairment, groundwater used for drinking water, livestock watering, irrigation, and groundwater flow to surface water used by aquatic life (freshwater and marine).

** Standard is pH dependent

Table 2: Metals in Soil
Job Number: 28847
Site Address: 440 Hendry Avenue, North Vancouver, BC
Client: North Vancouver School District #44

Sample ID						TH23-B Reanalysis	TH23-05-01	TH23-06-01
Certificate of Analysis	Soil Standards (µg/g)*					Dup. of TH23-04-03	23J2230	23J2230
Sample Date	Agricultural (AL)	Residential Low Density (RLD)	Urban Park (PL)	Commercial (CL)	Industrial (IL)	6/Oct/23	6/Oct/23	6/Oct/23
Depth of Sample (m)						1.37-1.52	0.15-0.31	0.31-0.46
Parameters								
pH	ns	ns	ns	ns	ns	-	6.01	6.75
Aluminum (Al)	40000	40000	40000	250000	250000	-	22800	15400
Antimony (Sb)	20	20	20	40	40	-	0.1	0.12
Arsenic (As)	10	10	10	10	10	-	2.54	2.54
Barium (Ba)	350	350	350	350	350	-	84.5	44.5
Beryllium (Be)	1-85**	1-85**	1-150**	1-350**	1-350**	-	0.2	0.18
Boron (B)	8500	8500	15000	50000	1000000	-	<2.0	<2.0
Cadmium (Cd)	1-10**	1-20**	1-30**	1-50**	1-50**	-	0.045	0.062
Chromium (Cr)	60	60	60	60	60	-	17.8	16.2
Cobalt (Co)	25	25	25	25	25	-	6.87	5.21
Copper (Cu)	75-150**	75-150**	75-150**	75-300**	75-300**	-	19.9	17.7
Iron (Fe)	35000	35000	35000	150000	150000	36900	18900	17000
Lead (Pb)	120	120	120	120-150**	120-1000**	-	3.35	3.85
Lithium (Li)	30	30	65	450	450	-	6.14	5.93
Manganese (Mn)	2000	2000	2000	2000	2000	-	279	208
Mercury (Hg)	0.6	10	25	75	75	-	<0.040	<0.040
Molybdenum (Mo)	3	15	15	15	15	-	0.38	0.46
Nickel (Ni)	70-150**	70-150**	70-150**	70-250**	70-250**	-	8.79	9.11
Selenium (Se)	1	1	1	1	1	-	<0.20	<0.20
Silver (Ag)	20	20	20	40	40	-	<0.10	<0.10
Strontium (Sr)	9500	9500	20000	150000	150000	-	75.8	27.9
Thallium (Tl)	2	9	9	25	25	-	<0.10	<0.10
Tin (Sn)	5	50	50	300	300	-	0.2	<0.20
Tungsten (W)	15	15	25	200	200	-	<0.20	<0.20
Uranium (U)	15	30	30	30	30	-	0.524	0.423
Vanadium (V)	100	100	100	100	100	-	57.2	54.7
Zinc (Zn)	150-200**	150-200**	150-200**	150-200**	150-200**	-	30.7	28.6

Notes:
Values in µg/g unless otherwise stated.
ns = no standard

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XXX.XX = Exceeds Applicable RLD Soil Standard
XXX.XX = Exceeds Applicable PL Soil Standard
XXX.XX = Exceeds Applicable CL Soil Standard
XXX.XX = Exceeds Applicable IL Soil Standard (> 3 m bgs)

* Standards provided in Schedule 3.1 of the BC Contaminated Sites Regulation. Site specific factors include intake of contaminated soil, toxicity to soil invertebrates and plants, livestock ingesting soil and fodder, major microbial functional impairment, groundwater used for drinking water, livestock watering, irrigation, and groundwater flow to surface water used by aquatic life (freshwater and marine).

** Standard is pH dependent

Table 9: Soil QA/QC
Job Number: 28847
Site Address: 440 Hendry Avenue, North Vancouver, BC
Client: North Vancouver School District #44

Parameters	Detection Limit	TH23-04-03	TH23-B	Mean	RPD
EPH (C10-C19)	50	<50	<50	NC	NC
EPH (C19-C32)	50	<50	<50	NC	NC
LEPH (C10-C19)	50	<50	<50	NC	NC
HEPH (C19-C32)	50	<50	<50	NC	NC
1-Methylnaphthalene	0.05	<0.050	<0.050	NC	NC
2-Methylnaphthalene	0.05	<0.050	<0.050	NC	NC
Acenaphthene	0.05	<0.050	<0.050	NC	NC
Acenaphthylene	0.05	<0.050	<0.050	NC	NC
Anthracene	0.05	<0.050	<0.050	NC	NC
Benz(a)anthracene	0.05	<0.050	<0.050	NC	NC
Benzo(a)pyrene	0.05	<0.050	<0.050	NC	NC
Benzo(b+j)fluoranthene	0.05	<0.050	<0.050	NC	NC
Benzo(g,h,i)perylene	0.05	<0.050	<0.050	NC	NC
Benzo(k)fluoranthene	0.05	<0.050	<0.050	NC	NC
Chrysene	0.05	<0.050	<0.050	NC	NC
Dibenz(a,h)anthracene	0.05	<0.050	<0.050	NC	NC
Fluoranthene	0.05	<0.050	<0.050	NC	NC
Fluorene	0.05	<0.050	<0.050	NC	NC
Indeno(1,2,3-c,d)pyrene	0.05	<0.050	<0.050	NC	NC
Naphthalene	0.05	<0.050	<0.050	NC	NC
Phenanthrene	0.05	<0.050	<0.050	NC	NC
Pyrene	0.05	<0.050	<0.050	NC	NC
Quinoline	0.05	<0.050	<0.050	NC	NC
Parameters	**Detection Limit**	**TH23-04-03**	**TH23-B**	**Mean**	**RPD**
Aluminum (Al)	40	38400	33100	35750	14.8%
Antimony (Sb)	0.1	0.32	0.35	0.335	NA
Arsenic (As)	0.3	7.92	7.58	7.75	4.4%
Barium (Ba)	1	161	137	149	16.1%
Beryllium (Be)	0.1	0.63	0.57	0.6	10.0%
Boron (B)	2	2.3	<2.0	2.3	NA
Cadmium (Cd)	0.04	0.131	0.111	0.121	NA
Chromium (Cr)	1	31.9	27.9	29.9	13.4%
Cobalt (Co)	0.1	15.5	14.7	15.1	5.3%
Copper (Cu)	0.4	60.9	50.7	55.8	18.3%
Iron (Fe)	20	40000	35600	37800	11.6%
Lead (Pb)	0.2	9.51	8.2	8.855	14.8%
Lithium (Li)	0.1	12.9	11	11.95	15.9%
Manganese (Mn)	0.4	744	628	686	16.9%
Mercury (Hg)	0.04	<0.040	<0.040	NC	NC
Molybdenum (Mo)	0.1	0.89	1.11	1	22.0%
Nickel (Ni)	0.6	24.1	21.6	22.85	10.9%
Selenium (Se)	0.2	<0.20	<0.20	NC	NC
Silver (Ag)	0.1	<0.10	<0.10	NC	NC
Strontium (Sr)	0.2	59.7	54.8	57.25	8.6%
Thallium (Tl)	0.1	0.14	0.13	0.135	NA
Tin (Sn)	0.2	0.5	0.54	0.52	NA
Tungsten (W)	0.2	<0.20	<0.20	NC	NC
Uranium (U)	0.05	0.961	0.899	0.93	6.7%
Vanadium (V)	1	99.3	93.4	96.35	6.1%
Zinc (Zn)	2	86.9	73.9	80.4	16.2%

Mean and RPD not calculated when results were below detection limits.
bold = Exceeds Acceptable Limit (RPD of 60%)
QA/QC = Quality Assurance / Quality Control
RPD = Relative Percent Difference
NA = Not applicable
NC = Not calculated

THURBER

CERTIFICATE OF ANALYSIS

REPORTED TO	Thurber Engineering Ltd. (Vancouver) 900 - 1281 West Georgia Street Vancouver, BC V6E 3J7
ATTENTION	[redacted]
PO NUMBER	28847
PROJECT	28847
PROJECT INFO	
WORK ORDER	21D2772
RECEIVED / TEMP	2021-04-27 11:30 / 4°C
REPORTED	2021-05-05 13:14
COC NUMBER	B102820

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

Work Order Comments:

This is a revised report; please refer to Appendix 3 for details.

If you have any questions or concerns, please contact me at [redacted]

Authorized By:

[redacted]

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
PROJECT	28847	**REPORTED**	2021-05-05 13:14

Analyte	Result	RL	Units	Analyzed	Qualifier
TH21-13-04 (21D2772-12) | Matrix: Soil | Sampled: 2021-04-21					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2021-04-29	
EPHs19-32	< 50	50	mg/kg dry	2021-04-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	< 50	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*104*	*70-125*	%	*2021-04-29*	
General Parameters					
Moisture	**20.9**	1.0	% wet	2021-04-30	
pH (1:2 H2O Solution)	**6.51**	0.10	pH units	2021-05-02	HT1
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2021-04-29	
Anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Chrysene	< 0.050	0.050	mg/kg dry	2021-04-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluorene	< 0.050	0.050	mg/kg dry	2021-04-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Quinoline	< 0.050	0.050	mg/kg dry	2021-04-29	
Surrogate: Acenaphthene-d10	*82*	*50-122*	%	*2021-04-29*	
Surrogate: Chrysene-d12	*94*	*50-140*	%	*2021-04-29*	
Surrogate: Naphthalene-d8	*82*	*50-140*	%	*2021-04-29*	
Surrogate: Perylene-d12	*86*	*50-140*	%	*2021-04-29*	
Surrogate: Phenanthrene-d10	*86*	*55-119*	%	*2021-04-29*	
Strong Acid Leachable Metals					
Aluminum	**20000**	40	mg/kg dry	2021-05-01	
Antimony	**0.17**	0.10	mg/kg dry	2021-05-01	
Arsenic	**3.21**	0.30	mg/kg dry	2021-05-01	
Barium	**82.7**	1.0	mg/kg dry	2021-05-01	
Beryllium	**0.25**	0.10	mg/kg dry	2021-05-01	
Boron	< 2.0	2.0	mg/kg dry	2021-05-01	
Cadmium	**0.099**	0.040	mg/kg dry	2021-05-01	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
PROJECT	28847	**REPORTED**	2021-05-05 13:14

Analyte	Result	RL	Units	Analyzed	Qualifier
TH21-13-04 (21D2772-12) | Matrix: Soil | Sampled: 2021-04-21, Continued					
Strong Acid Leachable Metals, Continued					
Chromium	**20.4**	1.0	mg/kg dry	2021-05-01	
Cobalt	**10.0**	0.10	mg/kg dry	2021-05-01	
Copper	**32.2**	0.40	mg/kg dry	2021-05-01	
Iron	**22600**	20	mg/kg dry	2021-05-01	
Lead	**5.07**	0.20	mg/kg dry	2021-05-01	
Lithium	**7.74**	0.10	mg/kg dry	2021-05-01	
Manganese	**483**	0.40	mg/kg dry	2021-05-01	
Mercury	< 0.040	0.040	mg/kg dry	2021-05-01	
Molybdenum	**0.65**	0.10	mg/kg dry	2021-05-01	
Nickel	**13.5**	0.60	mg/kg dry	2021-05-01	
Selenium	< 0.20	0.20	mg/kg dry	2021-05-01	
Silver	< 0.10	0.10	mg/kg dry	2021-05-01	
Strontium	**48.8**	0.20	mg/kg dry	2021-05-01	
Thallium	< 0.10	0.10	mg/kg dry	2021-05-01	
Tin	**0.34**	0.20	mg/kg dry	2021-05-01	
Tungsten	< 0.20	0.20	mg/kg dry	2021-05-01	
Uranium	**0.673**	0.050	mg/kg dry	2021-05-01	
Vanadium	**62.0**	1.0	mg/kg dry	2021-05-01	
Zinc	**49.8**	2.0	mg/kg dry	2021-05-01	
TH21-11-03 (21D2772-20) | Matrix: Soil | Sampled: 2021-04-21					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2021-04-29	
EPHs19-32	< 50	50	mg/kg dry	2021-04-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	< 50	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*107*	*70-125*	%	*2021-04-29*	
General Parameters					
Moisture	**19.1**	1.0	% wet	2021-04-30	
pH (1:2 H2O Solution)	**5.86**	0.10	pH units	2021-05-02	HT1
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2021-04-29	
Anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2021-04-29	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
PROJECT	28847	**REPORTED**	2021-05-05 13:14

Analyte	Result	RL	Units	Analyzed	Qualifier
TH21-11-03 (21D2772-20) | Matrix: Soil | Sampled: 2021-04-21, Continued					
Polycyclic Aromatic Hydrocarbons (PAH), Continued					
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Chrysene	< 0.050	0.050	mg/kg dry	2021-04-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluorene	< 0.050	0.050	mg/kg dry	2021-04-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Quinoline	< 0.050	0.050	mg/kg dry	2021-04-29	
Surrogate: Acenaphthene-d10	*83*	*50-122*	%	*2021-04-29*	
Surrogate: Chrysene-d12	*89*	*50-140*	%	*2021-04-29*	
Surrogate: Naphthalene-d8	*83*	*50-140*	%	*2021-04-29*	
Surrogate: Perylene-d12	*82*	*50-140*	%	*2021-04-29*	
Surrogate: Phenanthrene-d10	*87*	*55-119*	%	*2021-04-29*	
Strong Acid Leachable Metals					
Aluminum	**17700**	40	mg/kg dry	2021-05-01	
Antimony	**0.19**	0.10	mg/kg dry	2021-05-01	
Arsenic	**2.83**	0.30	mg/kg dry	2021-05-01	
Barium	**38.9**	1.0	mg/kg dry	2021-05-01	
Beryllium	**0.22**	0.10	mg/kg dry	2021-05-01	
Boron	**2.0**	2.0	mg/kg dry	2021-05-01	
Cadmium	**0.096**	0.040	mg/kg dry	2021-05-01	
Chromium	**14.2**	1.0	mg/kg dry	2021-05-01	
Cobalt	**4.81**	0.10	mg/kg dry	2021-05-01	
Copper	**12.1**	0.40	mg/kg dry	2021-05-01	
Iron	**13000**	20	mg/kg dry	2021-05-01	
Lead	**7.63**	0.20	mg/kg dry	2021-05-01	
Lithium	**5.76**	0.10	mg/kg dry	2021-05-01	
Manganese	**179**	0.40	mg/kg dry	2021-05-01	
Mercury	**0.059**	0.040	mg/kg dry	2021-05-01	
Molybdenum	**0.51**	0.10	mg/kg dry	2021-05-01	
Nickel	**7.61**	0.60	mg/kg dry	2021-05-01	
Selenium	**0.34**	0.20	mg/kg dry	2021-05-01	
Silver	< 0.10	0.10	mg/kg dry	2021-05-01	
Strontium	**19.8**	0.20	mg/kg dry	2021-05-01	
Thallium	< 0.10	0.10	mg/kg dry	2021-05-01	
Tin	**0.36**	0.20	mg/kg dry	2021-05-01	
Tungsten	< 0.20	0.20	mg/kg dry	2021-05-01	
Uranium	**0.456**	0.050	mg/kg dry	2021-05-01	
Vanadium	**49.5**	1.0	mg/kg dry	2021-05-01	
Zinc	**33.9**	2.0	mg/kg dry	2021-05-01	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
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Analyte	Result	RL	Units	Analyzed	Qualifier
TH21-08-02 (21D2772-31) | Matrix: Soil | Sampled: 2021-04-20					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2021-04-29	
EPHs19-32	< 50	50	mg/kg dry	2021-04-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	< 50	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*103*	*70-125*	%	*2021-04-29*	
General Parameters					
Moisture	**16.1**	1.0	% wet	2021-04-30	
pH (1:2 H2O Solution)	**5.96**	0.10	pH units	2021-05-02	HT1
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2021-04-29	
Anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Chrysene	< 0.050	0.050	mg/kg dry	2021-04-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluorene	< 0.050	0.050	mg/kg dry	2021-04-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Quinoline	< 0.050	0.050	mg/kg dry	2021-04-29	
Surrogate: Acenaphthene-d10	*81*	*50-122*	%	*2021-04-29*	
Surrogate: Chrysene-d12	*88*	*50-140*	%	*2021-04-29*	
Surrogate: Naphthalene-d8	*84*	*50-140*	%	*2021-04-29*	
Surrogate: Perylene-d12	*85*	*50-140*	%	*2021-04-29*	
Surrogate: Phenanthrene-d10	*85*	*55-119*	%	*2021-04-29*	
Strong Acid Leachable Metals					
Aluminum	**11900**	40	mg/kg dry	2021-05-01	
Antimony	**0.11**	0.10	mg/kg dry	2021-05-01	
Arsenic	**2.39**	0.30	mg/kg dry	2021-05-01	
Barium	**63.1**	1.0	mg/kg dry	2021-05-01	
Beryllium	**0.13**	0.10	mg/kg dry	2021-05-01	
Boron	< 2.0	2.0	mg/kg dry	2021-05-01	
Cadmium	< 0.040	0.040	mg/kg dry	2021-05-01	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
PROJECT	28847	**REPORTED**	2021-05-05 13:14

Analyte	Result	RL	Units	Analyzed	Qualifier
TH21-08-02 (21D2772-31) | Matrix: Soil | Sampled: 2021-04-20, Continued					
Strong Acid Leachable Metals, Continued					
Chromium	**18.3**	1.0	mg/kg dry	2021-05-01	
Cobalt	**4.71**	0.10	mg/kg dry	2021-05-01	
Copper	**13.7**	0.40	mg/kg dry	2021-05-01	
Iron	**14200**	20	mg/kg dry	2021-05-01	
Lead	**1.99**	0.20	mg/kg dry	2021-05-01	
Lithium	**7.95**	0.10	mg/kg dry	2021-05-01	
Manganese	**166**	0.40	mg/kg dry	2021-05-01	
Mercury	< 0.040	0.040	mg/kg dry	2021-05-01	
Molybdenum	**0.32**	0.10	mg/kg dry	2021-05-01	
Nickel	**8.38**	0.60	mg/kg dry	2021-05-01	
Selenium	< 0.20	0.20	mg/kg dry	2021-05-01	
Silver	< 0.10	0.10	mg/kg dry	2021-05-01	
Strontium	**26.5**	0.20	mg/kg dry	2021-05-01	
Thallium	< 0.10	0.10	mg/kg dry	2021-05-01	
Tin	< 0.20	0.20	mg/kg dry	2021-05-01	
Tungsten	< 0.20	0.20	mg/kg dry	2021-05-01	
Uranium	**0.310**	0.050	mg/kg dry	2021-05-01	
Vanadium	**49.1**	1.0	mg/kg dry	2021-05-01	
Zinc	**20.0**	2.0	mg/kg dry	2021-05-01	
TH21-09-02 (21D2772-36) | Matrix: Soil | Sampled: 2021-04-20					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2021-04-29	
EPHs19-32	< 50	50	mg/kg dry	2021-04-29	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	< 50	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*103*	*70-125*	%	*2021-04-29*	
General Parameters					
Moisture	**21.6**	1.0	% wet	2021-04-30	
pH (1:2 H2O Solution)	**6.18**	0.10	pH units	2021-05-02	HT1
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2021-04-29	
Anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2021-04-29	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
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Analyte	Result	RL	Units	Analyzed	Qualifier
TH21-09-02 (21D2772-36) | Matrix: Soil | Sampled: 2021-04-20, Continued					
Polycyclic Aromatic Hydrocarbons (PAH), Continued					
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Chrysene	< 0.050	0.050	mg/kg dry	2021-04-29	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluoranthene	< 0.050	0.050	mg/kg dry	2021-04-29	
Fluorene	< 0.050	0.050	mg/kg dry	2021-04-29	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Naphthalene	< 0.050	0.050	mg/kg dry	2021-04-29	
Phenanthrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Pyrene	< 0.050	0.050	mg/kg dry	2021-04-29	
Quinoline	< 0.050	0.050	mg/kg dry	2021-04-29	
Surrogate: Acenaphthene-d10	*79*	*50-122*	%	*2021-04-29*	
Surrogate: Chrysene-d12	*87*	*50-140*	%	*2021-04-29*	
Surrogate: Naphthalene-d8	*79*	*50-140*	%	*2021-04-29*	
Surrogate: Perylene-d12	*79*	*50-140*	%	*2021-04-29*	
Surrogate: Phenanthrene-d10	*84*	*55-119*	%	*2021-04-29*	
Strong Acid Leachable Metals					
Aluminum	**18800**	40	mg/kg dry	2021-05-01	
Antimony	**0.18**	0.10	mg/kg dry	2021-05-01	
Arsenic	**2.54**	0.30	mg/kg dry	2021-05-01	
Barium	**47.5**	1.0	mg/kg dry	2021-05-01	
Beryllium	**0.25**	0.10	mg/kg dry	2021-05-01	
Boron	< 2.0	2.0	mg/kg dry	2021-05-01	
Cadmium	**0.092**	0.040	mg/kg dry	2021-05-01	
Chromium	**15.4**	1.0	mg/kg dry	2021-05-01	
Cobalt	**5.29**	0.10	mg/kg dry	2021-05-01	
Copper	**14.4**	0.40	mg/kg dry	2021-05-01	
Iron	**16100**	20	mg/kg dry	2021-05-01	
Lead	**5.76**	0.20	mg/kg dry	2021-05-01	
Lithium	**6.72**	0.10	mg/kg dry	2021-05-01	
Manganese	**274**	0.40	mg/kg dry	2021-05-01	
Mercury	**0.055**	0.040	mg/kg dry	2021-05-01	
Molybdenum	**0.46**	0.10	mg/kg dry	2021-05-01	
Nickel	**8.39**	0.60	mg/kg dry	2021-05-01	
Selenium	**0.34**	0.20	mg/kg dry	2021-05-01	
Silver	**0.12**	0.10	mg/kg dry	2021-05-01	
Strontium	**25.2**	0.20	mg/kg dry	2021-05-01	
Thallium	< 0.10	0.10	mg/kg dry	2021-05-01	
Tin	**0.37**	0.20	mg/kg dry	2021-05-01	
Tungsten	< 0.20	0.20	mg/kg dry	2021-05-01	
Uranium	**0.468**	0.050	mg/kg dry	2021-05-01	
Vanadium	**48.4**	1.0	mg/kg dry	2021-05-01	
Zinc	**31.8**	2.0	mg/kg dry	2021-05-01	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
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Sample Qualifiers:

HT1 The sample was prepared and/or analyzed past the recommended holding time.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
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Analysis Description	Method Ref.	Technique	Accredited	Location
EPH in Soil	EPA 3570* / BCMOE EPHs*	Shaker Extraction (Hexane-Acetone 1:1) / Gas Chromatography (GC-FID)	✓	Richmond
HEPHs in Soil	BCMOE LEPH/HEPH	Calculation		N/A
LEPHs in Soil	BCMOE LEPH/HEPH	Calculation		N/A
Moisture in Soil	ASTM D2974-87*	Gravimetry (Dried at 105C)		N/A
pH in Soil	Carter 16.2 / SM 4500-H+ B (2017)	1:2 Soil/Water Slurry / Electrometry	✓	Richmond
Polycyclic Aromatic Hydrocarbons in Soil	EPA 3570* / EPA 8270D	Shaker Extraction (Hexane-Acetone 1:1) / GC-MSD (SIM)	✓	Richmond
SALM in Soil	BCMOE SALM V.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
% wet	Percent (as received basis)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
mg/kg dry	Milligrams per kilogram (dry weight basis)
pH units	pH < 7 = acidic, ph > 7 = basic
ASTM	ASTM International Test Methods
BCMOE	British Columbia Environmental Laboratory Manual, British Columbia Ministry of Environment
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued or once samples expire, whichever comes first. Longer hold is possible if agreed to in writing.

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline(s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
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The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
BCMOE Aggregate Hydrocarbons, Batch B1D2652										
Blank (B1D2652-BLK1)				Prepared: 2021-04-28, Analyzed: 2021-04-28						
EPHs10-19	< 50	50	mg/kg wet							
EPHs19-32	< 50	50	mg/kg wet							
Surrogate: 2-Methylnonane (EPH/F2-4)	*15.7*		*mg/kg wet*	16.5		*95*	*70-125*			
LCS (B1D2652-BS2)				Prepared: 2021-04-28, Analyzed: 2021-04-28						
EPHs10-19	2300	50	mg/kg wet	2780		82	70-110			
EPHs19-32	3200	50	mg/kg wet	3990		81	70-110			
Surrogate: 2-Methylnonane (EPH/F2-4)	*19.2*		*mg/kg wet*	16.0		*120*	*70-125*			
Reference (B1D2652-SRM1)				Prepared: 2021-04-28, Analyzed: 2021-04-29						
EPHs10-19	2800	75	mg/kg wet	3020		93	65-130			
EPHs19-32	3900	75	mg/kg wet	4330		91	65-130			
Surrogate: 2-Methylnonane (EPH/F2-4)	*25.0*		*mg/kg wet*	25.0		*100*	*70-125*			
Polycyclic Aromatic Hydrocarbons (PAH), Batch B1D2652										
Blank (B1D2652-BLK1)				Prepared: 2021-04-28, Analyzed: 2021-04-29						
1-Methylnaphthalene	< 0.050	0.050	mg/kg wet							
2-Methylnaphthalene	< 0.050	0.050	mg/kg wet							
Acenaphthene	< 0.050	0.050	mg/kg wet							
Acenaphthylene	< 0.050	0.050	mg/kg wet							
Anthracene	< 0.050	0.050	mg/kg wet							
Benz(a)anthracene	< 0.050	0.050	mg/kg wet							
Benzo(a)pyrene	< 0.050	0.050	mg/kg wet							
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg wet							
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg wet							
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg wet							
Chrysene	< 0.050	0.050	mg/kg wet							
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg wet							
Fluoranthene	< 0.050	0.050	mg/kg wet							
Fluorene	< 0.050	0.050	mg/kg wet							
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg wet							
Naphthalene	< 0.050	0.050	mg/kg wet							
Phenanthrene	< 0.050	0.050	mg/kg wet							
Pyrene	< 0.050	0.050	mg/kg wet							
Quinoline	< 0.050	0.050	mg/kg wet							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
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Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Polycyclic Aromatic Hydrocarbons (PAH), Batch B1D2652, Continued										
Blank (B1D2652-BLK1), Continued				Prepared: 2021-04-28, Analyzed: 2021-04-29						
Surrogate: Acenaphthene-d10	*1.30*		*mg/kg wet*	1.66		*79*	*50-122*			
Surrogate: Chrysene-d12	*1.36*		*mg/kg wet*	1.66		*82*	*50-140*			
Surrogate: Naphthalene-d8	*1.30*		*mg/kg wet*	1.66		*78*	*50-140*			
Surrogate: Perylene-d12	*1.31*		*mg/kg wet*	1.66		*79*	*50-140*			
Surrogate: Phenanthrene-d10	*1.35*		*mg/kg wet*	1.66		*81*	*55-119*			
LCS (B1D2652-BS1)				Prepared: 2021-04-28, Analyzed: 2021-04-29						
1-Methylnaphthalene	1.26	0.050	mg/kg wet	1.56		81	67-120			
2-Methylnaphthalene	1.21	0.050	mg/kg wet	1.56		78	71-122			
Acenaphthene	1.19	0.050	mg/kg wet	1.56		76	63-119			
Acenaphthylene	1.23	0.050	mg/kg wet	1.56		79	68-126			
Anthracene	1.25	0.050	mg/kg wet	1.56		80	69-117			
Benz(a)anthracene	1.26	0.050	mg/kg wet	1.56		81	56-127			
Benzo(a)pyrene	1.26	0.050	mg/kg wet	1.56		81	63-116			
Benzo(b+j)fluoranthene	2.59	0.050	mg/kg wet	3.11		83	71-122			
Benzo(g,h,i)perylene	1.01	0.050	mg/kg wet	1.56		65	56-133			
Benzo(k)fluoranthene	1.28	0.050	mg/kg wet	1.56		82	62-131			
Chrysene	1.29	0.050	mg/kg wet	1.56		83	66-132			
Dibenz(a,h)anthracene	1.08	0.050	mg/kg wet	1.56		69	56-119			
Fluoranthene	1.28	0.050	mg/kg wet	1.56		82	72-119			
Fluorene	1.19	0.050	mg/kg wet	1.56		76	62-115			
Indeno(1,2,3-cd)pyrene	0.982	0.050	mg/kg wet	1.56		63	59-118			
Naphthalene	1.22	0.050	mg/kg wet	1.56		78	70-136			
Phenanthrene	1.27	0.050	mg/kg wet	1.56		82	61-124			
Pyrene	1.36	0.050	mg/kg wet	1.56		87	70-119			
Quinoline	1.41	0.050	mg/kg wet	1.56		91	50-125			
Surrogate: Acenaphthene-d10	*1.21*		*mg/kg wet*	1.56		*77*	*50-122*			
Surrogate: Chrysene-d12	*1.22*		*mg/kg wet*	1.56		*78*	*50-140*			
Surrogate: Naphthalene-d8	*1.20*		*mg/kg wet*	1.56		*77*	*50-140*			
Surrogate: Perylene-d12	*1.23*		*mg/kg wet*	1.56		*79*	*50-140*			
Surrogate: Phenanthrene-d10	*1.25*		*mg/kg wet*	1.56		*80*	*55-119*			
Strong Acid Leachable Metals, Batch B1D3011										
Blank (B1D3011-BLK1)				Prepared: 2021-04-30, Analyzed: 2021-05-01						
Aluminum	< 40	40	mg/kg dry							
Antimony	< 0.10	0.10	mg/kg dry							
Arsenic	< 0.30	0.30	mg/kg dry							
Barium	< 1.0	1.0	mg/kg dry							
Beryllium	< 0.10	0.10	mg/kg dry							
Boron	< 2.0	2.0	mg/kg dry							
Cadmium	< 0.040	0.040	mg/kg dry							
Chromium	< 1.0	1.0	mg/kg dry							
Cobalt	< 0.10	0.10	mg/kg dry							
Copper	< 0.40	0.40	mg/kg dry							
Iron	< 20	20	mg/kg dry							
Lead	< 0.20	0.20	mg/kg dry							
Lithium	< 0.10	0.10	mg/kg dry							
Manganese	< 0.40	0.40	mg/kg dry							
Mercury	< 0.040	0.040	mg/kg dry							
Molybdenum	< 0.10	0.10	mg/kg dry							
Nickel	< 0.60	0.60	mg/kg dry							
Selenium	< 0.20	0.20	mg/kg dry							
Silver	< 0.10	0.10	mg/kg dry							
Strontium	< 0.20	0.20	mg/kg dry							
Thallium	< 0.10	0.10	mg/kg dry							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
PROJECT	28847	**REPORTED**	2021-05-05 13:14

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Strong Acid Leachable Metals, Batch B1D3011, Continued										
Blank (B1D3011-BLK1), Continued				Prepared: 2021-04-30, Analyzed: 2021-05-01						
Tin	< 0.20	0.20	mg/kg dry							
Tungsten	< 0.20	0.20	mg/kg dry							
Uranium	< 0.050	0.050	mg/kg dry							
Vanadium	< 1.0	1.0	mg/kg dry							
Zinc	< 2.0	2.0	mg/kg dry							
LCS (B1D3011-BS1)				Prepared: 2021-04-30, Analyzed: 2021-05-01						
Antimony	2.04	0.10	mg/kg dry	2.00		102	80-120			
Arsenic	1.86	0.06	mg/kg dry	2.00		93	80-120			
Barium	2.1	1.0	mg/kg dry	1.98		108	80-120			
Beryllium	1.98	0.10	mg/kg dry	1.98		100	80-120			
Boron	2.2	0.4	mg/kg dry	2.00		109	80-120			
Cadmium	1.97	0.040	mg/kg dry	1.99		99	80-120			
Chromium	1.9	1.0	mg/kg dry	1.98		98	80-120			
Cobalt	1.98	0.10	mg/kg dry	1.99		100	80-120			
Copper	1.99	0.40	mg/kg dry	2.00		100	80-120			
Iron	189	4	mg/kg dry	202		94	80-120			
Lead	2.00	0.20	mg/kg dry	1.99		101	80-120			
Lithium	2.07	0.02	mg/kg dry	2.00		104	80-120			
Manganese	1.96	0.08	mg/kg dry	1.99		99	80-120			
Mercury	0.094	0.040	mg/kg dry	0.100		94	80-120			
Molybdenum	1.85	0.10	mg/kg dry	2.00		93	80-120			
Nickel	2.03	0.60	mg/kg dry	2.00		101	80-120			
Selenium	1.95	0.20	mg/kg dry	2.00		98	80-120			
Silver	1.99	0.10	mg/kg dry	2.00		99	80-120			
Strontium	1.87	0.04	mg/kg dry	2.00		93	80-120			
Thallium	2.05	0.02	mg/kg dry	1.99		103	80-120			
Tin	2.10	0.20	mg/kg dry	2.00		105	80-120			
Tungsten	1.99	0.04	mg/kg dry	2.00		99	80-120			
Uranium	2.03	0.010	mg/kg dry	2.00		101	80-120			
Vanadium	2.0	1.0	mg/kg dry	2.00		98	80-120			
Zinc	2.0	2.0	mg/kg dry	2.00		100	80-120			
Reference (B1D3011-SRM1)				Prepared: 2021-04-30, Analyzed: 2021-05-01						
Aluminum	11300	40	mg/kg dry	11500		98	70-130			
Antimony	0.70	0.10	mg/kg dry	0.724		97	70-130			
Arsenic	81.7	0.30	mg/kg dry	82.1		99	70-130			
Barium	43.3	1.0	mg/kg dry	40.0		108	70-130			
Beryllium	0.36	0.10	mg/kg dry	0.369		96	70-130			
Chromium	63.6	1.0	mg/kg dry	63.1		101	70-130			
Cobalt	10.4	0.10	mg/kg dry	10.4		100	70-130			
Copper	19.5	0.40	mg/kg dry	19.8		99	70-130			
Iron	18300	20	mg/kg dry	20200		91	70-130			
Lead	17.0	0.20	mg/kg dry	17.3		98	70-130			
Manganese	313	0.40	mg/kg dry	315		99	70-130			
Mercury	0.107	0.040	mg/kg dry	0.110		98	70-130			
Molybdenum	0.63	0.10	mg/kg dry	0.619		102	70-130			
Nickel	31.9	0.60	mg/kg dry	31.7		101	70-130			
Silver	1.49	0.10	mg/kg dry	1.75		85	70-130			
Strontium	20.6	0.20	mg/kg dry	20.3		101	70-130			
Uranium	1.18	0.050	mg/kg dry	1.18		100	70-130			
Vanadium	34.6	1.0	mg/kg dry	33.5		103	70-130			
Zinc	37.6	2.0	mg/kg dry	40.2		93	70-130			

APPENDIX 3: REVISION HISTORY

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	21D2772
PROJECT	28847	**REPORTED**	2021-05-05 13:14

Sample ID	Changed	Change	Analysis	Analyte(s)
21D2772-	2021-05-05	Project	N/A	N/A
21D2772-12	2021-05-05	Made Non-Reportable	Polycyclic Aromatic Hydrocarbons	2-Chloronaphthalene
21D2772-20	2021-05-05	Made Non-Reportable	Polycyclic Aromatic Hydrocarbons	2-Chloronaphthalene
21D2772-31	2021-05-05	Made Non-Reportable	Polycyclic Aromatic Hydrocarbons	2-Chloronaphthalene
21D2772-36	2021-05-05	Made Non-Reportable	Polycyclic Aromatic Hydrocarbons	2-Chloronaphthalene

CERTIFICATE OF ANALYSIS

REPORTED TO	Thurber Engineering Ltd. (Vancouver) 900 - 1281 West Georgia Street Vancouver, BC V6E 3J7
ATTENTION	[redacted]
PO NUMBER	28847
PROJECT	28847
PROJECT INFO	
WORK ORDER	23J2230
RECEIVED / TEMP	2023-10-18 14:50 / 7.5°C
REPORTED	2023-10-30 13:11
COC NUMBER	No Number

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

Work Order Comments:

This is a revised report; please refer to Appendix 3 for details.

By engaging our services, you are agreeing to CARO Analytical Service's Standard Terms and Conditions outlined here: https://www.caro.ca/terms-conditions

If you have any questions or concerns, please contact me at [redacted]

Authorized By:

[redacted]

Account Manager

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Analyzed	Qualifier
TH23-02-02 (23J2230-01) | Matrix: Soil | Sampled: 2023-10-06					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2023-10-21	
EPHs19-32	**85**	50	mg/kg dry	2023-10-21	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	**85**	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*65*	*60-140*	%	*2023-10-21*	
General Parameters					
Moisture	**29.0**	1.0	% wet	2023-10-20	
pH (1:2 H2O Solution)	**5.98**	0.10	pH units	2023-10-24	
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
Acenaphthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2023-10-21	
Anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Chrysene	< 0.050	0.050	mg/kg dry	2023-10-21	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Fluorene	< 0.050	0.050	mg/kg dry	2023-10-21	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Naphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
Phenanthrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Quinoline	< 0.050	0.050	mg/kg dry	2023-10-21	
Surrogate: Acenaphthene-d10	*91*	*50-140*	%	*2023-10-21*	
Surrogate: Chrysene-d12	*94*	*50-140*	%	*2023-10-21*	
Surrogate: Naphthalene-d8	*95*	*50-140*	%	*2023-10-21*	
Surrogate: Perylene-d12	*80*	*50-140*	%	*2023-10-21*	
Surrogate: Phenanthrene-d10	*93*	*55-140*	%	*2023-10-21*	
Strong Acid Leachable Metals					
Aluminum	**22800**	40	mg/kg dry	2023-10-26	
Antimony	**0.45**	0.10	mg/kg dry	2023-10-26	
Arsenic	**4.24**	0.30	mg/kg dry	2023-10-26	
Barium	**39.1**	1.0	mg/kg dry	2023-10-26	
Beryllium	**0.30**	0.10	mg/kg dry	2023-10-26	
Boron	**2.2**	2.0	mg/kg dry	2023-10-26	
Cadmium	**0.181**	0.040	mg/kg dry	2023-10-26	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Analyzed	Qualifier
TH23-02-02 (23J2230-01) | Matrix: Soil | Sampled: 2023-10-06, Continued					
Strong Acid Leachable Metals, Continued					
Chromium	**14.6**	1.0	mg/kg dry	2023-10-26	
Cobalt	**5.62**	0.10	mg/kg dry	2023-10-26	
Copper	**32.3**	0.40	mg/kg dry	2023-10-26	
Iron	**17700**	20.0	mg/kg dry	2023-10-26	
Lead	**26.6**	0.20	mg/kg dry	2023-10-26	
Lithium	**6.38**	0.10	mg/kg dry	2023-10-26	
Manganese	**231**	0.40	mg/kg dry	2023-10-26	
Mercury	**0.125**	0.040	mg/kg dry	2023-10-26	
Molybdenum	**0.81**	0.10	mg/kg dry	2023-10-26	
Nickel	**12.3**	0.60	mg/kg dry	2023-10-26	
Selenium	**0.56**	0.20	mg/kg dry	2023-10-26	
Silver	**0.17**	0.10	mg/kg dry	2023-10-26	
Strontium	**17.6**	0.20	mg/kg dry	2023-10-26	
Thallium	< 0.10	0.10	mg/kg dry	2023-10-26	
Tin	**0.52**	0.20	mg/kg dry	2023-10-26	
Tungsten	**0.24**	0.20	mg/kg dry	2023-10-26	
Uranium	**0.460**	0.050	mg/kg dry	2023-10-26	
Vanadium	**48.0**	1.0	mg/kg dry	2023-10-26	
Zinc	**47.0**	2.0	mg/kg dry	2023-10-26	
TH23-02-02 (23J2230-01RE1) | Matrix: Soil | Sampled: 2023-10-06					
General Parameters					
pH (1:2 H2O Solution)	**5.28**	0.10	pH units	2023-10-26	
Strong Acid Leachable Metals					
Cadmium	**0.181**	0.040	mg/kg dry	2023-10-26	
Iron	**14300**	20.0	mg/kg dry	2023-10-27	
TH23-02-02 (23J2230-01RE2) | Matrix: Soil | Sampled: 2023-10-06					
General Parameters					
pH (1:2 H2O Solution)	**5.30**	0.10	pH units	2023-10-26	
Strong Acid Leachable Metals					
Aluminum	**22300**	40	mg/kg dry	2023-10-27	
Antimony	**0.50**	0.10	mg/kg dry	2023-10-27	
Arsenic	**4.21**	0.30	mg/kg dry	2023-10-27	
Barium	**42.8**	1.0	mg/kg dry	2023-10-27	
Beryllium	**0.28**	0.10	mg/kg dry	2023-10-27	
Boron	**2.5**	2.0	mg/kg dry	2023-10-27	
Cadmium	**0.152**	0.040	mg/kg dry	2023-10-26	
Chromium	**13.7**	1.0	mg/kg dry	2023-10-27	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Analyzed	Qualifier
TH23-02-02 (23J2230-01RE2) | Matrix: Soil | Sampled: 2023-10-06, Continued					
Strong Acid Leachable Metals, Continued					
Cobalt	**5.40**	0.10	mg/kg dry	2023-10-27	
Copper	**32.3**	0.40	mg/kg dry	2023-10-27	
Iron	**16900**	20.0	mg/kg dry	2023-10-27	
Lead	**29.0**	0.20	mg/kg dry	2023-10-27	
Lithium	**5.68**	0.10	mg/kg dry	2023-10-27	
Manganese	**233**	0.40	mg/kg dry	2023-10-27	
Mercury	**0.125**	0.040	mg/kg dry	2023-10-27	
Molybdenum	**0.86**	0.10	mg/kg dry	2023-10-27	
Nickel	**11.7**	0.60	mg/kg dry	2023-10-27	
Selenium	**0.52**	0.20	mg/kg dry	2023-10-27	
Silver	**0.15**	0.10	mg/kg dry	2023-10-27	
Strontium	**17.3**	0.20	mg/kg dry	2023-10-27	
Thallium	< 0.10	0.10	mg/kg dry	2023-10-27	
Tin	**0.54**	0.20	mg/kg dry	2023-10-27	
Tungsten	**0.31**	0.20	mg/kg dry	2023-10-27	
Uranium	**0.481**	0.050	mg/kg dry	2023-10-27	
Vanadium	**47.2**	1.0	mg/kg dry	2023-10-27	
Zinc	**43.0**	2.0	mg/kg dry	2023-10-27	
TH23-03-01 (23J2230-02) | Matrix: Soil | Sampled: 2023-10-06					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2023-10-21	
EPHs19-32	**76**	50	mg/kg dry	2023-10-21	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	**76**	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*65*	*60-140*	%	*2023-10-21*	
General Parameters					
Moisture	**4.8**	1.0	% wet	2023-10-20	
pH (1:2 H2O Solution)	**6.15**	0.10	pH units	2023-10-24	
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
Acenaphthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2023-10-21	
Anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Analyzed	Qualifier
TH23-03-01 (23J2230-02) | Matrix: Soil | Sampled: 2023-10-06, Continued					
Polycyclic Aromatic Hydrocarbons (PAH), Continued					
Chrysene	< 0.050	0.050	mg/kg dry	2023-10-21	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Fluorene	< 0.050	0.050	mg/kg dry	2023-10-21	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Naphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
Phenanthrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Quinoline	< 0.050	0.050	mg/kg dry	2023-10-21	
Surrogate: Acenaphthene-d10	*86*	*50-140*	%	*2023-10-21*	
Surrogate: Chrysene-d12	*93*	*50-140*	%	*2023-10-21*	
Surrogate: Naphthalene-d8	*88*	*50-140*	%	*2023-10-21*	
Surrogate: Perylene-d12	*77*	*50-140*	%	*2023-10-21*	
Surrogate: Phenanthrene-d10	*92*	*55-140*	%	*2023-10-21*	
Strong Acid Leachable Metals					
Aluminum	**23800**	40	mg/kg dry	2023-10-20	
Antimony	**0.74**	0.10	mg/kg dry	2023-10-20	
Arsenic	**5.45**	0.30	mg/kg dry	2023-10-20	
Barium	**56.3**	1.0	mg/kg dry	2023-10-20	
Beryllium	**0.33**	0.10	mg/kg dry	2023-10-20	
Boron	**2.2**	2.0	mg/kg dry	2023-10-20	
Cadmium	**0.228**	0.040	mg/kg dry	2023-10-20	
Chromium	**15.2**	1.0	mg/kg dry	2023-10-20	
Cobalt	**6.93**	0.10	mg/kg dry	2023-10-20	
Copper	**26.2**	0.40	mg/kg dry	2023-10-20	
Iron	**19500**	20.0	mg/kg dry	2023-10-20	
Lead	**36.6**	0.20	mg/kg dry	2023-10-20	
Lithium	**6.62**	0.10	mg/kg dry	2023-10-20	
Manganese	**580**	0.40	mg/kg dry	2023-10-20	
Mercury	**0.170**	0.040	mg/kg dry	2023-10-20	
Molybdenum	**0.79**	0.10	mg/kg dry	2023-10-20	
Nickel	**13.6**	0.60	mg/kg dry	2023-10-20	
Selenium	**0.63**	0.20	mg/kg dry	2023-10-20	
Silver	**0.16**	0.10	mg/kg dry	2023-10-20	
Strontium	**21.5**	0.20	mg/kg dry	2023-10-20	
Thallium	< 0.10	0.10	mg/kg dry	2023-10-20	
Tin	**0.70**	0.20	mg/kg dry	2023-10-20	
Tungsten	**0.43**	0.20	mg/kg dry	2023-10-20	
Uranium	**0.471**	0.050	mg/kg dry	2023-10-20	
Vanadium	**52.2**	1.0	mg/kg dry	2023-10-20	
Zinc	**57.6**	2.0	mg/kg dry	2023-10-20	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Analyzed	Qualifier
TH23-04-03 (23J2230-03) | Matrix: Soil | Sampled: 2023-10-06					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2023-10-21	
EPHs19-32	< 50	50	mg/kg dry	2023-10-21	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	< 50	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*67*	*60-140*	%	*2023-10-21*	
General Parameters					
Moisture	**20.4**	1.0	% wet	2023-10-20	
pH (1:2 H2O Solution)	**7.03**	0.10	pH units	2023-10-24	
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
Acenaphthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2023-10-21	
Anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Chrysene	< 0.050	0.050	mg/kg dry	2023-10-21	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Fluorene	< 0.050	0.050	mg/kg dry	2023-10-21	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Naphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
Phenanthrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Quinoline	< 0.050	0.050	mg/kg dry	2023-10-21	
Surrogate: Acenaphthene-d10	*92*	*50-140*	%	*2023-10-21*	
Surrogate: Chrysene-d12	*90*	*50-140*	%	*2023-10-21*	
Surrogate: Naphthalene-d8	*93*	*50-140*	%	*2023-10-21*	
Surrogate: Perylene-d12	*83*	*50-140*	%	*2023-10-21*	
Surrogate: Phenanthrene-d10	*92*	*55-140*	%	*2023-10-21*	
Strong Acid Leachable Metals					
Aluminum	**38400**	40	mg/kg dry	2023-10-20	
Antimony	**0.32**	0.10	mg/kg dry	2023-10-20	
Arsenic	**7.92**	0.30	mg/kg dry	2023-10-20	
Barium	**161**	1.0	mg/kg dry	2023-10-20	
Beryllium	**0.63**	0.10	mg/kg dry	2023-10-20	
Boron	**2.3**	2.0	mg/kg dry	2023-10-20	
Cadmium	**0.131**	0.040	mg/kg dry	2023-10-20	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Analyzed	Qualifier
TH23-04-03 (23J2230-03) | Matrix: Soil | Sampled: 2023-10-06, Continued					
Strong Acid Leachable Metals, Continued					
Chromium	**31.9**	1.0	mg/kg dry	2023-10-20	
Cobalt	**15.5**	0.10	mg/kg dry	2023-10-20	
Copper	**60.9**	0.40	mg/kg dry	2023-10-20	
Iron	**40000**	20.0	mg/kg dry	2023-10-20	
Lead	**9.51**	0.20	mg/kg dry	2023-10-20	
Lithium	**12.9**	0.10	mg/kg dry	2023-10-20	
Manganese	**744**	0.40	mg/kg dry	2023-10-20	
Mercury	< 0.040	0.040	mg/kg dry	2023-10-20	
Molybdenum	**0.89**	0.10	mg/kg dry	2023-10-20	
Nickel	**24.1**	0.60	mg/kg dry	2023-10-20	
Selenium	< 0.20	0.20	mg/kg dry	2023-10-20	
Silver	< 0.10	0.10	mg/kg dry	2023-10-20	
Strontium	**59.7**	0.20	mg/kg dry	2023-10-20	
Thallium	**0.14**	0.10	mg/kg dry	2023-10-20	
Tin	**0.50**	0.20	mg/kg dry	2023-10-20	
Tungsten	< 0.20	0.20	mg/kg dry	2023-10-20	
Uranium	**0.961**	0.050	mg/kg dry	2023-10-20	
Vanadium	**99.3**	1.0	mg/kg dry	2023-10-20	
Zinc	**86.9**	2.0	mg/kg dry	2023-10-20	
TH23-04-03 (23J2230-03RE1) | Matrix: Soil | Sampled: 2023-10-06					
Strong Acid Leachable Metals					
Iron	**34600**	20.0	mg/kg dry	2023-10-26	
TH23-04-03 (23J2230-03RE2) | Matrix: Soil | Sampled: 2023-10-06					
Strong Acid Leachable Metals					
Iron	**33100**	20.0	mg/kg dry	2023-10-26	
TH23-05-01 (23J2230-04) | Matrix: Soil | Sampled: 2023-10-06					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2023-10-24	
EPHs19-32	< 50	50	mg/kg dry	2023-10-24	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	< 50	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*65*	*60-140*	%	*2023-10-24*	
General Parameters					
Moisture	**18.3**	1.0	% wet	2023-10-20	
pH (1:2 H2O Solution)	**6.01**	0.10	pH units	2023-10-24	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Analyzed	Qualifier
TH23-05-01 (23J2230-04) | Matrix: Soil | Sampled: 2023-10-06, Continued					
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
Acenaphthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2023-10-21	
Anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Chrysene	< 0.050	0.050	mg/kg dry	2023-10-21	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Fluorene	< 0.050	0.050	mg/kg dry	2023-10-21	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Naphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
Phenanthrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Quinoline	< 0.050	0.050	mg/kg dry	2023-10-21	
Surrogate: Acenaphthene-d10	*83*	*50-140*	%	*2023-10-21*	
Surrogate: Chrysene-d12	*84*	*50-140*	%	*2023-10-21*	
Surrogate: Naphthalene-d8	*79*	*50-140*	%	*2023-10-21*	
Surrogate: Perylene-d12	*74*	*50-140*	%	*2023-10-21*	
Surrogate: Phenanthrene-d10	*83*	*55-140*	%	*2023-10-21*	
Strong Acid Leachable Metals					
Aluminum	**22800**	40	mg/kg dry	2023-10-20	
Antimony	**0.10**	0.10	mg/kg dry	2023-10-20	
Arsenic	**2.54**	0.30	mg/kg dry	2023-10-20	
Barium	**84.5**	1.0	mg/kg dry	2023-10-20	
Beryllium	**0.20**	0.10	mg/kg dry	2023-10-20	
Boron	< 2.0	2.0	mg/kg dry	2023-10-20	
Cadmium	**0.045**	0.040	mg/kg dry	2023-10-20	
Chromium	**17.8**	1.0	mg/kg dry	2023-10-20	
Cobalt	**6.87**	0.10	mg/kg dry	2023-10-20	
Copper	**19.9**	0.40	mg/kg dry	2023-10-20	
Iron	**18900**	20.0	mg/kg dry	2023-10-20	
Lead	**3.35**	0.20	mg/kg dry	2023-10-20	
Lithium	**6.14**	0.10	mg/kg dry	2023-10-20	
Manganese	**279**	0.40	mg/kg dry	2023-10-20	
Mercury	< 0.040	0.040	mg/kg dry	2023-10-20	
Molybdenum	**0.38**	0.10	mg/kg dry	2023-10-20	
Nickel	**8.79**	0.60	mg/kg dry	2023-10-20	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Analyzed	Qualifier
TH23-05-01 (23J2230-04) | Matrix: Soil | Sampled: 2023-10-06, Continued					
Strong Acid Leachable Metals, Continued					
Selenium	< 0.20	0.20	mg/kg dry	2023-10-20	
Silver	< 0.10	0.10	mg/kg dry	2023-10-20	
Strontium	**75.8**	0.20	mg/kg dry	2023-10-20	
Thallium	< 0.10	0.10	mg/kg dry	2023-10-20	
Tin	**0.20**	0.20	mg/kg dry	2023-10-20	
Tungsten	< 0.20	0.20	mg/kg dry	2023-10-20	
Uranium	**0.524**	0.050	mg/kg dry	2023-10-20	
Vanadium	**57.2**	1.0	mg/kg dry	2023-10-20	
Zinc	**30.7**	2.0	mg/kg dry	2023-10-20	
TH23-06-01 (23J2230-05) | Matrix: Soil | Sampled: 2023-10-06					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2023-10-24	
EPHs19-32	< 50	50	mg/kg dry	2023-10-24	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	< 50	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*65*	*60-140*	%	*2023-10-24*	
General Parameters					
Moisture	**12.8**	1.0	% wet	2023-10-20	
pH (1:2 H2O Solution)	**6.75**	0.10	pH units	2023-10-24	
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
Acenaphthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2023-10-21	
Anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Chrysene	< 0.050	0.050	mg/kg dry	2023-10-21	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Fluorene	< 0.050	0.050	mg/kg dry	2023-10-21	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Naphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
Phenanthrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Quinoline	< 0.050	0.050	mg/kg dry	2023-10-21	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Analyzed	Qualifier
TH23-06-01 (23J2230-05) | Matrix: Soil | Sampled: 2023-10-06, Continued					
Polycyclic Aromatic Hydrocarbons (PAH), Continued					
Surrogate: Acenaphthene-d10	*82*	*50-140*	%	*2023-10-21*	
Surrogate: Chrysene-d12	*88*	*50-140*	%	*2023-10-21*	
Surrogate: Naphthalene-d8	*84*	*50-140*	%	*2023-10-21*	
Surrogate: Perylene-d12	*73*	*50-140*	%	*2023-10-21*	
Surrogate: Phenanthrene-d10	*83*	*55-140*	%	*2023-10-21*	
Strong Acid Leachable Metals					
Aluminum	**15400**	40	mg/kg dry	2023-10-20	
Antimony	**0.12**	0.10	mg/kg dry	2023-10-20	
Arsenic	**2.54**	0.30	mg/kg dry	2023-10-20	
Barium	**44.5**	1.0	mg/kg dry	2023-10-20	
Beryllium	**0.18**	0.10	mg/kg dry	2023-10-20	
Boron	< 2.0	2.0	mg/kg dry	2023-10-20	
Cadmium	**0.062**	0.040	mg/kg dry	2023-10-20	
Chromium	**16.2**	1.0	mg/kg dry	2023-10-20	
Cobalt	**5.21**	0.10	mg/kg dry	2023-10-20	
Copper	**17.7**	0.40	mg/kg dry	2023-10-20	
Iron	**17000**	20.0	mg/kg dry	2023-10-20	
Lead	**3.85**	0.20	mg/kg dry	2023-10-20	
Lithium	**5.93**	0.10	mg/kg dry	2023-10-20	
Manganese	**208**	0.40	mg/kg dry	2023-10-20	
Mercury	< 0.040	0.040	mg/kg dry	2023-10-20	
Molybdenum	**0.46**	0.10	mg/kg dry	2023-10-20	
Nickel	**9.11**	0.60	mg/kg dry	2023-10-20	
Selenium	< 0.20	0.20	mg/kg dry	2023-10-20	
Silver	< 0.10	0.10	mg/kg dry	2023-10-20	
Strontium	**27.9**	0.20	mg/kg dry	2023-10-20	
Thallium	< 0.10	0.10	mg/kg dry	2023-10-20	
Tin	< 0.20	0.20	mg/kg dry	2023-10-20	
Tungsten	< 0.20	0.20	mg/kg dry	2023-10-20	
Uranium	**0.423**	0.050	mg/kg dry	2023-10-20	
Vanadium	**54.7**	1.0	mg/kg dry	2023-10-20	
Zinc	**28.6**	2.0	mg/kg dry	2023-10-20	
TH23-B (23J2230-06) | Matrix: Soil | Sampled: 2023-10-06					
BCMOE Aggregate Hydrocarbons					
EPHs10-19	< 50	50	mg/kg dry	2023-10-21	
EPHs19-32	< 50	50	mg/kg dry	2023-10-21	
LEPHs	< 50	50	mg/kg dry	N/A	
HEPHs	< 50	50	mg/kg dry	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*65*	*60-140*	%	*2023-10-21*	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Analyzed	Qualifier
TH23-B (23J2230-06) | Matrix: Soil | Sampled: 2023-10-06, Continued					
General Parameters					
Moisture	**20.9**	1.0	% wet	2023-10-20	
pH (1:2 H2O Solution)	**7.55**	0.10	pH units	2023-10-24	
Polycyclic Aromatic Hydrocarbons (PAH)					
1-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
2-Methylnaphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
Acenaphthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Acenaphthylene	< 0.050	0.050	mg/kg dry	2023-10-21	
Anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benz(a)anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(a)pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg dry	2023-10-21	
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Chrysene	< 0.050	0.050	mg/kg dry	2023-10-21	
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg dry	2023-10-21	
Fluoranthene	< 0.050	0.050	mg/kg dry	2023-10-21	
Fluorene	< 0.050	0.050	mg/kg dry	2023-10-21	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Naphthalene	< 0.050	0.050	mg/kg dry	2023-10-21	
Phenanthrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Pyrene	< 0.050	0.050	mg/kg dry	2023-10-21	
Quinoline	< 0.050	0.050	mg/kg dry	2023-10-21	
Surrogate: Acenaphthene-d10	*88*	*50-140*	%	*2023-10-21*	
Surrogate: Chrysene-d12	*94*	*50-140*	%	*2023-10-21*	
Surrogate: Naphthalene-d8	*91*	*50-140*	%	*2023-10-21*	
Surrogate: Perylene-d12	*78*	*50-140*	%	*2023-10-21*	
Surrogate: Phenanthrene-d10	*86*	*55-140*	%	*2023-10-21*	
Strong Acid Leachable Metals					
Aluminum	**33100**	40	mg/kg dry	2023-10-20	
Antimony	**0.35**	0.10	mg/kg dry	2023-10-20	
Arsenic	**7.58**	0.30	mg/kg dry	2023-10-20	
Barium	**137**	1.0	mg/kg dry	2023-10-20	
Beryllium	**0.57**	0.10	mg/kg dry	2023-10-20	
Boron	< 2.0	2.0	mg/kg dry	2023-10-20	
Cadmium	**0.111**	0.040	mg/kg dry	2023-10-20	
Chromium	**27.9**	1.0	mg/kg dry	2023-10-20	
Cobalt	**14.7**	0.10	mg/kg dry	2023-10-20	
Copper	**50.7**	0.40	mg/kg dry	2023-10-20	
Iron	**35600**	20.0	mg/kg dry	2023-10-20	
Lead	**8.20**	0.20	mg/kg dry	2023-10-20	
Lithium	**11.0**	0.10	mg/kg dry	2023-10-20	
Manganese	**628**	0.40	mg/kg dry	2023-10-20	

TEST RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Analyzed	Qualifier
TH23-B (23J2230-06) | Matrix: Soil | Sampled: 2023-10-06, Continued					
Strong Acid Leachable Metals, Continued					
Mercury	< 0.040	0.040	mg/kg dry	2023-10-20	
Molybdenum	**1.11**	0.10	mg/kg dry	2023-10-20	
Nickel	**21.6**	0.60	mg/kg dry	2023-10-20	
Selenium	< 0.20	0.20	mg/kg dry	2023-10-20	
Silver	< 0.10	0.10	mg/kg dry	2023-10-20	
Strontium	**54.8**	0.20	mg/kg dry	2023-10-20	
Thallium	**0.13**	0.10	mg/kg dry	2023-10-20	
Tin	**0.54**	0.20	mg/kg dry	2023-10-20	
Tungsten	< 0.20	0.20	mg/kg dry	2023-10-20	
Uranium	**0.899**	0.050	mg/kg dry	2023-10-20	
Vanadium	**93.4**	1.0	mg/kg dry	2023-10-20	
Zinc	**73.9**	2.0	mg/kg dry	2023-10-20	
TH23-B (23J2230-06RE1) | Matrix: Soil | Sampled: 2023-10-06					
Strong Acid Leachable Metals					
Iron	**40800**	20.0	mg/kg dry	2023-10-26	
TH23-B (23J2230-06RE2) | Matrix: Soil | Sampled: 2023-10-06					
Strong Acid Leachable Metals					
Iron	**36900**	20.0	mg/kg dry	2023-10-26	

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analysis Description	Method Ref.	Technique	Accredited	Location
EPH in Soil	EPA 3570* / BCMOE EPHs*	Shaker Extraction (Hexane-Acetone 1:1) / Gas Chromatography (GC-FID)	✓	Richmond
HEPHs in Soil	BCMOE LEPH/HEPH	Calculation		N/A
LEPHs in Soil	BCMOE LEPH/HEPH	Calculation		N/A
Moisture in Soil	ASTM D2974-87*	Gravimetry (Dried at 105C)		N/A
pH in Soil	Carter 16.2 / SM 4500-H+ B (2021)	1:2 Soil/Water Slurry / Electrometry	✓	Richmond
Polycyclic Aromatic Hydrocarbons in Soil	EPA 3570* / EPA 8270D	Shaker Extraction (Hexane-Acetone 1:1) / GC-MSD (SIM)	✓	Richmond
SALM in Soil	BCMOE SALM V.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
% wet	Percent (as received basis)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
mg/kg dry	Milligrams per kilogram (dry weight basis)
pH units	pH < 7 = acidic, ph > 7 = basic
ASTM	ASTM International Test Methods
BCMOE	British Columbia Environmental Laboratory Manual, British Columbia Ministry of Environment
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

General Comments:

The results in this report apply to the received samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Caro will dispose of all samples within 30 days of sample receipt, unless otherwise agreed.

Results in **Bold** indicate values that are above CARO's method reporting limits. Any results that are above regulatory limits are highlighted **red**. Please note that results will only be highlighted red if the regulatory limits are included on the CARO report. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager:pmand@caro.ca

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline(s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
BCMOE Aggregate Hydrocarbons, Batch B3J1948										
Blank (B3J1948-BLK1)				Prepared: 2023-10-20, Analyzed: 2023-10-20						
EPHs10-19	< 50	50	mg/kg wet							
EPHs19-32	< 50	50	mg/kg wet							
Surrogate: 2-Methylnonane (EPH/F2-4)	*48.3*		*mg/kg wet*	78.4		*62*	*60-140*			
Blank (B3J1948-BLK2)				Prepared: 2023-10-20, Analyzed: 2023-10-20						
EPHs10-19	< 50	50	mg/kg wet							
EPHs19-32	< 50	50	mg/kg wet							
Surrogate: 2-Methylnonane (EPH/F2-4)	*51.4*		*mg/kg wet*	76.8		*67*	*60-140*			
LCS (B3J1948-BS2)				Prepared: 2023-10-20, Analyzed: 2023-10-20						
EPHs10-19	2900	50	mg/kg wet	2720		108	70-130			
EPHs19-32	3700	50	mg/kg wet	3900		95	70-130			
Surrogate: 2-Methylnonane (EPH/F2-4)	*55.6*		*mg/kg wet*	77.6		*72*	*60-140*			
LCS (B3J1948-BS4)				Prepared: 2023-10-20, Analyzed: 2023-10-20						
EPHs10-19	3000	50	mg/kg wet	2800		109	70-130			
EPHs19-32	3800	50	mg/kg wet	4020		96	70-130			
Surrogate: 2-Methylnonane (EPH/F2-4)	*57.7*		*mg/kg wet*	80.0		*72*	*60-140*			
General Parameters, Batch B3J2301										
Duplicate (B3J2301-DUP3)			**Source: 23J2230-01**	Prepared: 2023-10-24, Analyzed: 2023-10-24						
pH (1:2 H2O Solution)	5.97	0.10	pH units		5.98			< 1	4	
Reference (B3J2301-SRM1)				Prepared: 2023-10-24, Analyzed: 2023-10-24						
pH (1:2 H2O Solution)	6.86	0.10	pH units	7.05		97	95-105			
Reference (B3J2301-SRM2)				Prepared: 2023-10-24, Analyzed: 2023-10-24						
pH (1:2 H2O Solution)	7.01	0.10	pH units	7.05		99	95-105			
Reference (B3J2301-SRM3)				Prepared: 2023-10-24, Analyzed: 2023-10-24						
pH (1:2 H2O Solution)	6.99	0.10	pH units	7.05		99	95-105			
General Parameters, Batch B3J2670										

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B3J2670, Continued										
Reference (B3J2670-SRM1)				Prepared: 2023-10-26, Analyzed: 2023-10-26						
pH (1:2 H2O Solution)	7.07	0.10	pH units	7.05		100	95-105			
Reference (B3J2670-SRM2)				Prepared: 2023-10-26, Analyzed: 2023-10-26						
pH (1:2 H2O Solution)	7.11	0.10	pH units	7.05		101	95-105			
Polycyclic Aromatic Hydrocarbons (PAH), Batch B3J1948										
Blank (B3J1948-BLK1)				Prepared: 2023-10-20, Analyzed: 2023-10-20						
1-Methylnaphthalene	< 0.050	0.050	mg/kg wet							
2-Methylnaphthalene	< 0.050	0.050	mg/kg wet							
Acenaphthene	< 0.050	0.050	mg/kg wet							
Acenaphthylene	< 0.050	0.050	mg/kg wet							
Anthracene	< 0.050	0.050	mg/kg wet							
Benz(a)anthracene	< 0.050	0.050	mg/kg wet							
Benzo(a)pyrene	< 0.050	0.050	mg/kg wet							
Benzo(b+j)fluoranthene	< 0.050	0.050	mg/kg wet							
Benzo(g,h,i)perylene	< 0.050	0.050	mg/kg wet							
Benzo(k)fluoranthene	< 0.050	0.050	mg/kg wet							
Chrysene	< 0.050	0.050	mg/kg wet							
Dibenz(a,h)anthracene	< 0.050	0.050	mg/kg wet							
Fluoranthene	< 0.050	0.050	mg/kg wet							
Fluorene	< 0.050	0.050	mg/kg wet							
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	mg/kg wet							
Naphthalene	< 0.050	0.050	mg/kg wet							
Phenanthrene	< 0.050	0.050	mg/kg wet							
Pyrene	< 0.050	0.050	mg/kg wet							
Quinoline	< 0.050	0.050	mg/kg wet							
Surrogate: Acenaphthene-d10	*0.715*		*mg/kg wet*	0.790		*91*	*50-140*			
Surrogate: Chrysene-d12	*0.796*		*mg/kg wet*	0.790		*101*	*50-140*			
Surrogate: Naphthalene-d8	*0.768*		*mg/kg wet*	0.790		*97*	*50-140*			
Surrogate: Perylene-d12	*0.604*		*mg/kg wet*	0.790		*76*	*50-140*			
Surrogate: Phenanthrene-d10	*0.704*		*mg/kg wet*	0.790		*89*	*55-140*			
LCS (B3J1948-BS1)				Prepared: 2023-10-20, Analyzed: 2023-10-20						
1-Methylnaphthalene	0.653	0.050	mg/kg wet	0.771		85	50-140			
2-Methylnaphthalene	0.659	0.050	mg/kg wet	0.771		85	50-140			
Acenaphthene	0.632	0.050	mg/kg wet	0.775		82	50-140			
Acenaphthylene	0.557	0.050	mg/kg wet	0.767		73	50-140			
Anthracene	0.606	0.050	mg/kg wet	0.775		78	50-140			
Benz(a)anthracene	0.598	0.050	mg/kg wet	0.775		77	50-140			
Benzo(a)pyrene	0.645	0.050	mg/kg wet	0.767		84	50-140			
Benzo(b+j)fluoranthene	1.08	0.050	mg/kg wet	1.53		71	50-140			
Benzo(g,h,i)perylene	0.571	0.050	mg/kg wet	0.767		74	50-140			
Benzo(k)fluoranthene	0.712	0.050	mg/kg wet	0.771		92	50-140			
Chrysene	0.696	0.050	mg/kg wet	0.763		91	50-140			
Dibenz(a,h)anthracene	0.600	0.050	mg/kg wet	0.779		77	50-140			
Fluoranthene	0.498	0.050	mg/kg wet	0.779		64	50-140			
Fluorene	0.574	0.050	mg/kg wet	0.794		72	50-140			
Indeno(1,2,3-cd)pyrene	0.536	0.050	mg/kg wet	0.767		70	50-140			
Naphthalene	0.708	0.050	mg/kg wet	0.771		92	50-140			
Phenanthrene	0.627	0.050	mg/kg wet	0.767		82	50-140			
Pyrene	0.539	0.050	mg/kg wet	0.779		69	50-140			
Quinoline	0.799	0.050	mg/kg wet	0.779		103	50-140			
Surrogate: Acenaphthene-d10	*0.652*		*mg/kg wet*	0.779		*84*	*50-140*			
Surrogate: Chrysene-d12	*0.743*		*mg/kg wet*	0.779		*95*	*50-140*			
Surrogate: Naphthalene-d8	*0.684*		*mg/kg wet*	0.779		*88*	*50-140*			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Polycyclic Aromatic Hydrocarbons (PAH), Batch B3J1948, Continued										
LCS (B3J1948-BS1), Continued				Prepared: 2023-10-20, Analyzed: 2023-10-20						
Surrogate: Perylene-d12	*0.497*		*mg/kg wet*	0.779		*64*	*50-140*			
Surrogate: Phenanthrene-d10	*0.601*		*mg/kg wet*	0.779		*77*	*55-140*			
Strong Acid Leachable Metals, Batch B3J1953										
Blank (B3J1953-BLK1)				Prepared: 2023-10-20, Analyzed: 2023-10-20						
Aluminum	< 40	40	mg/kg dry							
Antimony	< 0.10	0.10	mg/kg dry							
Arsenic	< 0.30	0.30	mg/kg dry							
Barium	< 1.0	1.0	mg/kg dry							
Beryllium	< 0.10	0.10	mg/kg dry							
Boron	< 2.0	2.0	mg/kg dry							
Cadmium	< 0.040	0.040	mg/kg dry							
Chromium	< 1.0	1.0	mg/kg dry							
Cobalt	< 0.10	0.10	mg/kg dry							
Copper	< 0.40	0.40	mg/kg dry							
Iron	50.5	20.0	mg/kg dry							BLK
Lead	< 0.20	0.20	mg/kg dry							
Lithium	< 0.10	0.10	mg/kg dry							
Manganese	0.88	0.40	mg/kg dry							BLK
Mercury	< 0.040	0.040	mg/kg dry							
Molybdenum	< 0.10	0.10	mg/kg dry							
Nickel	< 0.60	0.60	mg/kg dry							
Selenium	< 0.20	0.20	mg/kg dry							
Silver	< 0.10	0.10	mg/kg dry							
Strontium	< 0.20	0.20	mg/kg dry							
Thallium	< 0.10	0.10	mg/kg dry							
Tin	< 0.20	0.20	mg/kg dry							
Tungsten	< 0.20	0.20	mg/kg dry							
Uranium	< 0.050	0.050	mg/kg dry							
Vanadium	< 1.0	1.0	mg/kg dry							
Zinc	< 2.0	2.0	mg/kg dry							
LCS (B3J1953-BS1)				Prepared: 2023-10-20, Analyzed: 2023-10-20						
Aluminum	193	40	mg/kg dry	200		97	80-120			
Antimony	1.92	0.10	mg/kg dry	2.00		96	80-120			
Arsenic	19.7	0.30	mg/kg dry	20.0		98	80-120			
Barium	1.9	1.0	mg/kg dry	2.00		97	80-120			
Beryllium	1.97	0.10	mg/kg dry	2.00		98	80-120			
Boron	20.1	2.0	mg/kg dry	20.0		101	80-120			
Cadmium	1.90	0.040	mg/kg dry	2.00		95	80-120			
Chromium	2.0	1.0	mg/kg dry	2.00		102	80-120			
Cobalt	1.98	0.10	mg/kg dry	2.00		99	80-120			
Copper	1.99	0.40	mg/kg dry	2.00		100	80-120			
Iron	196	20.0	mg/kg dry	200		98	80-120			
Lead	1.94	0.20	mg/kg dry	2.00		97	80-120			
Lithium	1.97	0.10	mg/kg dry	2.00		99	80-120			
Manganese	2.07	0.40	mg/kg dry	2.00		103	80-120			
Mercury	0.191	0.040	mg/kg dry	0.200		95	80-120			
Molybdenum	1.90	0.10	mg/kg dry	2.00		95	80-120			
Nickel	1.97	0.60	mg/kg dry	2.00		99	80-120			
Selenium	19.8	0.20	mg/kg dry	20.0		99	80-120			
Silver	1.96	0.10	mg/kg dry	2.00		98	80-120			
Strontium	1.99	0.20	mg/kg dry	2.00		100	80-120			
Thallium	1.94	0.10	mg/kg dry	2.00		97	80-120			
Tin	1.92	0.20	mg/kg dry	2.00		96	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Strong Acid Leachable Metals, Batch B3J1953, Continued										
LCS (B3J1953-BS1), Continued				Prepared: 2023-10-20, Analyzed: 2023-10-20						
Tungsten	2.02	0.20	mg/kg dry	2.00		101	80-120			
Uranium	1.97	0.050	mg/kg dry	2.00		99	80-120			
Vanadium	2.0	1.0	mg/kg dry	2.00		98	80-120			
Zinc	19.5	2.0	mg/kg dry	20.0		98	80-120			
Duplicate (B3J1953-DUP1)		**Source: 23J2230-06**		Prepared: 2023-10-20, Analyzed: 2023-10-20						
Aluminum	30200	40	mg/kg dry		33100			9	40	
Antimony	0.31	0.10	mg/kg dry		0.35				30	
Arsenic	6.70	0.30	mg/kg dry		7.58			12	30	
Barium	135	1.0	mg/kg dry		137			1	40	
Beryllium	0.51	0.10	mg/kg dry		0.57			12	30	
Boron	2.2	2.0	mg/kg dry		< 2.0				30	
Cadmium	0.114	0.040	mg/kg dry		0.111				30	
Chromium	27.2	1.0	mg/kg dry		27.9			3	30	
Cobalt	14.3	0.10	mg/kg dry		14.7			2	30	
Copper	47.2	0.40	mg/kg dry		50.7			7	30	
Iron	32700	20.0	mg/kg dry		35600			8	30	
Lead	7.68	0.20	mg/kg dry		8.20			7	40	
Lithium	9.50	0.10	mg/kg dry		11.0			15	30	
Manganese	602	0.40	mg/kg dry		628			4	30	
Mercury	< 0.040	0.040	mg/kg dry		< 0.040				40	
Molybdenum	0.90	0.10	mg/kg dry		1.11			20	40	
Nickel	20.9	0.60	mg/kg dry		21.6			4	30	
Selenium	< 0.20	0.20	mg/kg dry		< 0.20				30	
Silver	< 0.10	0.10	mg/kg dry		< 0.10				40	
Strontium	52.5	0.20	mg/kg dry		54.8			4	40	
Thallium	0.12	0.10	mg/kg dry		0.13				30	
Tin	0.47	0.20	mg/kg dry		0.54				40	
Tungsten	< 0.20	0.20	mg/kg dry		< 0.20				40	
Uranium	0.844	0.050	mg/kg dry		0.899			6	30	
Vanadium	88.9	1.0	mg/kg dry		93.4			5	30	
Zinc	69.2	2.0	mg/kg dry		73.9			7	30	
Reference (B3J1953-SRM1)				Prepared: 2023-10-20, Analyzed: 2023-10-20						
Aluminum	11400	40	mg/kg dry	12100		94	70-130			
Antimony	0.67	0.10	mg/kg dry	0.634		105	70-130			
Arsenic	86.0	0.30	mg/kg dry	83.6		103	70-130			
Barium	42.3	1.0	mg/kg dry	41.4		102	70-130			
Beryllium	0.37	0.10	mg/kg dry	0.377		97	70-130			
Chromium	68.7	1.0	mg/kg dry	66.0		104	70-130			
Cobalt	10.8	0.10	mg/kg dry	10.8		100	70-130			
Copper	20.1	0.40	mg/kg dry	20.3		99	70-130			
Iron	20300	20.0	mg/kg dry	20400		100	70-130			
Lead	17.4	0.20	mg/kg dry	16.7		104	70-130			
Lithium	15.9	0.10	mg/kg dry	16.8		95	70-130			
Manganese	327	0.40	mg/kg dry	319		102	70-130			
Mercury	0.108	0.040	mg/kg dry	0.114		95	70-130			
Molybdenum	0.64	0.10	mg/kg dry	0.607		106	70-130			
Nickel	32.9	0.60	mg/kg dry	32.5		101	70-130			
Silver	1.57	0.10	mg/kg dry	1.55		101	70-130			
Strontium	22.7	0.20	mg/kg dry	22.5		101	70-130			
Thallium	< 0.10	0.10	mg/kg dry	0.0765		99	70-130			
Uranium	1.26	0.050	mg/kg dry	1.15		110	70-130			
Vanadium	37.3	1.0	mg/kg dry	36.3		103	70-130			
Zinc	39.3	2.0	mg/kg dry	39.7		99	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Strong Acid Leachable Metals, Batch B3J2652										
Blank (B3J2652-BLK1)				Prepared: 2023-10-26, Analyzed: 2023-10-26						
Aluminum	< 40	40	mg/kg dry							
Antimony	< 0.10	0.10	mg/kg dry							
Arsenic	< 0.30	0.30	mg/kg dry							
Barium	< 1.0	1.0	mg/kg dry							
Beryllium	< 0.10	0.10	mg/kg dry							
Boron	< 2.0	2.0	mg/kg dry							
Cadmium	< 0.040	0.040	mg/kg dry							
Chromium	< 1.0	1.0	mg/kg dry							
Cobalt	< 0.10	0.10	mg/kg dry							
Copper	< 0.40	0.40	mg/kg dry							
Iron	< 20.0	20.0	mg/kg dry							
Lead	< 0.20	0.20	mg/kg dry							
Lithium	< 0.10	0.10	mg/kg dry							
Manganese	< 0.40	0.40	mg/kg dry							
Mercury	< 0.040	0.040	mg/kg dry							
Molybdenum	< 0.10	0.10	mg/kg dry							
Nickel	< 0.60	0.60	mg/kg dry							
Selenium	< 0.20	0.20	mg/kg dry							
Silver	< 0.10	0.10	mg/kg dry							
Strontium	< 0.20	0.20	mg/kg dry							
Thallium	< 0.10	0.10	mg/kg dry							
Tin	< 0.20	0.20	mg/kg dry							
Tungsten	< 0.20	0.20	mg/kg dry							
Uranium	< 0.050	0.050	mg/kg dry							
Vanadium	< 1.0	1.0	mg/kg dry							
Zinc	< 2.0	2.0	mg/kg dry							
LCS (B3J2652-BS1)				Prepared: 2023-10-26, Analyzed: 2023-10-26						
Aluminum	217	40	mg/kg dry	200		109	80-120			
Antimony	2.05	0.10	mg/kg dry	2.00		102	80-120			
Arsenic	21.4	0.30	mg/kg dry	20.0		107	80-120			
Barium	2.1	1.0	mg/kg dry	2.00		105	80-120			
Beryllium	2.29	0.10	mg/kg dry	2.00		114	80-120			
Boron	24.0	2.0	mg/kg dry	20.0		120	80-120			
Cadmium	2.09	0.040	mg/kg dry	2.00		105	80-120			
Chromium	2.2	1.0	mg/kg dry	2.00		110	80-120			
Cobalt	2.18	0.10	mg/kg dry	2.00		109	80-120			
Copper	2.17	0.40	mg/kg dry	2.00		108	80-120			
Iron	222	20.0	mg/kg dry	200		111	80-120			
Lead	2.16	0.20	mg/kg dry	2.00		108	80-120			
Lithium	2.30	0.10	mg/kg dry	2.00		115	80-120			
Manganese	2.22	0.40	mg/kg dry	2.00		111	80-120			
Mercury	0.221	0.040	mg/kg dry	0.200		110	80-120			
Molybdenum	2.04	0.10	mg/kg dry	2.00		102	80-120			
Nickel	2.16	0.60	mg/kg dry	2.00		108	80-120			
Selenium	21.7	0.20	mg/kg dry	20.0		109	80-120			
Silver	2.17	0.10	mg/kg dry	2.00		109	80-120			
Strontium	2.22	0.20	mg/kg dry	2.00		111	80-120			
Thallium	2.13	0.10	mg/kg dry	2.00		106	80-120			
Tin	2.07	0.20	mg/kg dry	2.00		103	80-120			
Tungsten	2.12	0.20	mg/kg dry	2.00		106	80-120			
Uranium	2.18	0.050	mg/kg dry	2.00		109	80-120			
Vanadium	2.1	1.0	mg/kg dry	2.00		107	80-120			
Zinc	21.4	2.0	mg/kg dry	20.0		107	80-120			
Reference (B3J2652-SRM1)				Prepared: 2023-10-26, Analyzed: 2023-10-26						
Aluminum	13000	40	mg/kg dry	12100		107	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Strong Acid Leachable Metals, Batch B3J2652, Continued										
Reference (B3J2652-SRM1), Continued				Prepared: 2023-10-26, Analyzed: 2023-10-26						
Antimony	0.67	0.10	mg/kg dry	0.634		106	70-130			
Arsenic	90.4	0.30	mg/kg dry	83.6		108	70-130			
Barium	42.4	1.0	mg/kg dry	41.4		103	70-130			
Beryllium	0.42	0.10	mg/kg dry	0.377		112	70-130			
Chromium	72.8	1.0	mg/kg dry	66.0		110	70-130			
Cobalt	11.6	0.10	mg/kg dry	10.8		107	70-130			
Copper	22.3	0.40	mg/kg dry	20.3		110	70-130			
Iron	22400	20.0	mg/kg dry	20400		110	70-130			
Lead	18.0	0.20	mg/kg dry	16.7		108	70-130			
Lithium	18.9	0.10	mg/kg dry	16.8		113	70-130			
Manganese	350	0.40	mg/kg dry	319		110	70-130			
Mercury	0.122	0.040	mg/kg dry	0.114		107	70-130			
Molybdenum	0.65	0.10	mg/kg dry	0.607		107	70-130			
Nickel	34.8	0.60	mg/kg dry	32.5		107	70-130			
Silver	1.70	0.10	mg/kg dry	1.55		110	70-130			
Strontium	23.8	0.20	mg/kg dry	22.5		106	70-130			
Thallium	< 0.10	0.10	mg/kg dry	0.0765		114	70-130			
Uranium	1.24	0.050	mg/kg dry	1.15		108	70-130			
Vanadium	39.0	1.0	mg/kg dry	36.3		108	70-130			
Zinc	43.0	2.0	mg/kg dry	39.7		108	70-130			
Strong Acid Leachable Metals, Batch B3J2763										
Blank (B3J2763-BLK1)				Prepared: 2023-10-26, Analyzed: 2023-10-27						
Aluminum	< 40	40	mg/kg dry							
Antimony	< 0.10	0.10	mg/kg dry							
Arsenic	< 0.30	0.30	mg/kg dry							
Barium	< 1.0	1.0	mg/kg dry							
Beryllium	< 0.10	0.10	mg/kg dry							
Boron	< 2.0	2.0	mg/kg dry							
Chromium	< 1.0	1.0	mg/kg dry							
Cobalt	< 0.10	0.10	mg/kg dry							
Copper	< 0.40	0.40	mg/kg dry							
Iron	< 20.0	20.0	mg/kg dry							
Lead	< 0.20	0.20	mg/kg dry							
Lithium	< 0.10	0.10	mg/kg dry							
Manganese	< 0.40	0.40	mg/kg dry							
Mercury	< 0.040	0.040	mg/kg dry							
Molybdenum	< 0.10	0.10	mg/kg dry							
Nickel	< 0.60	0.60	mg/kg dry							
Selenium	< 0.20	0.20	mg/kg dry							
Silver	< 0.10	0.10	mg/kg dry							
Strontium	< 0.20	0.20	mg/kg dry							
Thallium	< 0.10	0.10	mg/kg dry							
Tin	< 0.20	0.20	mg/kg dry							
Tungsten	< 0.20	0.20	mg/kg dry							
Uranium	< 0.050	0.050	mg/kg dry							
Vanadium	< 1.0	1.0	mg/kg dry							
Zinc	< 2.0	2.0	mg/kg dry							
LCS (B3J2763-BS1)				Prepared: 2023-10-26, Analyzed: 2023-10-27						
Aluminum	206	40	mg/kg dry	200		103	80-120			
Antimony	2.01	0.10	mg/kg dry	2.00		100	80-120			
Arsenic	20.5	0.30	mg/kg dry	20.0		103	80-120			
Barium	2.0	1.0	mg/kg dry	2.00		102	80-120			
Beryllium	2.15	0.10	mg/kg dry	2.00		107	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Strong Acid Leachable Metals, Batch B3J2763, Continued										
LCS (B3J2763-BS1), Continued				Prepared: 2023-10-26, Analyzed: 2023-10-27						
Boron	22.3	2.0	mg/kg dry	20.0		112	80-120			
Chromium	2.1	1.0	mg/kg dry	2.00		104	80-120			
Cobalt	2.05	0.10	mg/kg dry	2.00		103	80-120			
Copper	2.05	0.40	mg/kg dry	2.00		102	80-120			
Iron	206	20.0	mg/kg dry	200		103	80-120			
Lead	2.02	0.20	mg/kg dry	2.00		101	80-120			
Lithium	2.18	0.10	mg/kg dry	2.00		109	80-120			
Manganese	2.08	0.40	mg/kg dry	2.00		104	80-120			
Mercury	0.217	0.040	mg/kg dry	0.200		109	80-120			
Molybdenum	1.96	0.10	mg/kg dry	2.00		98	80-120			
Nickel	2.03	0.60	mg/kg dry	2.00		101	80-120			
Selenium	19.7	0.20	mg/kg dry	20.0		98	80-120			
Silver	2.02	0.10	mg/kg dry	2.00		101	80-120			
Strontium	2.09	0.20	mg/kg dry	2.00		104	80-120			
Thallium	2.03	0.10	mg/kg dry	2.00		102	80-120			
Tin	2.04	0.20	mg/kg dry	2.00		102	80-120			
Tungsten	2.04	0.20	mg/kg dry	2.00		102	80-120			
Uranium	2.04	0.050	mg/kg dry	2.00		102	80-120			
Vanadium	2.0	1.0	mg/kg dry	2.00		102	80-120			
Zinc	20.4	2.0	mg/kg dry	20.0		102	80-120			
Reference (B3J2763-SRM1)				Prepared: 2023-10-26, Analyzed: 2023-10-27						
Aluminum	12400	40	mg/kg dry	12100		103	70-130			
Antimony	0.64	0.10	mg/kg dry	0.634		101	70-130			
Arsenic	82.4	0.30	mg/kg dry	83.6		99	70-130			
Barium	40.4	1.0	mg/kg dry	41.4		98	70-130			
Beryllium	0.42	0.10	mg/kg dry	0.377		113	70-130			
Chromium	68.7	1.0	mg/kg dry	66.0		104	70-130			
Cobalt	10.9	0.10	mg/kg dry	10.8		101	70-130			
Copper	20.9	0.40	mg/kg dry	20.3		103	70-130			
Iron	21400	20.0	mg/kg dry	20400		105	70-130			
Lead	17.1	0.20	mg/kg dry	16.7		102	70-130			
Lithium	19.4	0.10	mg/kg dry	16.8		115	70-130			
Manganese	331	0.40	mg/kg dry	319		104	70-130			
Mercury	0.118	0.040	mg/kg dry	0.114		104	70-130			
Molybdenum	0.60	0.10	mg/kg dry	0.607		99	70-130			
Nickel	31.8	0.60	mg/kg dry	32.5		98	70-130			
Silver	1.62	0.10	mg/kg dry	1.55		105	70-130			
Strontium	24.2	0.20	mg/kg dry	22.5		108	70-130			
Thallium	< 0.10	0.10	mg/kg dry	0.0765		108	70-130			
Uranium	1.16	0.050	mg/kg dry	1.15		101	70-130			
Vanadium	38.2	1.0	mg/kg dry	36.3		105	70-130			
Zinc	41.2	2.0	mg/kg dry	39.7		104	70-130			
Strong Acid Leachable Metals, Batch B3J2774										
Blank (B3J2774-BLK1)				Prepared: 2023-10-27, Analyzed: 2023-10-27						
Aluminum	< 40	40	mg/kg dry							
Antimony	< 0.10	0.10	mg/kg dry							
Arsenic	< 0.30	0.30	mg/kg dry							
Barium	< 1.0	1.0	mg/kg dry							
Beryllium	< 0.10	0.10	mg/kg dry							
Boron	< 2.0	2.0	mg/kg dry							
Chromium	< 1.0	1.0	mg/kg dry							
Cobalt	< 0.10	0.10	mg/kg dry							
Copper	< 0.40	0.40	mg/kg dry							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Strong Acid Leachable Metals, Batch B3J2774, Continued										
Blank (B3J2774-BLK1), Continued				Prepared: 2023-10-27, Analyzed: 2023-10-27						
Iron	< 20.0	20.0	mg/kg dry							
Lead	< 0.20	0.20	mg/kg dry							
Lithium	< 0.10	0.10	mg/kg dry							
Manganese	< 0.40	0.40	mg/kg dry							
Mercury	< 0.040	0.040	mg/kg dry							
Molybdenum	< 0.10	0.10	mg/kg dry							
Nickel	< 0.60	0.60	mg/kg dry							
Selenium	< 0.20	0.20	mg/kg dry							
Silver	< 0.10	0.10	mg/kg dry							
Strontium	< 0.20	0.20	mg/kg dry							
Thallium	< 0.10	0.10	mg/kg dry							
Tin	< 0.20	0.20	mg/kg dry							
Tungsten	< 0.20	0.20	mg/kg dry							
Uranium	< 0.050	0.050	mg/kg dry							
Vanadium	< 1.0	1.0	mg/kg dry							
Zinc	< 2.0	2.0	mg/kg dry							
LCS (B3J2774-BS1)				Prepared: 2023-10-27, Analyzed: 2023-10-27						
Aluminum	193	40	mg/kg dry	200		96	80-120			
Antimony	1.91	0.10	mg/kg dry	2.00		95	80-120			
Arsenic	18.9	0.30	mg/kg dry	20.0		95	80-120			
Barium	2.0	1.0	mg/kg dry	2.00		98	80-120			
Beryllium	1.94	0.10	mg/kg dry	2.00		97	80-120			
Boron	19.8	2.0	mg/kg dry	20.0		99	80-120			
Chromium	2.0	1.0	mg/kg dry	2.00		98	80-120			
Cobalt	1.93	0.10	mg/kg dry	2.00		97	80-120			
Copper	1.95	0.40	mg/kg dry	2.00		97	80-120			
Iron	194	20.0	mg/kg dry	200		97	80-120			
Lead	1.91	0.20	mg/kg dry	2.00		95	80-120			
Lithium	1.99	0.10	mg/kg dry	2.00		99	80-120			
Manganese	2.00	0.40	mg/kg dry	2.00		100	80-120			
Mercury	0.205	0.040	mg/kg dry	0.200		103	80-120			
Molybdenum	1.89	0.10	mg/kg dry	2.00		94	80-120			
Nickel	1.98	0.60	mg/kg dry	2.00		99	80-120			
Selenium	18.9	0.20	mg/kg dry	20.0		94	80-120			
Silver	1.97	0.10	mg/kg dry	2.00		99	80-120			
Strontium	1.90	0.20	mg/kg dry	2.00		95	80-120			
Thallium	1.88	0.10	mg/kg dry	2.00		94	80-120			
Tin	1.93	0.20	mg/kg dry	2.00		96	80-120			
Tungsten	1.96	0.20	mg/kg dry	2.00		98	80-120			
Uranium	1.94	0.050	mg/kg dry	2.00		97	80-120			
Vanadium	1.9	1.0	mg/kg dry	2.00		95	80-120			
Zinc	18.7	2.0	mg/kg dry	20.0		94	80-120			
Reference (B3J2774-SRM1)				Prepared: 2023-10-27, Analyzed: 2023-10-27						
Aluminum	12100	40	mg/kg dry	12100		100	70-130			
Antimony	0.64	0.10	mg/kg dry	0.634		101	70-130			
Arsenic	85.9	0.30	mg/kg dry	83.6		103	70-130			
Barium	42.2	1.0	mg/kg dry	41.4		102	70-130			
Beryllium	0.38	0.10	mg/kg dry	0.377		100	70-130			
Chromium	68.5	1.0	mg/kg dry	66.0		104	70-130			
Cobalt	11.1	0.10	mg/kg dry	10.8		102	70-130			
Copper	21.8	0.40	mg/kg dry	20.3		108	70-130			
Iron	21300	20.0	mg/kg dry	20400		104	70-130			
Lead	17.3	0.20	mg/kg dry	16.7		103	70-130			
Lithium	17.6	0.10	mg/kg dry	16.8		105	70-130			
Manganese	325	0.40	mg/kg dry	319		102	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Strong Acid Leachable Metals, Batch B3J2774, Continued										
Reference (B3J2774-SRM1), Continued				Prepared: 2023-10-27, Analyzed: 2023-10-27						
Mercury	0.119	0.040	mg/kg dry	0.114		105	70-130			
Molybdenum	0.62	0.10	mg/kg dry	0.607		102	70-130			
Nickel	33.2	0.60	mg/kg dry	32.5		102	70-130			
Silver	1.68	0.10	mg/kg dry	1.55		109	70-130			
Strontium	21.4	0.20	mg/kg dry	22.5		95	70-130			
Thallium	< 0.10	0.10	mg/kg dry	0.0765		104	70-130			
Uranium	1.22	0.050	mg/kg dry	1.15		106	70-130			
Vanadium	37.7	1.0	mg/kg dry	36.3		104	70-130			
Zinc	40.9	2.0	mg/kg dry	39.7		103	70-130			

QC Qualifiers:

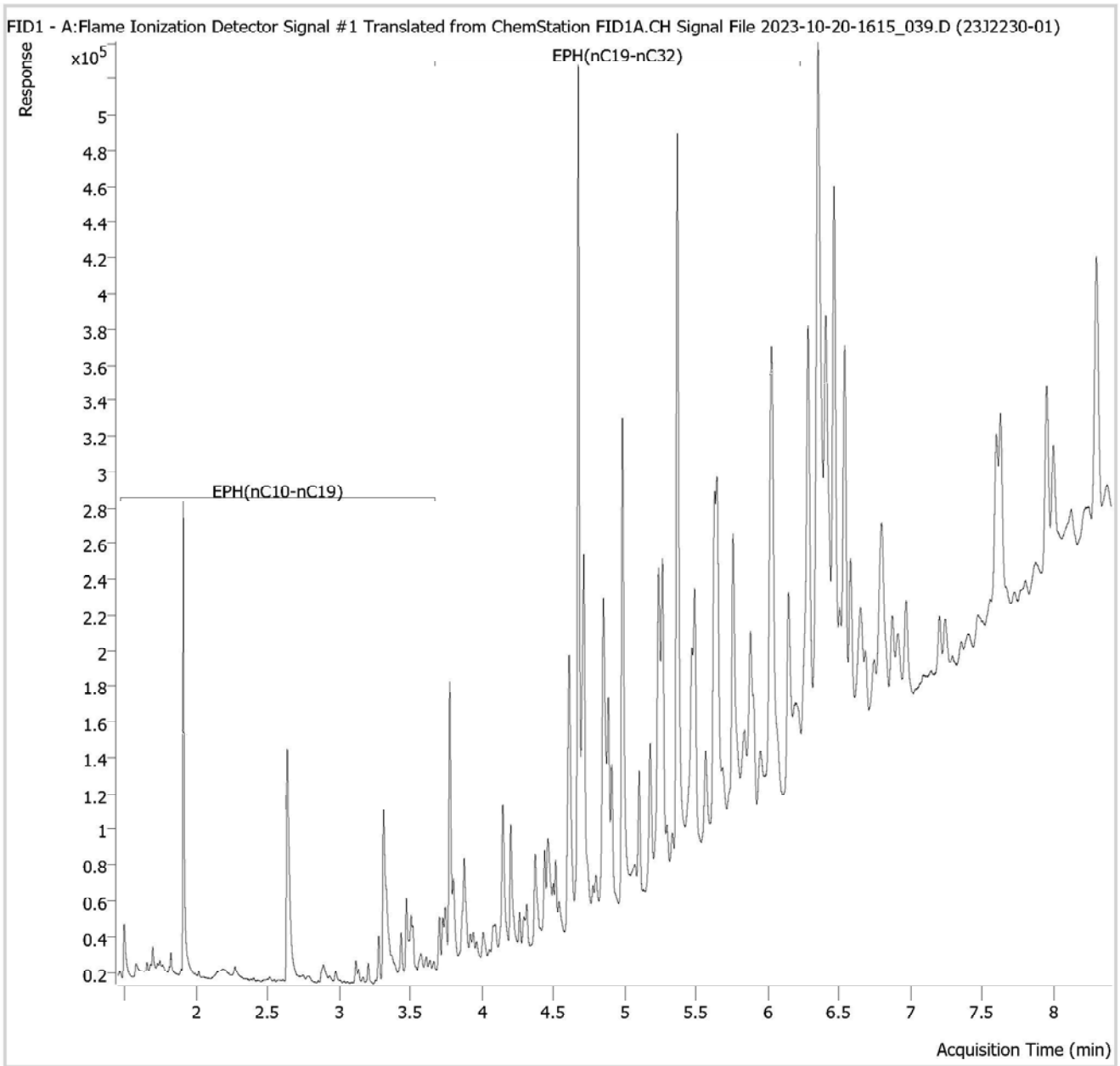
BLK Analyte concentration in the Method Blank is above the Reporting Limit (RL).

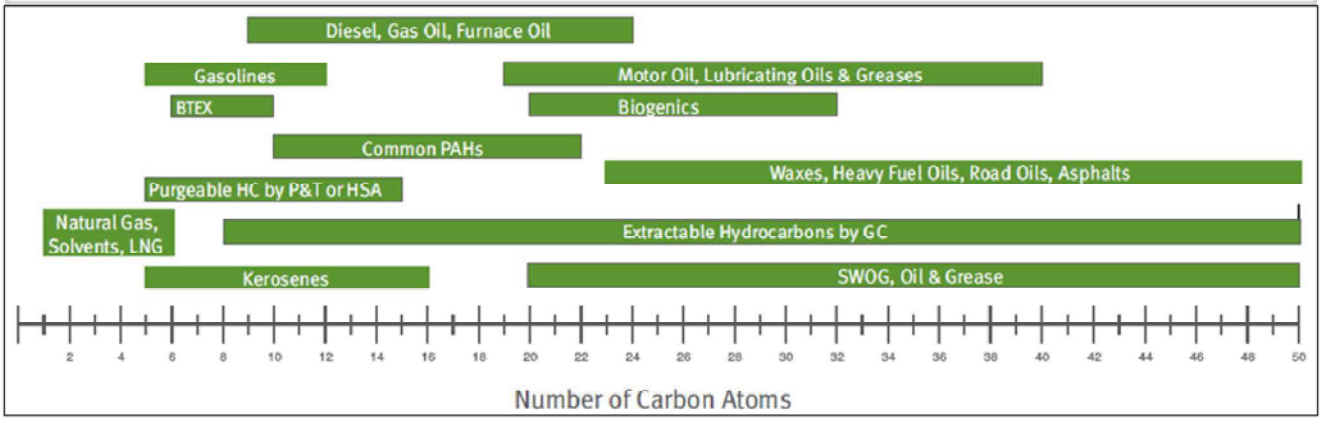
APPENDIX 3: REVISION HISTORY

REPORTED TO	Thurber Engineering Ltd. (Vancouver)	**WORK ORDER**	23J2230
PROJECT	28847	**REPORTED**	2023-10-30 13:11

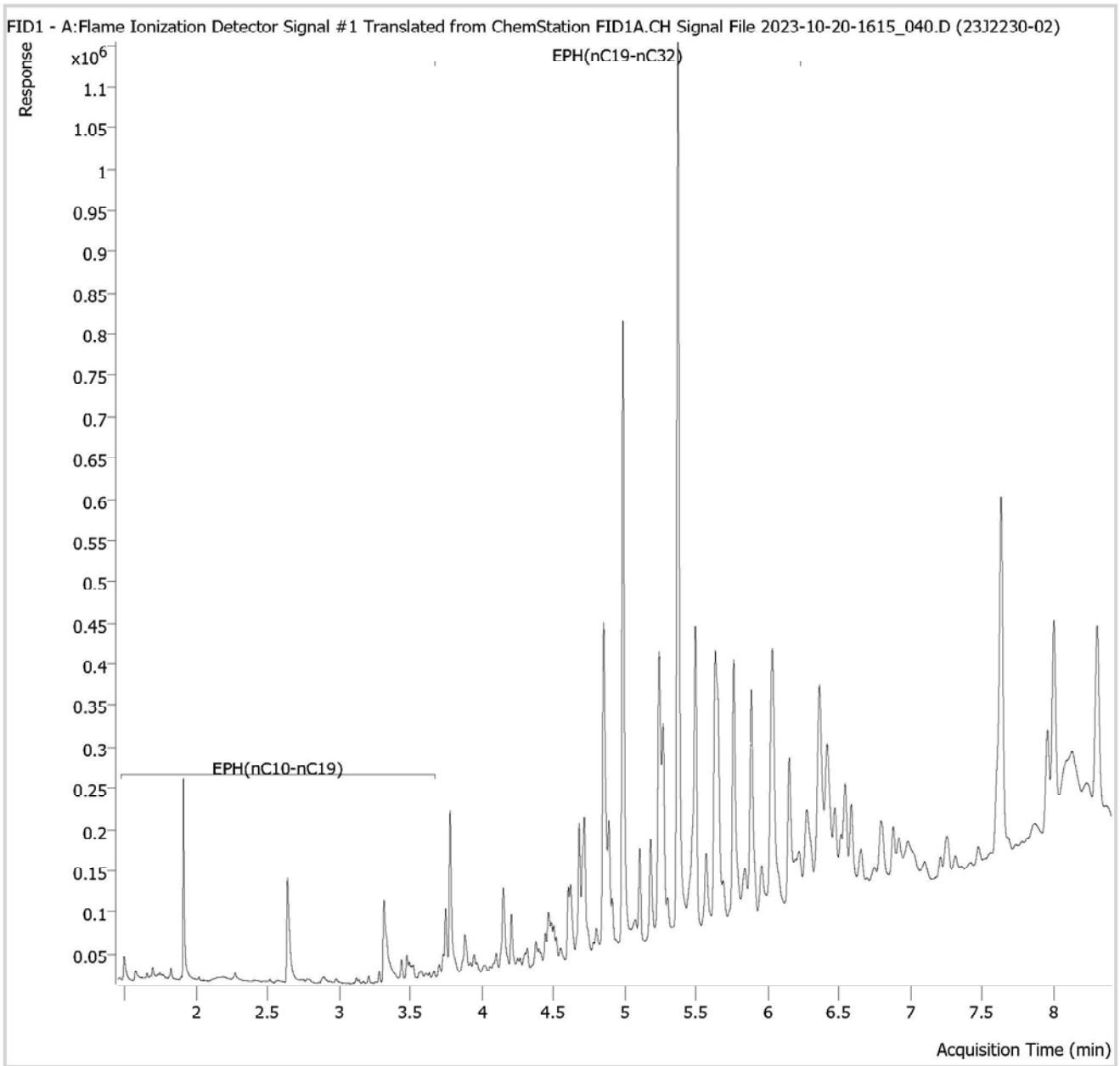
Sample ID	Changed	Change	Analysis	Analyte(s)
23J2230-01	2023-10-27	Result Revised	Aluminum in Soil	Aluminum
23J2230-01	2023-10-27	Result Revised	Antimony in Soil	Antimony
23J2230-01	2023-10-27	Result Revised	Arsenic in Soil	Arsenic
23J2230-01	2023-10-27	Result Revised	Barium in Soil	Barium
23J2230-01	2023-10-27	Result Revised	Beryllium in Soil	Beryllium
23J2230-01	2023-10-27	Result Revised	Boron in Soil	Boron
23J2230-01	2023-10-27	Result Revised	Cadmium in Soil	Cadmium
23J2230-01	2023-10-27	Result Revised	Chromium in Soil	Chromium
23J2230-01	2023-10-27	Result Revised	Cobalt in Soil	Cobalt
23J2230-01	2023-10-27	Result Revised	Copper in Soil	Copper
23J2230-01	2023-10-27	Result Revised	Iron in Soil	Iron
23J2230-01	2023-10-27	Result Revised	Lead in Soil	Lead
23J2230-01	2023-10-27	Result Revised	Lithium in Soil	Lithium
23J2230-01	2023-10-27	Result Revised	Manganese in Soil	Manganese
23J2230-01	2023-10-27	Result Revised	Mercury in Soil	Mercury
23J2230-01	2023-10-27	Result Revised	Molybdenum in Soil	Molybdenum
23J2230-01	2023-10-27	Result Revised	Nickel in Soil	Nickel
23J2230-01	2023-10-27	Result Revised	Selenium in Soil	Selenium
23J2230-01	2023-10-27	Result Revised	Silver in Soil	Silver
23J2230-01	2023-10-27	Result Revised	Strontium in Soil	Strontium
23J2230-01	2023-10-27	Result Revised	Thallium in Soil	Thallium
23J2230-01	2023-10-27	Result Revised	Tin in Soil	Tin
23J2230-01	2023-10-27	Result Revised	Tungsten in Soil	Tungsten
23J2230-01	2023-10-27	Result Revised	Uranium in Soil	Uranium
23J2230-01	2023-10-27	Result Revised	Vanadium in Soil	Vanadium
23J2230-01	2023-10-27	Result Revised	Zinc in Soil	Zinc

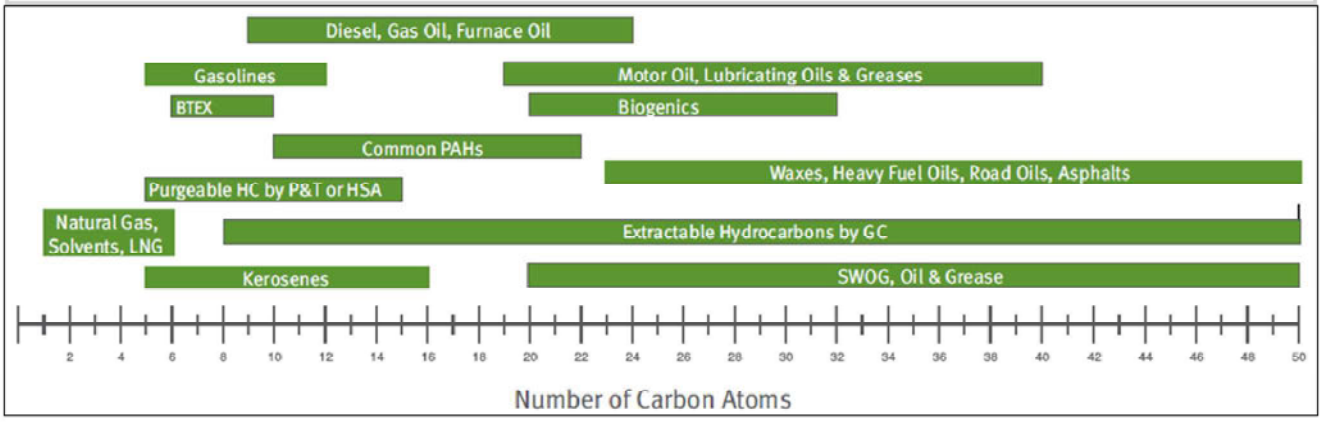
Sample ID: TH23-02-02
Lab ID: 23J2230-01 Batch: B3J1948





Sample ID: TH23-03-01
Lab ID: 23J2230-02 Batch: B3J1948





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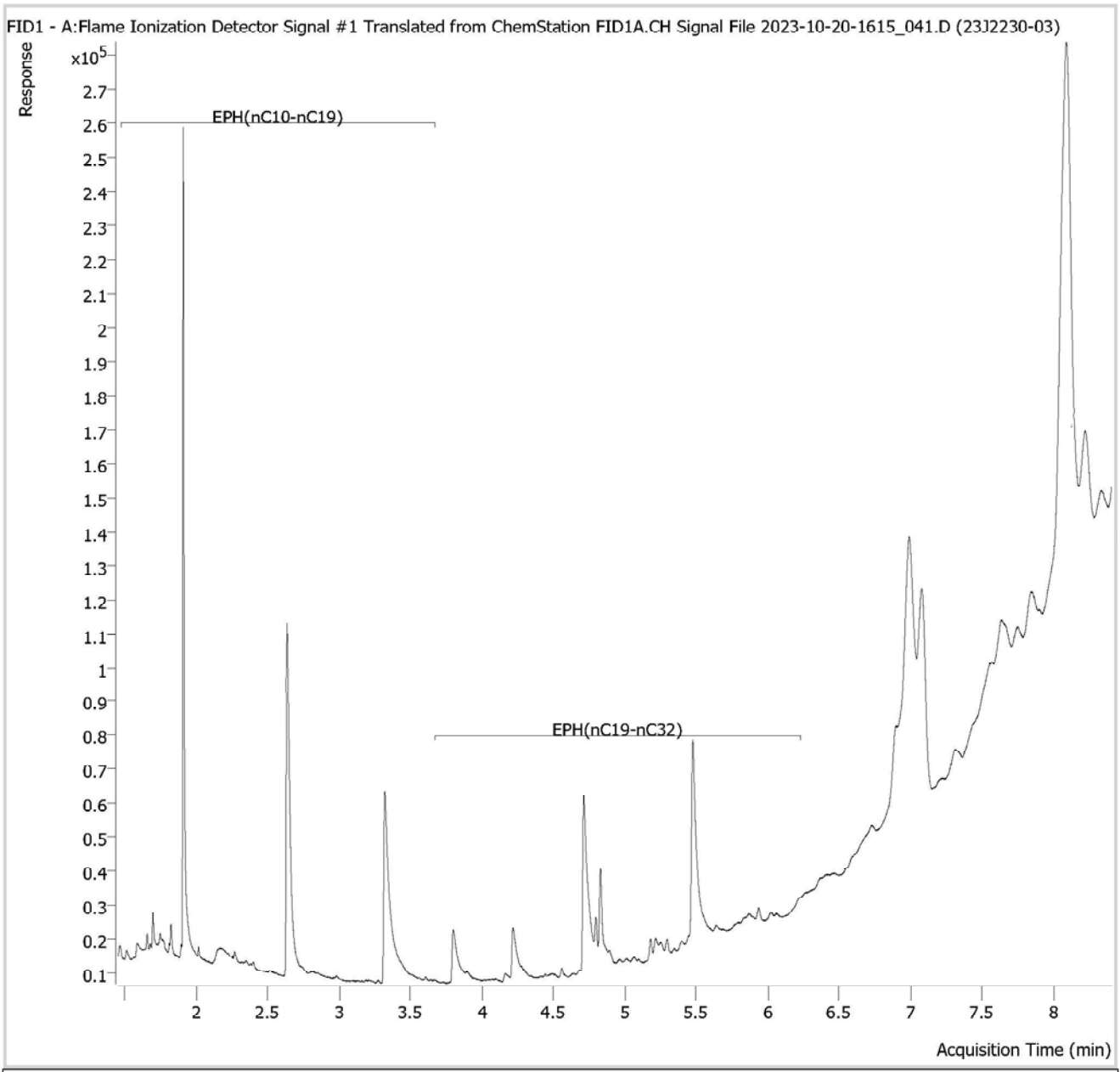
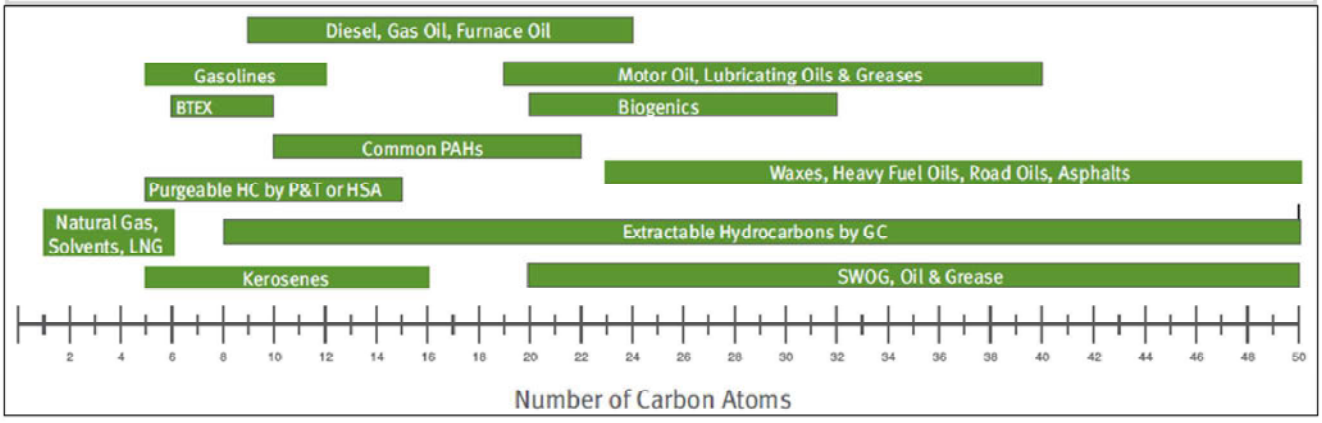
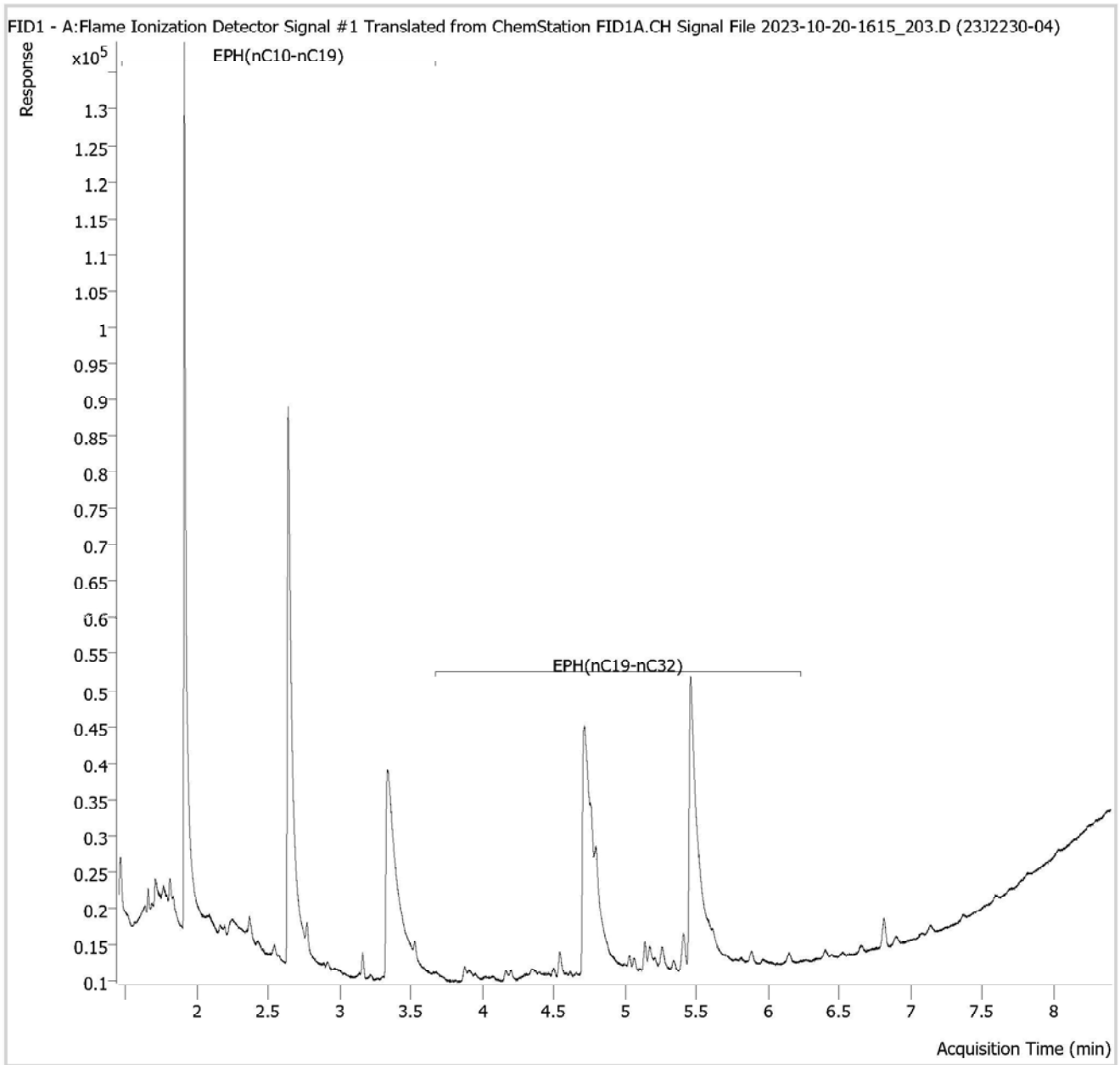
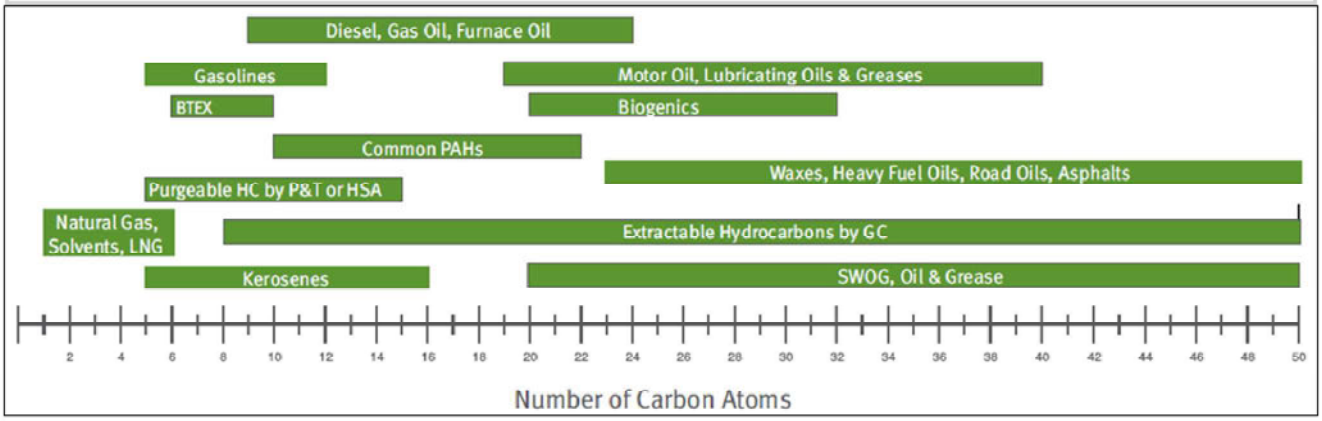
Lab ID: 23J2230-03 Batch: B3J1948



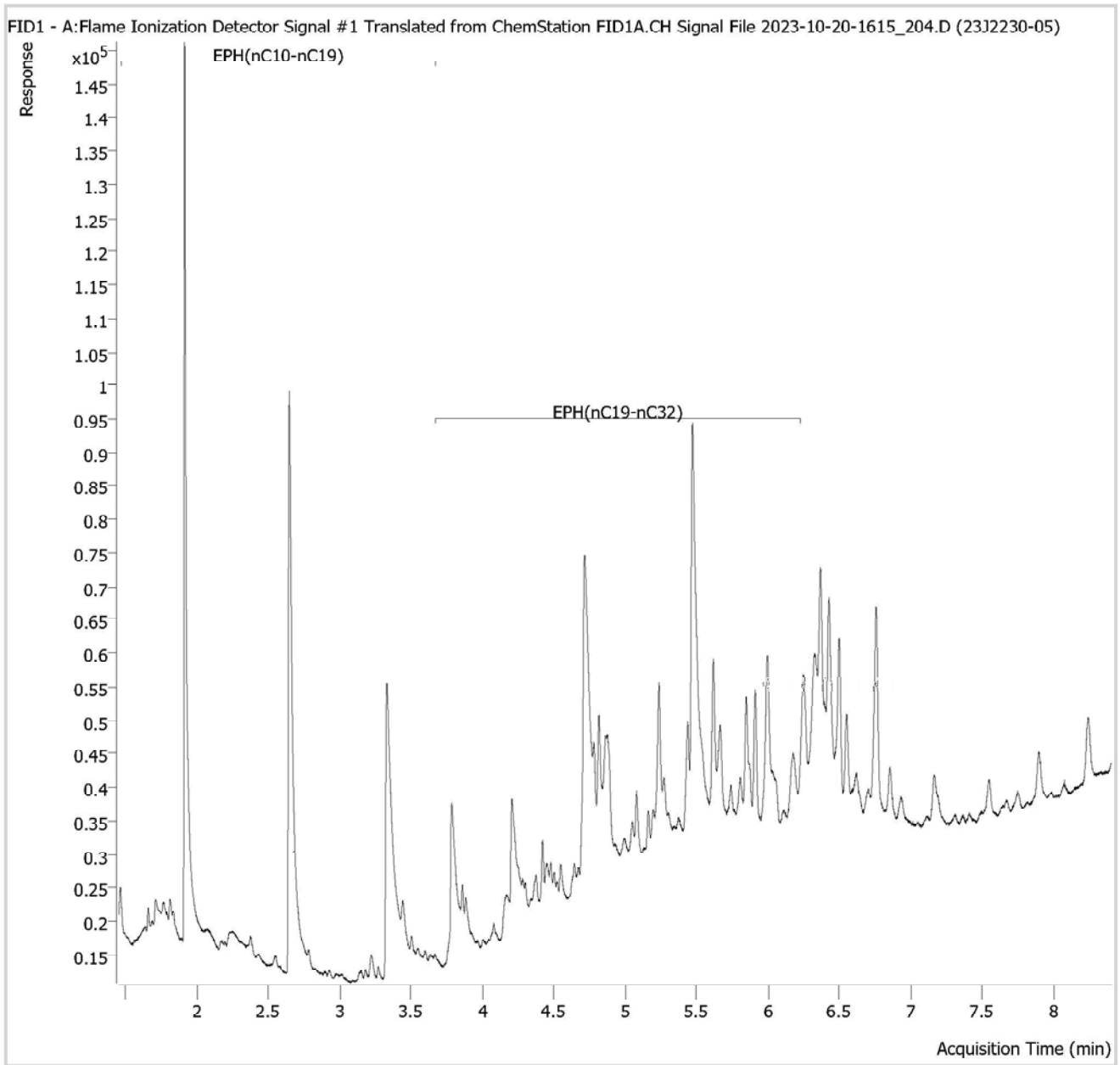


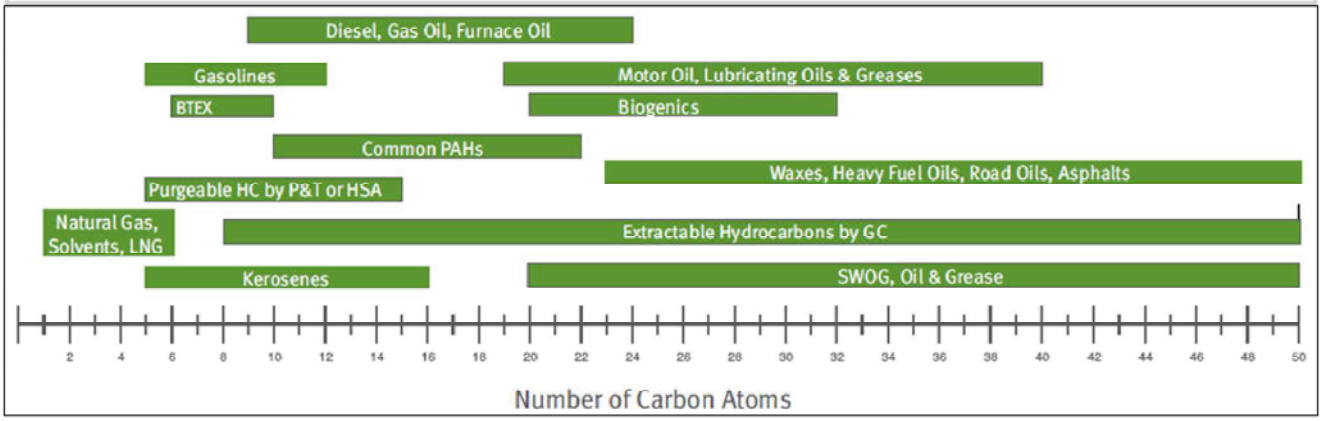
Sample ID: TH23-05-01
Lab ID: 23J2230-04 Batch: B3J1948



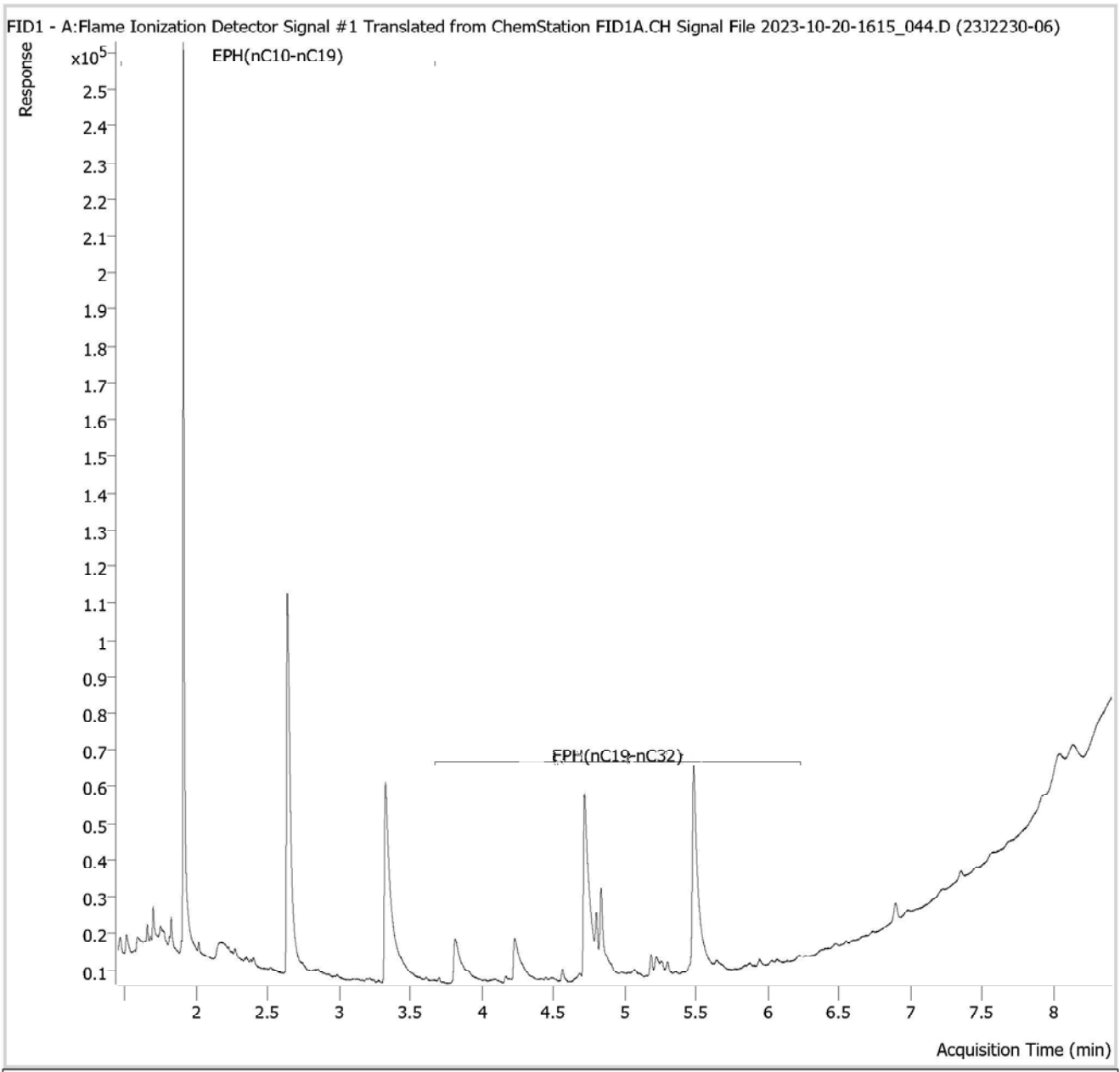


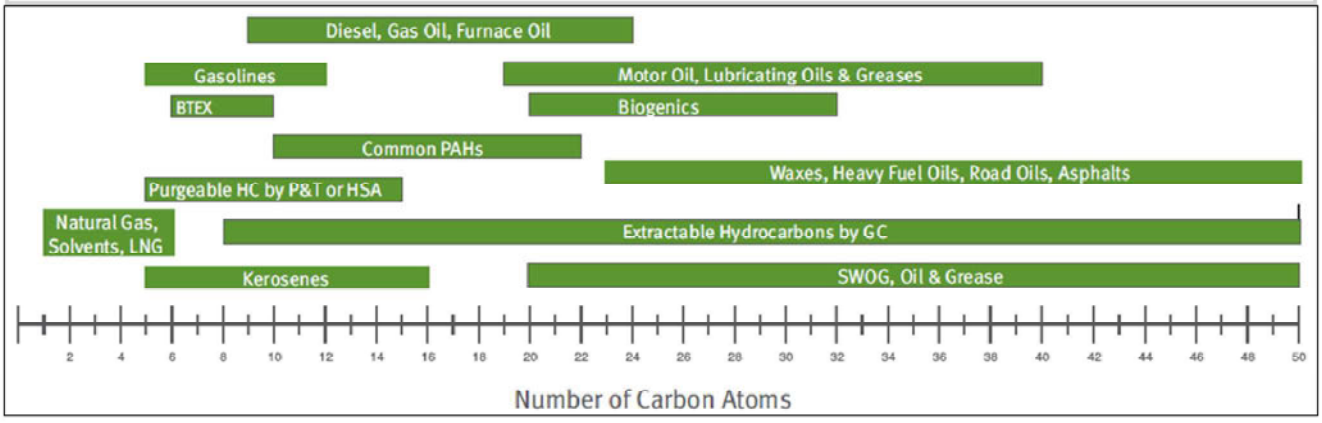
Sample ID: TH23-06-01
Lab ID: 23J2230-05 Batch: B3J1948





Sample ID: TH23-B
Lab ID: 23J2230-06 Batch: B3J1948





THURBER

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 49.311N 123.049W **User File Reference:** Cloverley Elementary School 2023-10-20 16:47 UT

Requested by: Intisar Ahmed, Thurber Engineering Ltd.

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.418	0.288	0.206	0.090
Sa (0.1)	0.636	0.440	0.316	0.139
Sa (0.2)	0.788	0.551	0.399	0.177
Sa (0.3)	0.788	0.556	0.404	0.177
Sa (0.5)	0.695	0.487	0.349	0.146
Sa (1.0)	0.395	0.271	0.189	0.075
Sa (2.0)	0.242	0.161	0.109	0.041
Sa (5.0)	0.077	0.045	0.027	0.009
Sa (10.0)	0.027	0.016	0.010	0.003
PGA (g)	0.342	0.240	0.173	0.075
PGV (m/s)	0.514	0.349	0.241	0.090

Notes: Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information