THE CITY OF DAWSON

SPECIAL COMMITTEE OF THE WHOLE MEETING #CW21-03

DATE: Thursday February 4, 2021
TIME: 5:30 PM
LOCATION: City of Dawson Council Chambers – Safe Spacing rules apply

1. **CALL TO ORDER**

2. **ACCEPTANCE OF ADDENDUM & ADOPTION OF AGENDA**
   a) Special Committee of the Whole Agenda CW21-03

3. **MINUTES**

4. **BUSINESS ARISING FROM MINUTES**

5. **SPECIAL MEETING, COMMITTEE, AND DEPARTMENTAL REPORTS**
   a) RFD- Rec Centre Location Geotechnical & Environmental Reports
   b) RFD- CBC Building Update
   c) RFD- Rec Master Plan

6. **BYLAWS & POLICIES**
   a) Council Remuneration Bylaw (2018-10)
   b) Art Procurement Policy (2021-01)

7. **CORRESPONDENCE**

8. **PUBLIC QUESTIONS**

9. **IN CAMERA**

10. **ADJOURNMENT**

TETRA TECH

Detailed Geotechnical Evaluation
Proposed Recreation Centre Site near Bottom of Dome Road
Dawson City, Yukon



PRESENTED TO

Government of Yukon, Community Services
Infrastructure Development Branch

JANUARY 14, 2021
ISSUED FOR REVIEW
FILE: 704-ENG.WARC03386-65

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse, YT Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

This page intentionally left blank.

EXECUTIVE SUMMARY

Tetra Tech Canada Inc. (Tetra Tech) was retained by the Government of Yukon to complete a geotechnical evaluation of Lot 1059 on the corner of Dome Road and the Klondike Highway in the City of Dawson, Yukon and to provide detailed recommendations for the construction of a proposed new recreation center. The work was procured via Tetra Tech's Standing Offer Agreement and authorized under contract C00055004.

On September 16, 2020 Tetra Tech retained the services of Midnight Sun Drilling of Whitehorse to complete a drilling program throughout the site. A total of four boreholes were drilled to various depths using Midnight Sun Drilling's Prospector 1 Tracked RC/DD drill rig, and the soil profile in each borehole was logged by a qualified geotechnical engineer. The site consists of a varying thickness of Klondike River Tailings overlaying bedrock. The groundwater was observed in open excavations around the site and estimated to be about 6 m below the crown of the Klondike Highway.

Based on the soil conditions encountered during the field evaluation, Tetra Tech considers the site suitable for construction of the proposed recreation centre, after significant foundation preparation has been completed. At this time no detailed design drawings have been provided, but a suitable foundation can consist of shallow foundations (strip and spread concrete footings) on an engineered fill pad, or a deep foundation (rock socketted piles) on a partially prepared engineered fill pad. A topographic survey should be completed prior to construction to estimate the volume of material that will be required to be rearranged or imported. The site should be stripped of all unsuitable material and levelled to 1.5 m above the water table before backfilling to the desired final grade.

Tetra Tech assumed strip and spread footing thickness of 0.3 m, and a surface cover of 1.0 m from the underside of footing to finished grade. An unfactored Ultimate Limit State (ULS) bearing resistance of 400 kPa can be used for 0.4 m wide strip footings and 1.0 m wide spread footings. A Serviceability Limit State (SLS) bearing pressure of 200 kPa can be used for 0.4 m wide strip footings and 1.0 m spread footings. SLS was calculated based on an allowable settlement of 25 mm, which is generally sufficient to limit differential settlement to tolerable levels for most buildings. Unfactored bearing resistances are provided based on a footing width of 0.4 m for strip footings and 1 m for spread footings. Bearing resistance is highly sensitive to soil properties and footing geometry (e.g., burial depth, footing size, footing shape, etc.). Tetra Tech should be retained to review and adjust the provided bearing resistance if different footings sizes, shapes, burial depth, or higher bearing resistances are required.

If a deep foundation system is preferred, a structural slab will be required to support the building and associated slabs (hockey and curling rinks). A 219 mm outer diameter steel pipe pile installed a minimum of 3 m into the bedrock will have a factored geotechnical resistance of 503 kN in compression and 377 kN in tension. The final design of the deep foundation will require a review of loads and other details with a structural engineer.

TABLE OF CONTENTS

LIST OF TABLES IN TEXT

APPENDIX SECTIONS

FIGURES

APPENDICES

ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
2015 NBCC	2015 National Building Code of Canada
CSA	Canadian Standards Association
SPMDD	Standard Proctor Maximum Dry Density
YG	Government of Yukon Department of Community Services, Infrastructure Development Branch

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Government of Yukon and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Government of Yukon, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

1.1 General

Tetra Tech Canada Inc. (Tetra Tech) was retained by the Government of Yukon Department of Community Services, Infrastructure Development Branch (YG) to complete a geotechnical evaluation and provide recommendations for the construction of a new recreation center located at Lot 1059 on the corner of Dome Road and the Klondike Highway in the City of Dawson, Yukon. The work was procured via Tetra Tech's Standing Offer Agreement No. 2017/18-2753-03 and authorized under YG contract No. C00055004.

Previously, a desktop geotechnical evaluation was completed on the site using available geotechnical information. This study concluded that the site was suitable for development of a new recreation centre.

The current Detailed Geotechnical Evaluation presents specific information for foundation design at the subject site.

1.2 Scope of Services

A subsurface geotechnical exploration program was completed at the subject site to develop geotechnical recommendations for foundation design and construction. This geotechnical report was prepared using the results of the exploration program, and includes the following:

- A summary of the geotechnical and groundwater conditions observed at site, a site plan with borehole locations, and borehole logs;
- Recommendations for site preparation and construction of the proposed new building;
- Geotechnical bearing resistances for shallow building foundations (spread/strip footings or monolithic slab-on-grade);
- Geotechnical design information for deep foundations (steel pipe piles);
- Site classification and other considerations for seismic design; and
- Recommended construction monitoring and materials testing requirements during construction.

2.0 WORK COMPLETED

Tetra Tech previously completed a geotechnical report entitled "Preliminary Geotechnical Evaluation – Desktop Study, Proposed Recreation Center Site near Dome Road – Dawson City, Yukon (Tetra Tech file No. 704-ENG.WARC03386-55, dated March 31) on behalf of YG, which provided preliminary geotechnical recommendations for the construction of a new recreation center, based on available information.

Tetra Tech retained Midnight Sun Drilling of Whitehorse to carry out a drilling program at the site using their Prospector P1 Tracked RC/DD drill rig. The drilling program started on September 16, 2020 and was completed September 17. Four boreholes were advanced to depths that ranged from 10.1 m to 12.8 m below ground surface. Due to lost circulation through the porous tailings, no samples were recovered during the field program.

During the drilling program, the soil profile encountered in each borehole was logged by Tetra Tech's field representative, Mr. Taylor Pasloski, P.Eng.

Borehole locations are shown in Figure 1, and detailed borehole logs are attached in Appendix B.

3.0 SITE CONDITIONS

3.1 Surficial Conditions

The proposed site for the recreation center is located on ancient alluvial deposits of the Klondike River. The site has been subjected to placer mining at least once in the past 110 years. There may be localized areas that weren't mined, mostly located close to the toe of the Dome Road Access near the valley wall. The site is undulating, and the elevation varies throughout. Ponded water at surface was located at the entrance into the lot off Dome road. Tetra Tech understands that the city of Dawson uses the lot as a snow disposal area in the winter.

3.2 Subsurface Conditions

Subsurface conditions around the site consisted of Klondike River Tailings that are primarily cobbles and boulders interbedded with sand and/or gravel with trace silt or sandy silt. Cobbles varied in size but were around 200 mm in diameter, and there were boulders sporadically throughout. Sand and gravel fill (White Channel gravel) were observed on surface at the entrance of the lot. Tetra Tech assumes the soil was placed as part of the snow removal process.

3.3 Groundwater

The groundwater visible in the open depressions was estimated to be at 6 m below the crown of the Klondike Highway during the time of drilling. The groundwater level should be verified during a topographic survey. It is believed that groundwater level at the site is related to water level fluctuations in the adjacent Klondike River. There are water-bearing depressions on site that can be used to monitor the groundwater elevation.

3.4 Permafrost

Permafrost was not encountered during the field evaluation.

3.5 Bedrock

Bedrock (assumed to be Klondike Schist) was encountered at 12.2 m, 10.1 m, 10.1 m, and 12.8 m in boreholes BH20-01, BH20-02, BH20-03, and BH20-04, respectively.

4.0 RECOMMENDATIONS

YG has indicated that there is no preferred foundation type for the new recreation center. Based on the evaluation program completed, Tetra Tech considers the site suitable for building construction using either shallow (strip and spread) footings, or deep foundations (rock-socketted steel pipe piles). A topographic survey of the site should be completed to determine the amount of material that will need to be re-arranged/imported for future construction estimations, and to determine the approximate borehole collar elevations for a potential deep foundation system.

4.1 Site Preparation

Site preparation should be undertaken in accordance with the following recommendations:

4.1.1 Shallow Foundations

- All unsuitable material at surface (fill, organics, debris, fine grained soils) should be removed from the site, and the site should be levelled to a uniform elevation 1.5 m above the existing ground water elevation. Additional subexcavation may be required to remove loose, soft, disturbed or otherwise unsuitable material. The water bearing depressions should be backfilled with the local tailings to the desired 1.5 m above the water elevation;
- The side slopes of the excavation must be shored or shaped in accordance with the most recent edition of Occupational Health and Safety Regulations. Tetra Tech should be contacted to provide recommendations if steeper sidewall slopes are desired or planned. Any overhanging cobbles or boulders should be removed from sidewalls. Spoil piles should be kept a distance away from the excavation crest equal to or greater than the excavation depth;
- The exposed subgrade should be inspected by a qualified geotechnical engineer to confirm that suitable ground conditions have been encountered and to provide additional recommendations if necessary;
- The levelled tailings surface must be compacted with a large vibratory drum roller, to at least 98% of Standard Proctor Maximum Dry Density (SPMDD) per ASTM D698, or equivalent relative density;
- The excavations should be backfilled using the remainder of the excavated tailings, or using a pit run non-frost susceptible (NFS) gravel conforming to the specifications as outlined in Table 1. The engineered fill should be placed in lifts no thicker than 300 mm, moisture conditioned and compacted to at least 98% SPMDD;
- A 0.15 m thick layer of 20 mm crushed basecourse conforming to the specifications in Table 1 should be placed immediately below the underside of the concrete foundations, floor slabs, and parking areas. The basecourse should be moisture conditioned and compacted to at least 98% SPMDD; and
- The final elevation of the foundation pad should be at least 300 mm higher than the surrounding terrain, to promote positive drainage away from the building foundations.

Table 1 - Recommended Granular Material Specification

Pit Run Gravel		**20 mm Crushed Basecourse Gravel**	
Particle Size (mm)	**% Passing by Mass**	**Particle Size (mm)**	**% Passing by Mass**
80.0	100	-	-
25.0	55 - 100	20.0	100
12.5	42 - 84	12.5	64 - 100
5.00	26 - 65	5.00	36 - 72
1.25	11 - 47	1.25	12 - 42
0.315	3 - 30	0.315	4 - 22
0.080	0 - 8	0.080	3 - 6

4.1.2 Deep Foundations

Site preparation for deep foundations with structural slabs does not need to be as extensive as that required for shallow foundations. The area under the building itself will only need to be levelled, but the surrounding parking areas should be prepared in accordance with the recommendations in Section 4.1.1 above.

4.2 Foundation Design

4.2.1 Shallow Foundations

Spread and strip footings or a mat foundation may be designed in accordance with the following recommendations, assuming that the site preparation as detailed in Section 4.1 is completed:

- Tetra Tech assumed strip and spread footing thickness of 0.3 m, and a surface cover of 1.0 m from the underside of footing to finished grade;
- Unfactored bearing resistances are provided based on a footing width of 0.4 m for strip footings and 1 m for spread footings. Bearing resistance is highly sensitive to soil properties and footing geometry (e.g., burial depth, footing size, footing shape, etc.). Tetra Tech should be retained to review and adjust the provided bearing resistance if different footings sizes, shapes, burial depth, or higher bearing resistances are required;
- An unfactored ULS bearing resistance of 400 kPa should be used for 0.4 m wide strip footings and 1.0 m spread footings. An SLS bearing pressure of 200 kPa should be used for 0.4 m wide strip footings and 1.0 m spread footings. SLS was calculated based on an allowable settlement of 25 mm, which is generally sufficient to limit differential settlement to tolerable levels for most buildings; and
- Foundation elements should not be cast directly onto or over seasonally frozen soils, and the soils under the foundation must not be allowed to freeze during construction.

4.2.2 Deep Foundations

A deep foundation consisting of grouted rock-socketted steel pipe piles is also considered suitable for this site. A preliminary pile foundation design is shown in Figure 2. The pile length will vary throughout the site depending on the depth to bedrock and the structural loads. The final design of the deep foundation will require a review of loads and other details with a structural engineer. If deep foundations are selected, site preparation as described in Section 4.1 will also be required, and the entire building, including hockey and curling rinks, etc. could be supported on either a structural slab or a slab-on-grade. A 219 mm outer diameter steel pipe pile installed a minimum of 3 m into the bedrock will have a factored geotechnical resistance of 503 kN in compression and 377 kN in tension.

4.3 Parking Areas

YG has not indicated if the parking areas will be paved. However, if the site preparation recommendations outlined in Section 4.1 are followed, the only additional requirement for parking areas is that the recommended thickness of White Channel gravel or road crush be increased to 300 mm to account for material losses during periodic regrading and snow removal. It is also recommended that a non-woven geotextile (or acceptable alternative) be placed at the base of the surfacing material so that fines aren’t lost into the tailings below, from repeated vehicular traffic. Recommended gradations for granular fill materials are provided in Table 2. All backfill should be placed in lifts no thicker than 300 mm, moisture conditioned, and compacted to at least 98% SPMDD.

4.4 Site Grading and Drainage

Final site grading and drainage plans should direct surface water away from the proposed structures. Tetra tech recommends that the final grade within 3.0 m of the proposed structures be sloped down and away at a minimum of 4%. It is also recommended that gravel or landscaped areas beyond this be graded at a minimum of 2%. This should provide positive drainage without causing erosion problems.

Future and existing development should be taken into consideration when directing drainage, so flow is not directed into adjacent developments.

4.5 Seismic Considerations

The 2015 National Building Code of Canada (2015 NBCC) requires that a site classification be established for seismic design of new structures, based on average soil properties of the top 30, (i.e., “site stiffness”). Tetra Tech recommends the site be considered Site Class C, per Table 4.1.8.4.A (National Research Council of Canada, 2015).

4.6 Seasonal Frost Protection

Based on Tetra Tech’s historical knowledge of the area, the gravel tailings are not considered frost susceptible. If the site is prepared following the recommendations outlined in Section 4.1, perimeter insulation should not be required.

4.7 Concrete

Concrete should be cast onto a clean, level, compacted granular bearing surface. It is important that no loose and/or disturbed materials be allowed to remain on the bearing surface. As noted in Section 4.1, the foundation bearing surface should consist of 20 mm crushed basecourse, moisture conditioned and compacted to at least 98% SPMDD.

Tetra Tech recommends that all concrete be designed, mixed, placed and tested in accordance with the most recent editions of the Canadian Standards Association (CSA) Standard CAN/CSA-A23.1 and 23.2. According to these standards, concrete should be designed to at least satisfy minimum durability requirements as defined by exposure class.

The exposure class of the concrete is dependent upon the presence or lack of chlorides, sulphates, freezing and thawing conditions and soil saturation. Building foundations for this project are expected to be exposed to freeze-thaw cycles in non-saturated conditions. The governing exposure class is “F-2” and type GU cement is acceptable.

Exterior concrete exposed to chlorides and freeze-thaw conditions should be designed using exposure class “C-1” (structurally reinforced) or “C-2” (non-structurally reinforced) concrete.

In addition to the above, CAN/CSA-A23.1 also provides recommendations for cold weather concrete placement. These include protecting freshly placed concrete from freezing conditions.

5.0 CONSTRUCTION OBSERVATIONS AND TESTING SERVICES

All recommendations presented herein are site specific and based on the assumption that an adequate level of monitoring during foundation excavation and construction will be provided, and that all construction activities will be carried out by a suitably qualified, experienced contractor. An adequate level of construction monitoring also provides opportunity to confirm that recommendations based on data obtained at discrete locations are relevant to other areas of the sites.

It is recommended that Tetra Tech be given the opportunity to review details related to the geotechnical aspects of the final design prior to construction. Experience has shown that this may prevent inconsistencies, deficient performance, and/or increased costs that may lead disputes.

For this project, assuming that the building is constructed on a shallow foundation, we expect that the following construction monitoring, and testing activities will be required:

- Inspection and approval of prepared subgrade;
- Compaction testing during granular fill placement; and
- Concrete testing of foundation elements, slabs, and other concrete structures.

If a deep foundation is selected for the building, full time pile inspection services will be required in addition to the construction monitoring for general site preparation as described above.

6.0 CLOSURE

We trust this document meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

Prepared by:
Taylor Pasloski, P.Eng.
Geotechnical Engineer, Arctic Region
Engineering Practice
Direct Line: 867.668.9213
Taylor.Pasloski@tetratech.com

Reviewed by:
J. Richard Trimble, P.Eng., FEC
Principal Consultant, Arctic Region
Engineering Practice
Direct Line: 867.668.9216
Richard.Trimble@tetratech.com

/cr

7.0 REFERENCES

Canadian Geotechnical Society . (2006). *Canadian Foundation Engineering Manual 4th Edition.* Canadian Geotechnical Society.

National Research Council of Canada. (2015). *National Building Code of Canada.* Ottawa.

FIGURES

LEGEND

⌖ - BOREHOLE LOCATION

⊞ - TESTPIT LOCATION

0 150m

Scale: 1:3,000 @ 8.5"x11"

CLIENT

Yukon Government

TETRA TECH

DETAILED GEOTECHNICAL EVALUATION PROPOSED RECREATION CENTRE - DAWSON, YT

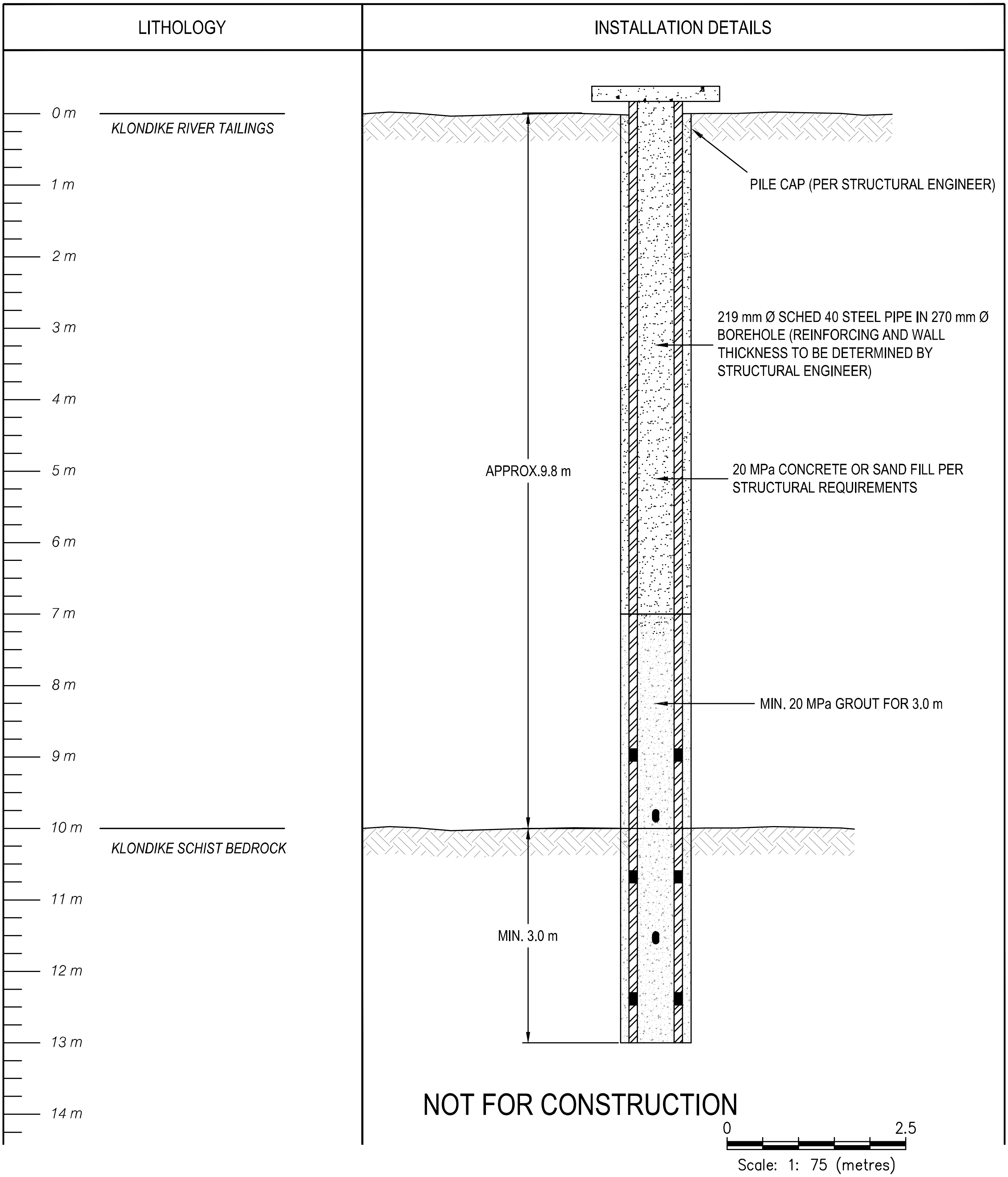
SITE PLAN SHOWING TESTHOLE LOCATIONS

PROJECT NO.	DWN	CKD	REV
ENG.WARC03386-65	TP	JRT	0

OFFICE	DATE
EBA-WHSE	September 18, 2020

Figure 1

Q:\Whitehorse\Data\0201drawings\Dawson City Area\ENG.WARC03386-65 - Detailed Rec Center\ENG.WARC03386-65 Fig.1-R0.dwg [FIGURE 1] September 18, 2020 - 11:26:13 am (BY: PASLOSKI, TAYLOR)



NOTES :

- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED
- 219 mm OD STEEL PIPE PILES INSTALLED WITH A 3 m ROCK SOCKET WILL HAVE A FACTORED GEOTECHNICAL RESISTANCE OF 503 KN IN COMPRESSION AND 377 KN IN TENSION"

CLIENT

Yukon Government

TETRA TECH

NEW RECREATION CENTER - DOME ROAD
DAWSON, YUKON

PROPOSED ROCK SOCKET STEEL PIPE PILE FOUNDATION

PROJECT NO.	DWN	CKD	REV
ENG.WARC03386-65	TP	JRT	0

OFFICE	DATE
EBA-WHSE	October 20, 2020

Figure 2

Q:\Whitehorse\Data\0201\drawings\Dawson City Area\ENG.WARC03386-65 Detailed Rec Center\ENG.WARC03386-65 - Fig 2 Dome Road Rock Socket Pile.dwg [FIGURE 2] November 19, 2020 - 8:56:37 am (BY: PASLOSKI, TAYLOR)

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL – YUKON GOVERNMENT

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the “Professional Document”).

The Professional Document is intended for the use of TETRA TECH’s Client, its officers, employees, agents, representatives, successors and assigns (the “Client”) as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the “Contract” herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH. Any changes to the conclusions, opinions, and recommendations presented in TETRA TECH’s Professional Document must be authorized by TETRA TECH.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH’s “Instruments of Professional Service”), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems, as per agreed project deliverable formats. TETRA TECH makes no representation about the compatibility of these files with the Client’s future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be brought to the attention of TETRA TECH within a reasonable time.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, and subject to the standard of care herein, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage, except where TETRA TECH has subcontracted for such information.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to make, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the Client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

1.8 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to explore, address or consider and has not explored, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.9 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems, methods and standards employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.10 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.11 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historical environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional exploration and review may be necessary.

1.12 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.13 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.14 INFLUENCE OF CONSTRUCTION ACTIVITY

Construction activity can impact structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques, and construction sequence are known.

1.15 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, and the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.16 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued satisfactory performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

1.17 DESIGN PARAMETERS

Bearing capacities for Limit States or Allowable Stress Design, strength/stiffness properties and similar geotechnical design parameters quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition used in this report. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions considered in this report in fact exist at the site.

1.18 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.19 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

This document has been prepared based on the applicable codes, standards, guidelines or best practice as identified in the report. Some mandated codes, standards and guidelines (such as ASTM, AASHTO Bridge Design/Construction Codes, Canadian Highway Bridge Design Code, National/Provincial Building Codes) are routinely updated and corrections made. TETRA TECH cannot predict nor be held liable for any such future changes, amendments, errors or omissions in these documents that may have a bearing on the assessment, design or analyses included in this report.

APPENDIX B

BOREHOLE LOGS

TERMS USED ON BOREHOLE LOGS

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on 0.075mm sieve): Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as inferred from laboratory or in situ tests.

DESCRIPTIVE TERM	RELATIVE DENSITY	N (blows per 0.3m)
Very Loose	0 TO 20%	0 to 4
Loose	20 TO 40%	4 to 10
Compact	40 TO 75%	10 to 30
Dense	75 TO 90%	30 to 50
Very Dense	90 TO 100%	greater than 50

The number of blows, N, on a 51mm O.D. split spoon sampler of a 63.5kg weight falling 0.76m, required to drive the sampler a distance of 0.3m from 0.15m to 0.45m.

FINE GRAINED SOILS (major portion passing 0.075mm sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as estimated from laboratory or in situ tests.

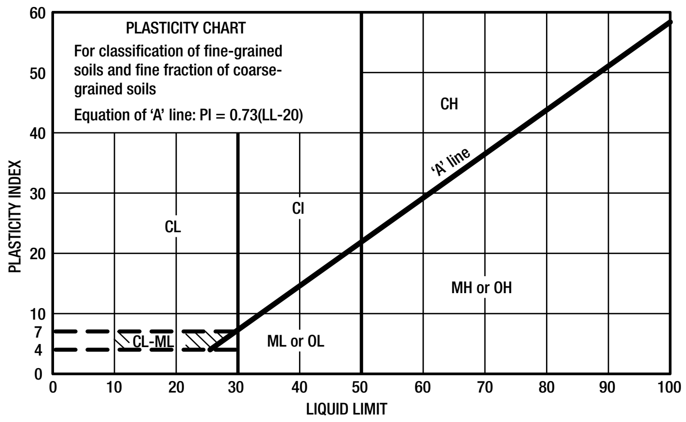
DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH (KPA)
Very Soft	Less than 25
Soft	25 to 50
Firm	50 to 100
Stiff	100 to 200
Very Stiff	200 to 400
Hard	Greater than 400

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil.

GENERAL DESCRIPTIVE TERMS

Slickensided - having inclined planes of weakness that are slick and glossy in appearance.
Fissured - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated - composed of thin layers of varying colour and texture.
Interbedded - composed of alternate layers of different soil types.
Calcareous - containing appreciable quantities of calcium carbonate.;
Well graded - having wide range in grain sizes and substantial amounts of intermediate particle sizes.
Poorly graded - predominantly of one grain size, or having a range of sizes with some intermediate size missing.

MODIFIED UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA		
COARSE - GRAINED SOILS More than 50% retained on No. 75 µm sieve*	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines Less than 5% pass 75 µm sieve — GW, GP, SW, SP More than 12% pass 75 µm sieve — GM, GC, SM, SC 5% to 12% pass 75 µm sieve — Borderline classification requiring use of dual symbols	$C_u = D_{60} / D_{10}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW	
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below 'A' line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits plot above 'A' line and plasticity index greater than 7	
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW	Well-graded sands and gravelly sands, little or no fines		$C_u = D_{60} / D_{10}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP	Poorly-graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures		Atterberg limits plot above 'A' line and plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above 'A' line and plasticity index greater than 7	
FINE-GRAINED SOILS (by behavior) 50% or more passes 75 µm sieve*	SILTS	Liquid limit <50	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands of slight plasticity			
		Liquid limit >50	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts			
	CLAYS Above "A" line on plasticity chart negligible organic content	Liquid limit <30	CL	Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays			
		Liquid limit 30-50	CI	Inorganic clay of medium plasticity, silty clays			
		Liquid limit >50	CH	Inorganic clay of high plasticity, fat clays			
	ORGANIC SILTS AND CLAYS	Liquid limit <50	OL	Organic silts and organic silty clays of low plasticity			
		Liquid limit >50	OH	Organic clays of medium to high plasticity			
HIGHLY ORGANIC SOILS			PT	Peat, muck and other highly organic soils			

PLASTICITY CHART
For classification of fine-grained soils and fine fraction of coarse-grained soils

Equation of 'A' line: PI = 0.73(LL-20)

* Based on the material passing the 75 mm sieve

† ASTM Designation D 2487, for identification procedure see D 2488 USC as modified by PFRA

GROUND ICE DESCRIPTION

ICE NOT VISIBLE

GROUP SYMBOL	SYMBOL	SUBGROUP DESCRIPTION	
N	Nf	Poorly-bonded or friable	▨
	Nbn	No excess ice, well-bonded	▨
	Nbe	Excess ice, well-bonded	▨

VISIBLE ICE LESS THAN 50% BY VOLUME

GROUP SYMBOL	SYMBOL	SUBGROUP DESCRIPTION	
V	Vx	Individual ice crystals or inclusions	▨
	Vc	Ice coatings on particles	▨
	Vr	Random or irregularly oriented ice formations	▨
	Vs	Stratified or distinctly oriented ice formations	▨

VISIBLE ICE GREATER THAN 50% BY VOLUME

ICE	ICE + Soil Type	Ice with soil inclusions	■
	ICE	Ice without soil inclusions (greater than 25 mm thick	■

NOTES:

1. Dual symbols are used to indicate borderline or mixed ice classifications.
2. Visual estimates of ice contents indicated on borehole logs ± 5%
3. This system of ground ice description has been modified from NRC Technical Memo 79, Guide to the Field Description of Permafrost for Engineering Purposes.

LEGEND: Soil □ Ice ■

Tt_Modified Unified Soil Classification_Arctic.cdr

TETRA TECH

BOREHOLE KEYSHEET

Water Level Measurement

- ▼ Measured in standpipe, piezometer or well
- ▽ Inferred

Sample Types

- A-Casing
- Core
- Disturbed, Bag, Grab
- HQ Core
- Jar
- Jar and Bag
- 75 mm SPT
- No Recovery
- Split Spoon/SPT
- Tube
- CRREL Core

Backfill Materials

- ■ Asphalt
- Bentonite
- Cement/ Grout
- Drill Cuttings
- Grout
- Gravel
- Sand
- Slough
- Topsoil Backfill

Lithology - Graphical Legend[1]

- ■ Asphalt
- Bedrock
- Cobbles/Boulders
- Clay
- Coal
- Concrete
- Fill
- Gravel
- Limestone
- Mudstone
- Organics
- Peat
- Sand
- Sandstone
- Shale
- Silt
- Siltstone
- Conglomerate
- Topsoil
- Till

1. The graphical legend is an approximation and for visual representation only. Soil strata may comprise a combination of the basic symbols shown above. Particle sizes are not drawn to scale

TETRA TECH

Yukon

Borehole No: **BH20-01**

Project: Detailed Recreaction Center Evaluation	Project No: 704-ENG.WARC03386-65
Location: Dome Road	
Dawson City	UTM: 576957 E; 7103554 N; Z 7 NAD83

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit, Moisture Content, Liquid Limit 20 40 60 80	Depth (ft)
0	Air Rotary	GRAVEL and COBBLES (Tailings) - sub rounded, greyish, lost circulation in tailings, no recovery	Unfrozen			0 2
1						4 6
2						8
3						10 12
4						14
5						16 18
6						20 22
7		- sand and gravel, sub rounded, approximately 10 mm diameter, damp				24
8						26 28
9		BEDROCK - white				30 32
10						34
11						36 38
12		End of Borehole at 12.2 m - Target Depth				40 42
13						

TETRA TECH

Contractor: Midnight Sun Drilling	Completion Depth: 12.2 m
Drilling Rig Type: Rig 5	Start Date: 2020 September 16
Logged By: TTP	Completion Date: 2020 September 16
Reviewed By: JRT	Page 1 of 1

Borehole No: **BH20-02**

Project: Detailed Recreaction Center Evaluation	Project No: 704-ENG.WARC03386-65
Location: Dome Road	
Dawson City	UTM: 577015 E; 7103542 N; Z 7 NAD83

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit ⊢ Moisture Content ● Liquid Limit ⊣ 20 40 60 80	Depth (ft)
0	Air Rotary	GRAVEL and COBBLES (Tailings) - sub rounded, greyish, lost circulation in tailings, no recovery	Unfrozen			0 2
1						4 6
2		- boulder (600 mm thick), brown				8
3						10 12
4						14 16
5		- silty, sandy, some gravel, wet, brown				18
6		BEDROCK - light brown				20 22
7						24 26
8						28
9						30 32
10		End of Borehole at 10.1 m - Target Depth				34 36
11						38
12						40 42
13						

Contractor: Midnight Sun Drilling	Completion Depth: 10.1 m
Drilling Rig Type: Rig 5	Start Date: 2020 September 17
Logged By: TTP	Completion Date: 2020 September 17
Reviewed By: JRT	Page 1 of 1

Borehole No: **BH20-03**

Project: Detailed Recreaction Center Evaluation	Project No: 704-ENG.WARC03386-65
Location: Dome Road	
Dawson City	UTM: 577023 E; 7103517 N; Z 7 NAD83

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit ⊢ Moisture Content ● Liquid Limit ⊣ 20 40 60 80	Depth (ft)
0	Air Rotary	GRAVEL and COBBLES (Tailings) - sub rounded, greyish, lost circulation in tailings, no recovery	Unfrozen			0
		- silty, sandy, some gravel, wet, brown				
		BEDROCK - white				
		End of Borehole at 10.1 m - Target Depth				

Depth (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13

Depth (ft): 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42

Contractor: Midnight Sun Drilling	Completion Depth: 10.1 m
Drilling Rig Type: Rig 5	Start Date: 2020 September 17
Logged By: TTP	Completion Date: 2020 September 17
Reviewed By: JRT	Page 1 of 1

Borehole No: **BH20-04**

Project: Detailed Recreaction Center Evaluation	Project No: 704-ENG.WARC03386-65
Location: Dome Road	
Dawson City	UTM: 577063 E; 7103424 N; Z 7 NAD83

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit ┣━●━┫ Moisture Content ━ Liquid Limit 20 40 60 80	Depth (ft)
0	Air Rotary	GRAVEL and COBBLES (Tailings) - sub rounded, greyish, lost circulation in tailings, no recovery	Unfrozen			0 2
1						4
2						6 8
3						10 12
4						14 16
5		- silty, sandy, some gravel, wet, brown				18
6						20 22
7						24
8						26 28
9						30
		BEDROCK - brown				32
10						34
11						36
		- light greyish brown				38
12						40
13		End of Borehole at 12.8 m - Target Depth				42

TETRA TECH

Contractor: Midnight Sun Drilling	Completion Depth: 12.8 m
Drilling Rig Type: Rig 5	Start Date: 2020 September 17
Logged By: TTP	Completion Date: 2020 September 17
Reviewed By: JRT	Page 1 of 1

Detailed Geotechnical Evaluation
Proposed Recreation Centre Site at the Gold Rush Campground
Dawson City, Yukon

PRESENTED TO

Government of Yukon, Community Services
Infrastructure Development Branch

JANUARY 14, 2021
ISSUED FOR REVIEW
FILE: 704-ENG.WARC03386-65

This "Issued for Review" document is provided solely for the purpose of client review and presents our interim findings and recommendations to date. Our usable findings and recommendations are provided only through an "Issued for Use" document, which will be issued subsequent to this review. Final design should not be undertaken based on the interim recommendations made herein. Once our report is issued for use, the "Issued for Review" document should be either returned to Tetra Tech Canada Inc. (Tetra Tech) or destroyed.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse, YT Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

This page intentionally left blank.

EXECUTIVE SUMMARY

Tetra Tech Canada Inc. (Tetra Tech) was retained by the Government of Yukon to complete a geotechnical evaluation of Block Q at the current location of the Gold Rush Campground in the City of Dawson, Yukon and to provide detailed recommendations for the foundation construction of a proposed new recreation center. The work was procured via Tetra Tech's Standing Offer Agreement and authorized under contract C00055004.

On September 15, 2020 Tetra Tech retained the services of Midnight Sun Drilling of Whitehorse to complete a drilling program throughout the site. Three boreholes were advanced to termination depths of 16.2 m, 16.2 m, and 2.1 m. Standard Penetration Tests were completed at 1 m and 2.5 m in borehole BH20-01 to collect soil samples to undergo further environmental testing. Monitoring wells were installed in boreholes BH20-01 and BH20-02 to 3 m depth, and 2.1 m in borehole BH20-03. Subsurface conditions at the site consisted of sand and gravel fill for 1 m to 1.2 m, overlaying a permafrost silt and organic matrix that extended down to approximately 4 m to 4.6 m below ground surface. Sand, gravel and cobbles were encountered underlying the silt and organics until bedrock. Groundwater was measured at 1.9 m, 2.2 m, and 1.7 m in boreholes BH20-01, BH20-02, and BH20-03, respectively, perched on top of the permafrost. Permafrost was continuous below the perched water table to the bottom of the holes.

Based on the soil conditions encountered during the field evaluation, Tetra Tech considers the site suitable for construction of the proposed recreation centre, assuming significant foundation improvements are made. These improvements are presented in the site preparation recommendations outlined in the report. At this time no detailed design drawings have been provided, but a suitable foundation can consist of either shallow foundations (strip and spread footings) after a significant subcut and backfill operation, or a deep foundation (rock socketted piles). For the shallow foundation system, the site must be stripped to remove all the unsuitable frozen silt and organics and to expose the underlying sand and gravel. The excavation should extend to the site property lines. If the excavation walls cannot be shaped or shored in accordance with the most recent edition Occupational Health and Safety Regulations, then the excavation walls will need to be supported so that adjacent streets and underground utilities aren't compromised. For the deep foundation (rock-socketted piles supporting a structural slab) the area under the building does not need to be stripped, but adjacent parking areas might need to be partially subcut and backfilled if settlement is noted around the building.

For the shallow foundation on backfill, Tetra Tech assumed a strip and spread footing thickness of 0.3 m, and a surface cover of 1.0 m from the underside of footing to finished grade. An unfactored Ultimate Limit State (ULS) bearing resistance of 400 kPa can be used for 0.4 m wide strip footings and 1.0 m wide spread footings, and a Serviceability Limit State (SLS) bearing pressure of 300 kPa can be used for 0.4 m wide strip footings and 1.0 m spread footings. SLS was calculated based on an allowable settlement of 25 mm, which is generally sufficient to limit differential settlement to tolerable levels for most buildings. Bearing resistance is highly sensitive to soil properties and footing geometry (e.g., burial depth, footing size, footing shape, etc.). Tetra Tech should be retained to review and adjust the provided bearing resistance if different footings sizes, shapes, burial depth, or higher bearing resistances are required.

If a deep foundation system is preferred, a structural slab will be required to support the building and associated slabs (hockey and curling rinks). A 219 mm outer diameter steel pipe pile installed a minimum of 3 m into the bedrock will have a factored geotechnical resistance of 503 kN in compression and 377 kN in tension. The final design of the deep foundation will require a review of loads and other details with a structural engineer.

TABLE OF CONTENTS

LIST OF TABLES IN TEXT

APPENDIX SECTIONS

FIGURES

APPENDICES

ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
2015 NBCC	2015 National Building Code of Canada
CSA	Canadian Standards Association
SPMDD	Standard Proctor Maximum Dry Density
YG	Government of Yukon Department of Community Services, Infrastructure Development Branch

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Government of Yukon and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Government of Yukon, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

1.1 General

Tetra Tech Canada Inc. (Tetra Tech) was retained by the Government of Yukon Department of Community Services, Infrastructure Development Branch (YG) to complete a geotechnical evaluation and provide recommendations for the foundation construction of a new recreation center located at the existing Gold Rush Campground (Block Q) in the City of Dawson, Yukon. The work was procured via Tetra Tech's Standing Offer Agreement No. 2017/18-2753-03 and authorized under YG contract No. C00055004.

1.2 Scope of Services

A subsurface geotechnical exploration program was completed at the subject site to develop geotechnical recommendations for foundation design and construction. This geotechnical report was prepared using the results of the exploration program, and includes the following:

- A summary of the geotechnical and groundwater conditions observed at site, a site plan with borehole locations, and borehole logs;
- Recommendations for site preparation and construction of the proposed new building;
- Preliminary geotechnical bearing resistances for shallow building foundations (spread/strip footings or monolithic slab-on-grade) on compacted backfill;
- Factored capacities of deep foundations (rock-socketted steel pipe piles) in compression and tension;
- Site classification and other considerations for seismic design; and
- Recommended construction monitoring and materials testing requirements during construction.

2.0 WORK COMPLETED

Tetra Tech previously completed a geotechnical report entitled "Preliminary Geotechnical Evaluation – Desktop Study, Proposed Recreation Center Site on Gold Rush Campground Property – Dawson City, Yukon (Tetra Tech File No. 704-ENG.WARC03386-55, dated March 31) on behalf of YG, which provided preliminary geotechnical recommendations for the construction of a new recreation center.

Tetra Tech retained Midnight Sun Drilling of Whitehorse to carry out a drilling program at the site using their Prospector P1 Tracked RC/DD drill rig. The drilling program started on September 15, 2020 and was completed September 16. Three boreholes were advanced to termination depths of 16.2 m, 16.2 m, and 2.1 m. Standard Penetration Tests were completed at 1 m and 2.5 m in borehole BH20-01 to collect soil samples to undergo further environmental testing. No other soil samples were collected during the field program. Monitoring wells were installed in boreholes BH20-01 and BH20-02 to 3 m depth, and 2.1 m in borehole BH20-03.

During the drilling program, the soil profile encountered in each borehole was logged by Tetra Tech's field representative, Mr. Taylor Pasloski, P.Eng. Soil samples were not collected as it was assumed that for shallow foundations the fill and organics would be stripped from site, therefore the depth to gravel was the primary consideration; and for deep foundations the depth to bedrock was the primary consideration.

It was intended for BH20-03 to be drilled to the target depth of 16.2 m, but the hole was prematurely terminated due to drill casing breaking down hole. Mr. Pasloski made the field decision that enough information was collected to complete the design from the previous two boreholes, and it was more cost effective to terminate the hole as is than incur additional standby costs.

Borehole locations are shown in Figure 1, and detailed borehole logs are attached in Appendix B.

3.0 SITE CONDITIONS

3.1 Surficial Conditions

The proposed location is between Fourth Avenue and Fifth Avenue and York Street and Duke Street. The site is currently developed and used seasonally as a campground.

3.2 Subsurface Conditions

Ground conditions encountered during the drill program were generally consistent throughout the site and can be summarized as sand and gravel fill for 1 m to 1.2 m, overlying a frozen silt and organic matrix that extended down to approximately 4 m to 4.6 m below ground surface. Sand, gravel and cobbles were encountered underlying the silt and organics until bedrock.

It was anecdotally reported that there were areas of buried machinery and other metal parts, etc. on this property, but these were not encountered during the drilling program.

3.3 Groundwater

Groundwater was at 1.9 m, 2.2 m, and 1.7 m in boreholes BH20-01, BH20-02, and BH20-03, respectively. This is considered to be a perched water table on top of the permafrost.

3.4 Permafrost

Although no samples were collected due to the drilling method, Tetra Tech’s local knowledge of the area expects the silty organic matrix to contain both visible non-visible ice in the permafrost.

It is well known that permafrost is continuous in Dawson City north of Church Street. As this area was not glaciated in the last ice age, the permafrost is at least 50,000 years old and probably much older. Our knowledge of the campground site inferred from adjacent boreholes and excavations is that permafrost is continuous under the property within silty and organic soils down to a depth of approximately 20 m. The permafrost is usually ice rich near surface with lenses and crystals of ice throughout. Massive ice wedges have also been encountered in other areas of Dawson.

The presence of permafrost makes this site an undesirable location for the construction of a recreation centre, unless significant foundation improvements are made (subcut and backfill) or the building loads are transferred through the permafrost into the underlying bedrock. Previous experience has shown that the gravel and cobbles underlying the organic silts and sands near surface are considered to be thaw stable, after any visible ground ice has been removed from the top of this layer. The bedrock is also thaw stable.

3.5 Bedrock

Bedrock (Klondike Schist) was encountered at 14.0 and 13.7 m below ground surface in boreholes BH20-01 and BH20-02, respectively.

4.0 RECOMMENDATIONS

YG has indicated that there is no preferred foundation type for the new recreation center. Based on the evaluation program completed, Tetra Tech considers the site suitable for construction. Both shallow (strip and spread footings) on an engineered fill pad, and deep foundations (rock-socket piles) are considered suitable foundations.

4.1 Site Preparation

4.1.1 Shallow Foundations

Site preparation for shallow foundations (concrete footings) should be undertaken in accordance with the following recommendations:

- The entire lot should be excavated down to remove the fill and frozen silts and organics to expose the underlying gravels. The excavation depth will vary throughout the site, but will extend down at least 4.6 m as shown in borehole BH20-02;
- Any visible ground ice exposed at the top of the gravel surface must also be removed;
- The excavation should extend from property line to property line in all directions, so that future performance of the site is acceptable (i.e. no soft spots, thaw depressions, or seasonal frost related movements);
- The excavation side slopes must be shored or shaped in accordance with the most recent edition of Occupational Health and Safety Regulations. Tetra Tech should be contacted to provide recommendations if steeper sidewall slopes are desired or planned. Any overhanging cobbles or boulders should be removed from sidewalls. Spoil piles should be kept a distance away from the excavation crest equal to or greater than the excavation depth;
- If the excavation walls cannot be shaped or shored, they will need to be supported so that adjacent streets and underground utilities aren’t compromised. Such ground support methods can consist of sheet pilings, soil anchors, a temporary retaining wall, or other similar methods;
- If minor groundwater is encountered at the base of the excavation, coarse tailings or rockfill will be required to backfill up to just above the water elevation;
- If significant groundwater is encountered, the contractor should be prepared to pump and treat the water before disposing of it offsite;
- The exposed subgrade should be inspected by a qualified geotechnical engineer to confirm that suitable ground conditions have been encountered and to provide additional recommendations if necessary;

- The excavations should be backfilled using a pit run gravel conforming to the specifications as outlined in Table 1. The engineered fill should be placed in lifts no thicker than 300 mm, moisture conditioned and compacted to at least 98% of Standard Proctor Maximum Dry Density (SPMDD) per ASTM D698;
- A 0.15 m thick layer of 20 mm crushed basecourse conforming to the specifications in Table 1 should be placed immediately below the underside of the concrete foundations and floor slabs. The basecourse should be moisture conditioned and compacted to at least 98% SPMDD; and
- The elevation of the top of the building pad should be higher than the surrounding terrain, to promote positive drainage away from the building foundations.

Table 1 - Recommended Granular Material Specification

Pit Run Gravel		20 mm Crushed Basecourse Gravel	
Particle Size (mm)	**% Passing by Mass**	**Particle Size (mm)**	**% Passing by Mass**
80.0	100	-	-
25.0	55 - 100	20.0	100
12.5	42 - 84	12.5	64 - 100
5.00	26 - 65	5.00	36 - 72
1.25	11 - 47	1.25	12 - 42
0.315	3 - 30	0.315	4 - 22
0.080	0 - 8	0.080	3 - 6

4.1.2 Deep Foundations

If deep foundations are selected, it will not be necessary to prepare the area under the building other than to ensure there is enough gravel surfacing for piling rig access.

4.2 Foundation Design

4.2.1 Shallow Foundations

Spread and strip footings or a mat foundation may be designed in accordance with the following recommendations, assuming that the site preparation as detailed in Section 4.1 is completed:

- Tetra Tech assumed strip and spread footing thickness of 0.3 m, and a surface cover of 1.0 m from the underside of footing to finished grade;
- Unfactored bearing resistances are provided based on a footing width of 0.4 m for strip footings and 1 m for spread footings. Bearing resistance is highly sensitive to soil properties and footing geometry (e.g., burial depth, footing size, footing shape, etc.). Tetra Tech should be retained to review and adjust the provided bearing resistance if different footings sizes, shapes, burial depth, or higher bearing resistances are required;
- An unfactored ULS bearing resistance of 400 kPa should be used for 0.4 m wide strip footings and 1.0 m spread footings. An SLS bearing pressure of 200 kPa should be used for 0.4 m wide strip footings and 1.0 m spread footings. SLS was calculated based on an allowable settlement of 25 mm, which is generally sufficient to limit differential settlement to tolerable levels for most buildings.
- Foundation elements should not be cast directly onto or over seasonally frozen soils, and the soils under the foundation must not be allowed to freeze during construction; and

- Finished grades should be sloped to promote positive drainage and direct surface runoff away from the building foundations.

4.2.2 Deep Foundations

A deep foundation consisting of grouted rock-socketted steel pipe piles is also considered suitable for this site. A preliminary pile foundation design is shown in Figure 2. The pile length will vary throughout the site depending on the depth to bedrock and the structural loads. The final design of the deep foundation will require a review of loads and other details with a structural engineer. If deep foundations are selected, site preparation as described in Section 4.1 will also be required, and the entire building, including hockey and curling rinks, etc. could be supported on either a structural slab or a slab-on-grade. A 219 mm outer diameter steel pipe pile grouted a minimum of 3 m into the bedrock will have a factored geotechnical resistance of 503 kN in compression and 377 kN in tension.

4.3 Site Grading and Drainage

Final site grading and drainage plans should direct surface water away from the proposed structures. Tetra tech recommends that the final grade within 3.0 m of the proposed structures be sloped down and away at a minimum of 4%. It is also recommended that gravel or landscaped areas beyond this be graded at a minimum of 2%. This should provide positive drainage without causing erosion problems.

Future and existing development should be taken into consideration when directing drainage, so flow is not directed into adjacent developments.

It should be noted that if a pile foundation supporting a structural slab is selected, then there will eventually be a large thaw depression under the building that will collect surface water and may affect adjacent parking areas and other small surface structures. The maintenance and filling of this area next to the building will be an ongoing activity until all the permafrost has thawed. There will also be ponded water under the slab that should be considered in future maintenance of the structure.

4.4 Seismic Considerations

The 2015 National Building Code of Canada (2015 NBCC) requires that a site classification be established for seismic design of new structures, based on average soil properties of the top 30, (i.e., “site stiffness”). Tetra Tech recommends the site be considered Site Class C, per Table 4.1.8.4.A (National Research Council of Canada, 2015).

4.5 Seasonal Frost Protection

Based on Tetra Tech’s historical knowledge of the area, the gravel tailings proposed for site backfill are not considered frost susceptible. If shallow foundations are selected and the site is prepared in accordance with the recommendations outlined in Section 4.1, perimeter insulation should not be required.

If deep foundations (piles) are selected, they have been designed to resist seasonal frost penetration around the perimeter of the building.

4.6 Parking Areas

YG has not indicated if the parking areas will be paved. Following site preparation recommendations outlined in Section 4.1, the site should be capped with at least 300 mm of 20 mm crushed gravel (Gran A). the recommended gradation for the crush is outlined in Table 2. All backfill should be placed in lifts no thicker than 300 mm, moisture conditioned, and compacted to at least 98% SPMDD.

4.7 Concrete

Concrete should be cast onto a clean, level, compacted granular bearing surface. It is important that no loose and/or disturbed materials be allowed to remain on the bearing surface. As noted in Section 4.1, the foundation bearing surface should consist of 20 mm crushed basecourse, moisture conditioned and compacted to at least 98% SPMDD.

Tetra Tech recommends that all concrete be designed, mixed, placed and tested in accordance with the most recent editions of the Canadian Standards Association (CSA) Standard CAN/CSA-A23.1 and 23.2. According to these standards, concrete should be designed to at least satisfy minimum durability requirements as defined by exposure class.

The exposure class of the concrete is dependent upon the presence or lack of chlorides, sulphates, freezing and thawing conditions and soil saturation. Building foundations for this project are expected to be exposed to freeze-thaw cycles in non-saturated conditions. The governing exposure class is “F-2” and type GU cement is acceptable.

Exterior concrete exposed to chlorides and freeze-thaw conditions should be designed using exposure class “C-1” (structurally reinforced) or “C-2” (non-structurally reinforced) concrete. In addition to the above, CAN/CSA-A23.1 also provides recommendations for cold weather concrete placement. These include protecting freshly placed concrete from freezing conditions.

5.0 CONSTRUCTION OBSERVATIONS AND TESTING SERVICES

All recommendations presented herein are site specific and based on the assumption that an adequate level of monitoring during foundation excavation and construction will be provided, and that all construction activities will be carried out by a suitably qualified, experienced contractor. An adequate level of construction monitoring also provides opportunity to confirm that recommendations based on data obtained at discrete locations are relevant to other areas of the sites.

It is recommended that Tetra Tech be given the opportunity to review details related to the geotechnical aspects of the final design prior to construction. Experience has shown that this may prevent inconsistencies, deficient performance, and/or increased costs that may lead disputes.

For this project, assuming that the building is constructed on a shallow foundation, we expect that the following construction monitoring, and testing activities will be required:

- Inspection and approval of prepared subgrade;
- Compaction testing during granular fill placement; and
- Concrete testing of foundation elements, slabs, and other concrete structures.

If a deep foundation is selected for the building, full time pile inspection services will be required in addition to the construction monitoring for general site preparation as described above.

6.0 CLOSURE

We trust this document meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

Prepared by:
Taylor Pasloski, P.Eng.
Geotechnical Engineer, Arctic Region
Engineering Practice
Direct Line: 867.668.9213
Taylor.Pasloski@tetratech.com

Reviewed by:
J. Richard Trimble, P.Eng., FEC
Principal Consultant, Arctic Region
Engineering Practice
Direct Line: 867.668.9216
Richard.Trimble@tetratech.com

/cr

7.0 REFERENCES

Canadian Geotechnical Society . (2006). *Canadian Foundation Engineering Manual 4th Edition.* Canadian Geotechnical Society.

National Research Council of Canada. (2015). *National Building Code of Canada.* Ottawa.

FIGURES

Q:\Whitehorse\Data\0201drawings\Dawson City Area\ENG.WARC03386-65 - Detailed Rec Center\ENG.WARC03386-65 Fig.1-R0 V2.dwg [FIGURE 1] September 18, 2020 - 11:14:45 am (BY: PASLOSKI, TAYLOR)

LEGEND

⌖ - BOREHOLE LOCATION

0 100m

Scale: 1:2,000 @ 8.5"x11"

CLIENT

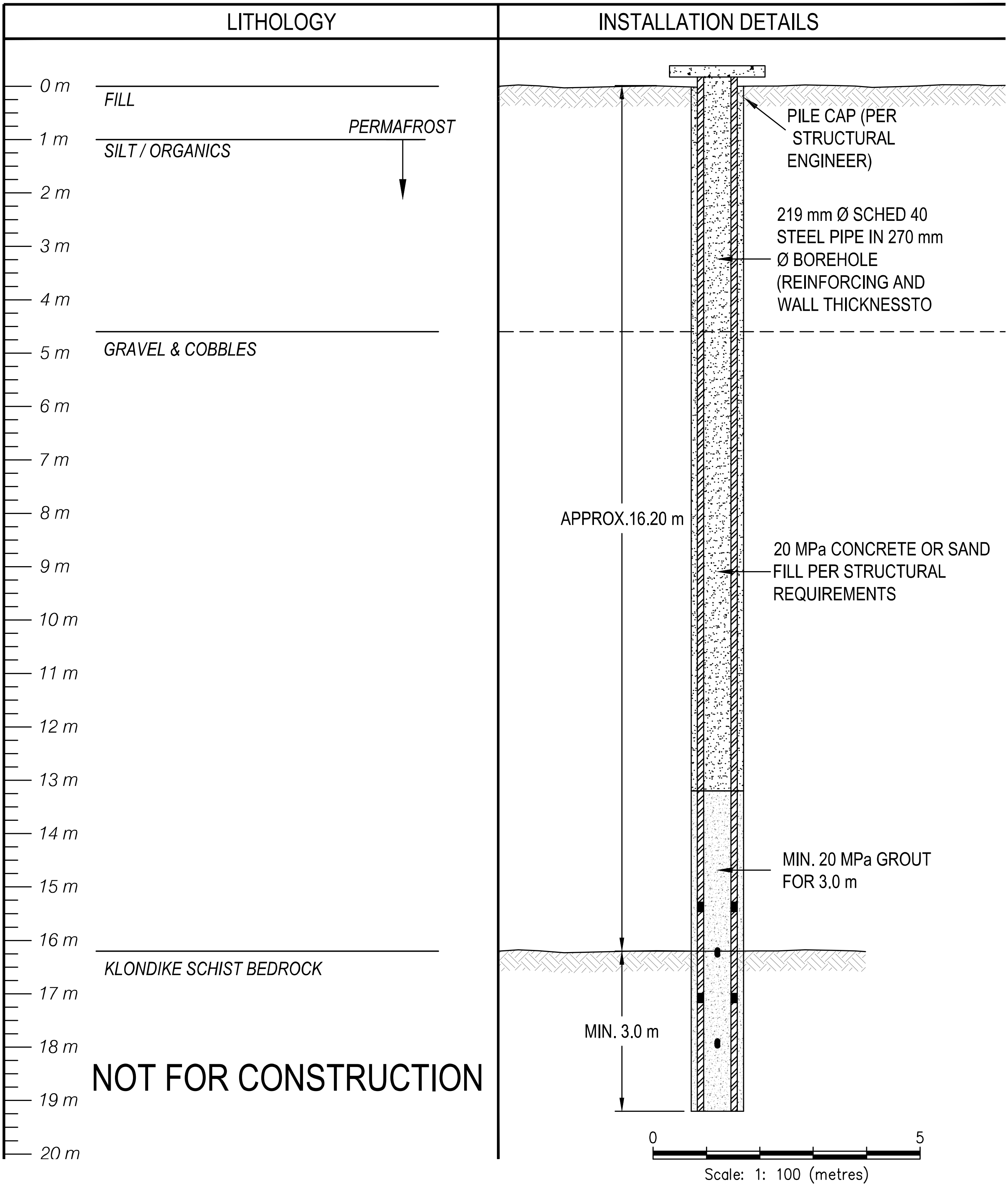
Yukon Government

TETRA TECH

DETAILED GEOTECHNICAL EVALUATION PROPOSED RECREATION CENTRE - DAWSON, YT

SITE PLAN SHOWING TESTHOLE LOCATIONS

PROJECT NO.	DWN	CKD	REV	
ENG.WARC03386-65	TP	JRT	0	Figure 1
OFFICE	DATE			
EBA-WHSE	September 18, 2020			



Q:\Whitehorse\Data\0201drawings\Dawson City Area\ENG.WARC03386-65 Detailed Rec Center\ENG.WARC03386-65 - Fig 2 GRC Rock Socket Pile.dwg [FIGURE 2] November 19, 2020 - 11:12:20 am (BY: PASLOSKI, TAYLOR)

NOTES :

- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SPECIFIED
- 219 mm OD STEEL PIPE PILES INSTALLED WITH A 3 m ROCK SOCKET WILL HAVE A FACTORED GEOTECHNICAL RESISTANCE OF 503 KN IN COMPRESSION AND 377 KN IN TENSION"

CLIENT

Yukon
Government

TETRA TECH

NEW RECREATION CENTER - GOLD RUSH CAMPGROUND
DAWSON, YUKON

PROPOSED ROCK SOCKET STEEL PIPE PILE FOUNDATION

PROJECT NO.	DWN	CKD	REV
ENG.WARC03386-65	TP	JRT	0

OFFICE	DATE
EBA-WHSE	October 20, 2020

Figure 2

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL – YUKON GOVERNMENT

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the use of TETRA TECH's Client, its officers, employees, agents, representatives, successors and assigns (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH. Any changes to the conclusions, opinions, and recommendations presented in TETRA TECH's Professional Document must be authorized by TETRA TECH.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems, as per agreed project deliverable formats. TETRA TECH makes no representation about the compatibility of these files with the Client's future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be brought to the attention of TETRA TECH within a reasonable time.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, and subject to the standard of care herein, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage, except where TETRA TECH has subcontracted for such information.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to make, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the Client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

1.8 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to explore, address or consider and has not explored, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.9 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems, methods and standards employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.10 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.11 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historical environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional exploration and review may be necessary.

1.12 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.13 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.14 INFLUENCE OF CONSTRUCTION ACTIVITY

Construction activity can impact structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques, and construction sequence are known.

1.15 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, and the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.16 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued satisfactory performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

1.17 DESIGN PARAMETERS

Bearing capacities for Limit States or Allowable Stress Design, strength/stiffness properties and similar geotechnical design parameters quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition used in this report. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions considered in this report in fact exist at the site.

1.18 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client’s expense upon written request, otherwise samples will be discarded.

1.19 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

This document has been prepared based on the applicable codes, standards, guidelines or best practice as identified in the report. Some mandated codes, standards and guidelines (such as ASTM, AASHTO Bridge Design/Construction Codes, Canadian Highway Bridge Design Code, National/Provincial Building Codes) are routinely updated and corrections made. TETRA TECH cannot predict nor be held liable for any such future changes, amendments, errors or omissions in these documents that may have a bearing on the assessment, design or analyses included in this report.

APPENDIX B

BOREHOLE LOGS

TERMS USED ON BOREHOLE LOGS

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on 0.075mm sieve): Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as inferred from laboratory or in situ tests.

DESCRIPTIVE TERM	RELATIVE DENSITY	N (blows per 0.3m)
Very Loose	0 TO 20%	0 to 4
Loose	20 TO 40%	4 to 10
Compact	40 TO 75%	10 to 30
Dense	75 TO 90%	30 to 50
Very Dense	90 TO 100%	greater than 50

The number of blows, N, on a 51mm O.D. split spoon sampler of a 63.5kg weight falling 0.76m, required to drive the sampler a distance of 0.3m from 0.15m to 0.45m.

FINE GRAINED SOILS (major portion passing 0.075mm sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as estimated from laboratory or in situ tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH (KPA)
Very Soft	Less than 25
Soft	25 to 50
Firm	50 to 100
Stiff	100 to 200
Very Stiff	200 to 400
Hard	Greater than 400

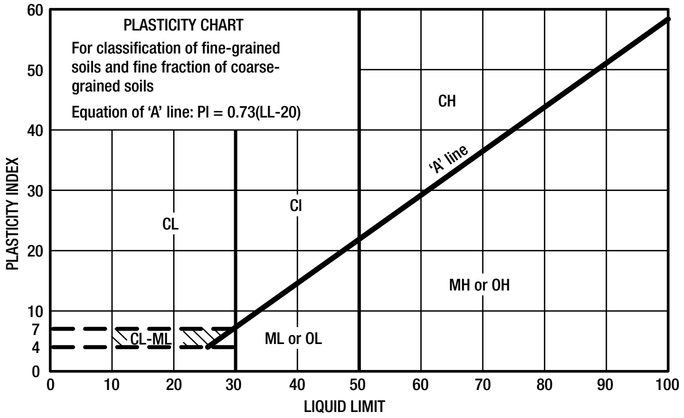
NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil.

GENERAL DESCRIPTIVE TERMS

Slickensided - having inclined planes of weakness that are slick and glossy in appearance.
Fissured - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
Laminated - composed of thin layers of varying colour and texture.
Interbedded - composed of alternate layers of different soil types.
Calcareous - containing appreciable quantities of calcium carbonate.;
Well graded - having wide range in grain sizes and substantial amounts of intermediate particle sizes.
Poorly graded - predominantly of one grain size, or having a range of sizes with some intermediate size missing.

MODIFIED UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION				GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA		
COARSE - GRAINED SOILS More than 50% retained on No. 75 µm sieve*	GRAVELS 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS		GW	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines Less than 5% pass 75 µm sieve GW, GP, SW, SP More than 12% pass 75 µm sieve GM, GC, SM, SC 5% to 12% pass 75 µm sieve Borderline classification requiring use of dual symbols	$C_u = D_{60} / D_{10}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
				GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW	
		GRAVELS WITH FINES		GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below 'A' line or plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
				GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits plot above 'A' line and plasticity index greater than 7	
	SANDS More than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS		SW	Well-graded sands and gravelly sands, little or no fines		$C_u = D_{60} / D_{10}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
				SP	Poorly-graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		SANDS WITH FINES		SM	Silty sands, sand-silt mixtures		Atterberg limits plot above 'A' line and plasticity index less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
				SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above 'A' line and plasticity index greater than 7	
FINE-GRAINED SOILS (by behavior) 50% or more passes 75 µm sieve*	SILTS	Liquid limit	<50	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands of slight plasticity			
			>50	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts			
	CLAYS Above "A" line on plasticity chart negligible organic content	Liquid limit	<30	CL	Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			30-50	CI	Inorganic clay of medium plasticity, silty clays			
			>50	CH	Inorganic clay of high plasticity, fat clays			
	ORGANIC SILTS AND CLAYS	Liquid limit	<50	OL	Organic silts and organic silty clays of low plasticity			
			>50	OH	Organic clays of medium to high plasticity			
HIGHLY ORGANIC SOILS				PT	Peat, muck and other highly organic soils			


PLASTICITY CHART

For classification of fine-grained soils and fine fraction of coarse-grained soils

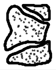
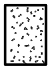
Equation of 'A' line: PI = 0.73(LL-20)

* Based on the material passing the 75 mm sieve

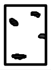
† ASTM Designation D 2487, for identification procedure see D 2488 USC as modified by PFRA

GROUND ICE DESCRIPTION

ICE NOT VISIBLE

GROUP SYMBOL	SYMBOL	SUBGROUP DESCRIPTION	
N	Nf	Poorly-bonded or friable	
	Nbn	No excess ice, well-bonded	
	Nbe	Excess ice, well-bonded	

VISIBLE ICE LESS THAN 50% BY VOLUME

GROUP SYMBOL	SYMBOL	SUBGROUP DESCRIPTION	
V	Vx	Individual ice crystals or inclusions	
	Vc	Ice coatings on particles	
	Vr	Random or irregularly oriented ice formations	
	Vs	Stratified or distinctly oriented ice formations	

NOTES:

1. Dual symbols are used to indicate borderline or mixed ice classifications.
2. Visual estimates of ice contents indicated on borehole logs ± 5%
3. This system of ground ice description has been modified from NRC Technical Memo 79, Guide to the Field Description of Permafrost for Engineering Purposes.

LEGEND: Soil ☐ Ice ■

VISIBLE ICE GREATER THAN 50% BY VOLUME

ICE	ICE + Soil Type	Ice with soil inclusions	
	ICE	Ice without soil inclusions (greater than 25 mm thick	

TETRA TECH

BOREHOLE KEYSHEET

Water Level Measurement

- ▼ Measured in standpipe, piezometer or well
- ▽ Inferred

Sample Types

- A-Casing
- Core
- Disturbed, Bag, Grab
- HQ Core
- Jar
- Jar and Bag
- 75 mm SPT
- No Recovery
- Split Spoon/SPT
- Tube
- CRREL Core

Backfill Materials

- ■ Asphalt
- Bentonite
- Cement/ Grout
- Drill Cuttings
- Grout
- Gravel
- Sand
- Slough
- Topsoil Backfill

Lithology - Graphical Legend[1]

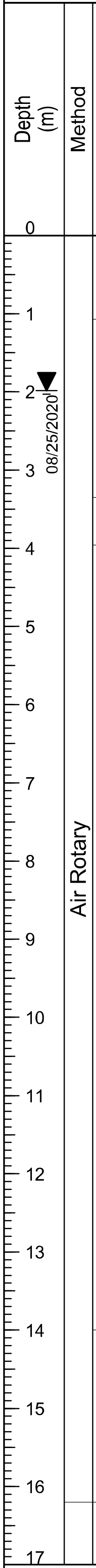
- ■ Asphalt
- Bedrock
- Cobbles/Boulders
- Clay
- Coal
- Concrete
- Fill
- Gravel
- Limestone
- Mudstone
- Organics
- Peat
- Sand
- Sandstone
- Shale
- Silt
- Siltstone
- Conglomerate
- Topsoil
- Till

1. The graphical legend is an approximation and for visual representation only. Soil strata may comprise a combination of the basic symbols shown above. Particle sizes are not drawn to scale

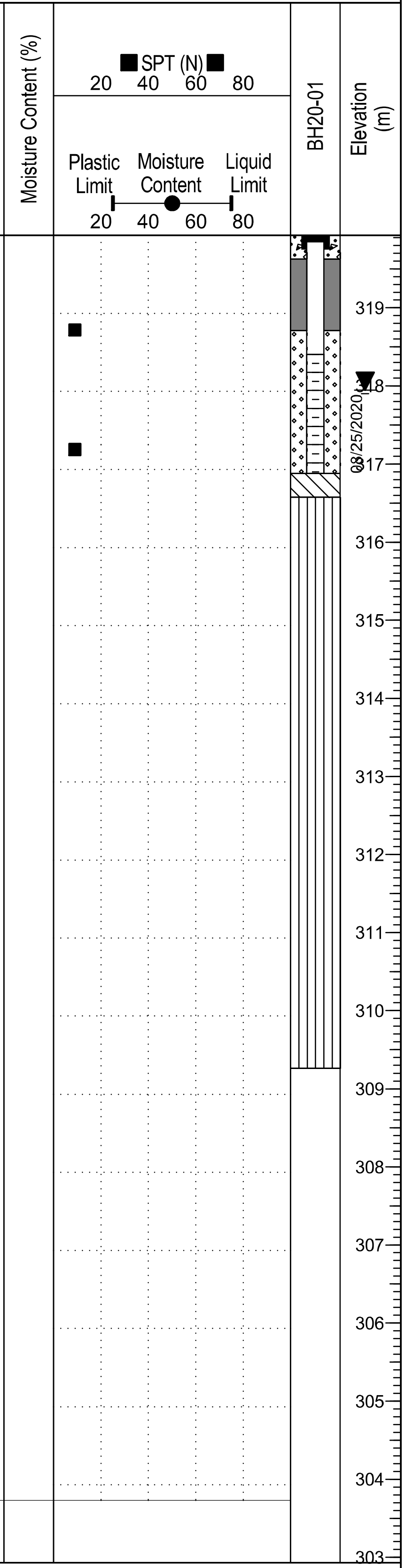
TETRA TECH

Borehole No: **BH20-01**

Project: Detailed Recreation Center Evaluation	Project No: ENG.WARC03386-65
Location: Gold Rush Campground	Ground Elev: 319.93 m
Dawson City, Yukon	UTM: 576786.81 E; 7105023.2 N; Z 7 NAD83



Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	SPT (N)
Air Rotary	SAND and GRAVEL (White Channel Gravel) - trace silt, well graded, sub rounded to sub angular, damp, white	Unfrozen			
	SILT and ORGANICS - interbedded, black		☒	SA1	9
	- water measured at 1.92 m, September 17				
		Frozen (estimated) - Nbn	☒	SA2	9
	SILT - non plastic and damp when thawed, brown				
	SAND and GRAVEL- sub rounded, damp when thawed, brown				
	BEDROCK - brown (oxidized) chips and dust, angular (assumed Klondike Schist Bedrock)				
	End of Borehole at 16.2 m - Target Depth				



Contractor: Midnight Sun Drilling	Completion Depth: 16.2 m
Drilling Rig Type: Prospector P1	Start Date: 2020 September 15
Logged By: TTP	Completion Date: 2020 September 15
Reviewed By: JRT	Page 1 of 1

Yukon

Borehole No: **BH20-02**

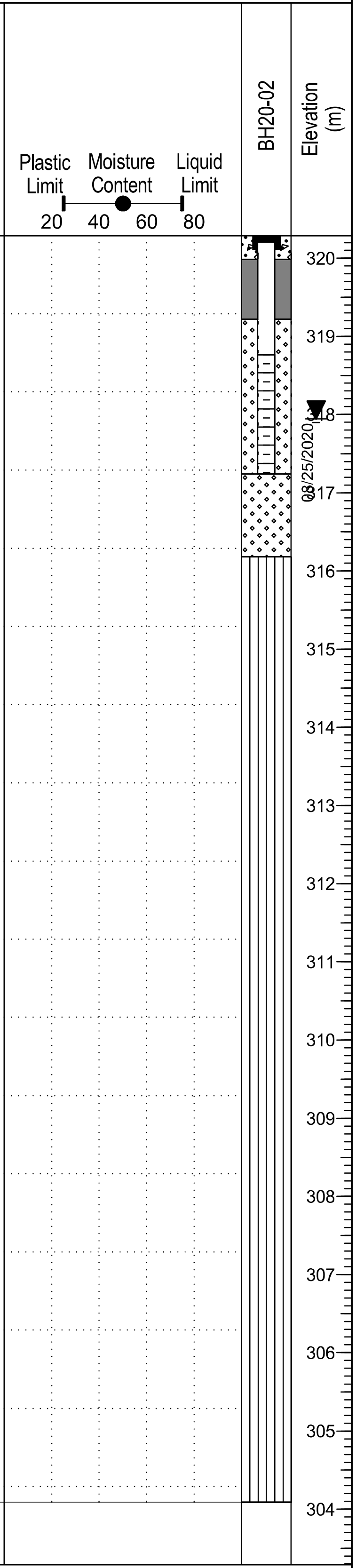
Project: Detailed Recreation Center Evaluation	Project No: ENG.WARC03386-65
Location: Gold Rush Campground	Ground Elev: 320.29 m
Dawson City, Yukon	UTM: 576801.21 E; 7105105.77 N; Z 7 NAD83

Depth (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

08/25/2020

Method: Air Rotary

Soil Description	Ground Ice Description	Moisture Content (%)
SAND and GRAVEL (White Channel Gravel) - trace silt, well graded, sub rounded to sub angular, damp, white	Unfrozen	
SILT and ORGANICS - interbedded, black - water measured at 2.27, September 17	Frozen (estimated) - Nbn	
SAND and GRAVEL- sub rounded, damp when thawed, brown		
BEDROCK - brown chips and dust, angular (assumed Klondike Schist Bedrock) - grey - light brown		
End of Borehole at 16.2 m - Target Depth		



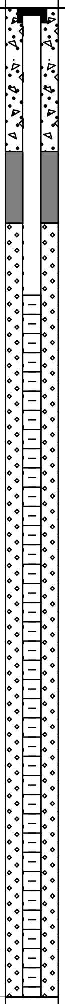
TETRA TECH

Contractor: Midnight Sun Drilling	Completion Depth: 16.2 m
Drilling Rig Type: Prospector P1	Start Date: 2020 September 15
Logged By: TTP	Completion Date: 2020 September 16
Reviewed By: JRT	Page 1 of 1

Borehole No: **BH20-03**

Project: Detailed Recreation Center Evaluation	Project No: ENG.WARC03386-65
Location: Gold Rush Campground	Ground Elev: 319.69 m
Dawson City, Yukon	UTM: 576767.01 E; 7105048.14 N; Z 7 NAD83

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	BH20-03	Elevation (m)
0	Air Rotary	SAND and GRAVEL (White Channel Gravel) - trace silt, well graded, sub rounded to sub angular, damp, white	Unfrozen				
							319
1							
		SILT and ORGANICS - interbedded, black					
		- water measured at 1.7 m, September 17					318
08/25/2020							08/25/2020
2			Frozen (estimated) - Nbn				
		End of Borehole at 2.1 m - Broken Drill					
							317
3							



Contractor: Midnight Sun Drilling	Completion Depth: 2.1 m
Drilling Rig Type: Prospector P1	Start Date: 2020 September 16
Logged By: TTP	Completion Date: 2020 September 16
Reviewed By: JRT	Page 1 of 1

TETRA TECH

Phase II Environmental Site Assessment
1207 Fifth Avenue
Dawson City, Yukon

PRESENTED TO

Government of Yukon, Community Services, Land Development Branch

NOVEMBER 17, 2020
ISSUED FOR REVIEW
FILE: 704-ENW.PENW03102-01

This "Issued for Review" document is provided solely for the purpose of client review and presents our interim findings and recommendations to date. Our usable findings and recommendations are provided only through an "Issued for Use" document, which will be issued subsequent to this review. Final design should not be undertaken based on the interim recommendations made herein. Once our report is issued for use, the "Issued for Review" document should be either returned to Tetra Tech Canada Inc. (Tetra Tech) or destroyed.

Tetra Tech Canada Inc.
61 Wasson Place
Whitehorse, YT Y1A 0H7 CANADA
Tel 867.668.3068 Fax 867.668.4349

This page intentionally left blank.

EXECUTIVE SUMMARY

Tetra Tech Canada Inc. (Tetra Tech) was retained by the Government of Yukon, Community Services, Land Development Branch (YG-CS) to conduct a Phase II Environmental Site Assessment (ESA) at 1207 Fifth Avenue, Goldrush Campground, Dawson City, Yukon (hereinafter referred to as the "Site").

Summary of Background, Objectives and Methods

Since circa 1970s, the Site, which is owned by the City of Dawson, has been operating as a recreation vehicle (RV) park. At the time of Tetra Tech's field investigation, the Site was occupied by the Goldrush Campground – an 82-spot campsite and (recreational vehicle) RV park; however, the campground was closed for the season. According to the City of Dawson Zoning Bylaw No. 2018-2019 (City of Dawson 2019), the Site is zoned as R1 – single-detached/duplex residential. Tetra Tech understands that YG-CS is considering developing the Site for use as a community centre.

This Phase II ESA follows the report titled *Phase I Environmental Site Assessment, Lots 1-20, Block Q Ladue Estate, 8338A CLSR, Dawson City, Yukon (Gold Rush Campground)* prepared by Golder Associates Ltd. (Golder) for Department of Community Services, Infrastructure on July 31, 2020 (2020 Phase I ESA; Golder 2020). The Phase I ESA identified two on-site areas of potential environmental concern (APECs) based on a review of the current and historical use of the Site and surrounding areas. The APECs and potential contaminants of concern (PCOCs) are outlined in the table below.

Table EX1: 2020 Phase I ESA APEC and PCOCs

APEC	Rationale	PCOCs
APEC 1 Former land use for waste disposal activities	The current tenant and former tenant reported that waste disposal may have occurred on-Site prior to circa 1970s. Possible large equipment and associated fuel and lubricant may have been buried in place with fill material.	Metals, LEPH/HEPH, PAH, VOC, VPH, BTEXS, MTBE
APEC 2 Site-wide fill material	Large quantities of fill material of unknown origin was reportedly brought on-Site to infill a swamp. The quality of the fill is unknown; however, it was reported to be locally-sourced gravel and channel rock.	Metals, LEPH/HEPH, PAH, VOC, VPH, BTEXS, MTBE

Notes:
LEPH – Light Extractable Petroleum Hydrocarbons
HEPH – Heavy Extractable Petroleum Hydrocarbons
VPH – Volatile Petroleum Hydrocarbons
MTBE – methyl tert-butyl ether
PAH – Polycyclic Aromatic Hydrocarbons
VOC – Volatile Organic Compounds
BTEXS – benzene, toluene, ethylbenzene, xylene, styrene

The objective of this Phase II ESA was to assess the PCOCs in soil and groundwater in APECs 1 and 2 relative to the applicable *Yukon Contaminated Sites Regulation* (YCSR) standards. During the Phase II ESA soil and/or groundwater quality were assessed through the analytical testing of subsurface soil samples collected at seven testpits, and groundwater samples collected from three groundwater wells installed as part of the geotechnical investigation conducted by Tetra Tech, reported under a separate cover – *Detailed Geotechnical Evaluation, Proposed Recreation Centre on Gold Rush Campground Property – Dawson City, Yukon*, prepared by Tetra Tech, 2020 (Tetra Tech in progress). Analytical results were compared to the YCSR residential land use soil standards (RL) and groundwater standards protective of drinking water (DW) and freshwater aquatic life (AW).

Phase II ESA Findings:

- Soil samples collected from the testpits (TP20-01, TP20-03 through TP20-05, and TP20-07 through TP20-09) were analyzed for PCOCs consisting of metals, hydrocarbons and/or glycols. Reported concentrations for hydrocarbons and glycols were less than the reportable method detection limit (MDL). Reported concentrations of select metals at select locations were greater than the applicable standards. Chromium concentrations were greater than the YCSR RL standard at TP20-01 and TP20-03 through TP20-05. Following chromium speciation, the reported concentrations of the hexavalent species were less than the YCSR RL standards at the four locations tested and reported concentrations of the trivalent species were less than the YCSR RL at TP20-03. However, reported concentrations of the trivalent species were greater than the YCSR RL standard for groundwater flow to surface water used by freshwater AW for samples collected from TP20-01, TP20-04 and TP20-05. In addition, reported concentrations of nickel at TP20-05 at 0.75 m in the fill unit, and at 1.25 m (an in the duplicate pair) in the silt and organics unit were greater than the YCSR RL standard. The source of the metals exceedances may in part be due to poor quality fill identified throughout the Site and/or elevated background concentrations for chromium and nickel.

- Groundwater samples collected from the Site were analyzed for metals, hydrocarbons and glycols. Reported concentrations of glycols at the three monitoring wells were less than the MDL. At the three monitoring wells, the reported concentrations of dissolved cobalt were greater than the YCSR AW standard, and the reported concentrations of dissolved iron and manganese were greater than the YCSR DW standard. Reported concentrations of chromium in MW20-02 and MW20-03 were greater than the YCSR AW standards. Reported concentrations of arsenic in MW20-02, and arsenic, barium and lead in MW20-03 were greater than the YCSR DW standards. All other dissolved metals concentrations were less than the YCSR AW and DW standards. Hydrocarbon concentrations were less than the YCSR AW and DW standards; however, detectable concentrations of ethylbenzene, toluene and polycyclic aromatic hydrocarbon (PAH) parameters of benz(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, fluorene, 1-methylnaphthalene, 2-methylnaphthalene and naphthalene, phenanthrene and pyrene were reported in groundwater.

  Reported concentrations of light extractable petroleum hydrocarbons (LEPH) in MW20-01 were greater than the YCSR AW standards; however, given the high organic content noted within soils on-Site, Tetra Tech conducted a silica-gel cleanup for the analysis of extractable petroleum hydrocarbons (EPH). Per the British Columbia (BC) Environmental Laboratory Manual produced by the BC Ministry of Environment and Climate Change Strategy (ENV; ENV 2020), the silica-gel cleanup is a method which “can exclude biogenic organics from quantitative EPH results, based on the premise that most naturally occurring hydrocarbons are polar, and so will be irreversibly retained by activated silica gel.” Based on the stratigraphy encountered at the Site (consisting of high organic content), there is sufficient evidence to support that naturally occurring organics are present in soils immediately below the Site. Following the silica-gel cleanup, the EPH analytical results came back below the MDL. Therefore, the concentrations of LEPH above the YCSR AW standards are considered to have been caused by the naturally occurring organics present at the Site. Therefore, LEPH is not considered a contaminant of concern at the Site.

- Trivalent chromium concentrations in soil exceeded the YCSR RL standard for groundwater flow to surface water used by freshwater AW. For comparison purposes, the BC *Contaminated Site Regulation* (ENV 2019) standard for this site-specific factor is 60 mg/g for hexavalent chromium (a known toxic substance) and > 1,000 mg/g for trivalent chromium. The speciated chromium at the Site was shown to be entirely trivalent.

Recommendations:

Tetra Tech recommends at least one more groundwater monitoring event be conducted, preferably during the spring as water quality may fluctuate seasonally. Given that clear groundwater could not be sampled from any of the monitoring wells, Tetra Tech recommends sampling when the groundwater table is likely to be higher (i.e., during the early spring) so that more groundwater is available within the wells for purging and subsequent sampling. The intent of the groundwater monitoring event(s) is to further characterize the subsurface groundwater conditions on-Site and assess whether metals concentrations on-Site are greater than the YCSR standards or if they were caused by silty groundwater samples. Future water quality monitoring should consist of the PCOCs tested in this Phase II ESA. Future monitoring events should include soil vapour modelling of detectable volatile hydrocarbon concentrations for residential indoor and outdoor exposure per BC ENV *Technical Guidance 4 – Vapour Investigation and Remediation (2017)*. In addition, if drinking water wells are installed on-Site, these wells should be tested for potable water quality including metals and hydrocarbons prior to use to confirm water quality is suitable for consumption.

Tetra Tech also recommends additional soil sampling in proximity to the identified soil exceedances in order to delineate the chromium and nickel exceedances in soil found at these locations.

TABLE OF CONTENTS

LIST OF TABLES IN TEXT

APPENDIX SECTIONS

TABLES

FIGURES

APPENDICES

ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
ALS	ALS Environmental
APEC	area of potential environmental concern
Arcrite	Arcrite Northern Ltd.
AW	aquatic life
BC	British Columbia
BTEXS	benzene, toluene, ethylbenzene, xylene and styrene
CALA	Canadian Association of Laboratory Accreditation
DQO	data quality objective
DW	drinking water
ENV	Ministry of Environment and Climate Change Strategy
EPH	extractable petroleum hydrocarbons
ESA	Environmental Site Assessment
Golder	Golder Associates Ltd.
GPR	ground penetrating radar
Grenon	Grenon Enterprises
HDPE	high-density polyethylene
HEPH	heavy extractable petroleum hydrocarbons
IR	irrigation
LEPH	light extractable petroleum hydrocarbons
LNAPL	light non-aqueous phase liquids
LW	livestock water
masl	metres above sea level
mbgs	metres below ground surface
mbTOC	metres below top of casing
MDL	method detection limit
Midnight Sun	Midnight Sun Drilling Inc.
MTBE	methyl tert-butyl ether
OVE	organic vapour emissions
PAH	polycyclic aromatic hydrocarbons
PCOC	potential contaminants of concern

Acronyms/Abbreviations	Definition
Phase I ESA	*Phase I Environmental Site Assessment, Lots 1-20, Block Q Ladue Estate, 8338A CLSR, Dawson City, Yukon (Gold Rush Campground)*, prepared by Golder Associates Ltd, July 31, 2020
PID	photo-ionization detector
ppmv	parts per million by volume
Protocol No. 6	*Protocol No. 6: Application of Water Quality Standards*
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
QMS	Quality Management System
RL	residential land use
RL	residential land use
RM	reference material
RPD	relative percent difference
Tetra Tech	Tetra Tech Canada Inc.
VH	volatile hydrocarbons
VOC	volatile organic compounds
VPH	volatile petroleum hydrocarbons
YCSR	*Yukon Contaminated Sites Regulation*
YG-CS	Government of Yukon, Community Services, Land Development Branch
YSI	YSI ProDSS multi-parameter water quality

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the Government of Yukon and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than the Government of Yukon, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in Appendix A or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION AND BACKGROUND

Tetra Tech Canada Inc. (Tetra Tech), was retained by the Government of Yukon, Community Services, Land Development Branch (YG-CS) to conduct a Phase II Environmental Site Assessment (ESA) for 1207 Fifth Avenue, Dawson City, Yukon (hereinafter referred to as the “Site”).

Since circa 1970s, the Site, which is owned by the City of Dawson, has been operating as a recreation vehicle (RV) park. At the time of Tetra Tech’s field investigation, the Site was occupied by the Goldrush Campground. Tetra Tech understands that YG-CS is considering developing the Site for use as a community centre. The location and the current layout for the Site is shown on the attached Figures 1 and 2, respectively.

This Phase II ESA follows the report titled *Phase I Environmental Site Assessment, Lots 1-20, Block Q Ladue Estate, 8338A CLSR, Dawson City, Yukon (Gold Rush Campground)* prepared by Golder Associates Ltd. (Golder) for Department of Community Services, Infrastructure on July 31, 2020 (Phase I ESA; Golder 2020). The Phase I ESA identified two areas of potential environmental concern (APECs) for the Site based on a review of the current and historical use of the Site and surrounding area. The Phase I ESA findings are further described in Section 1.2.

Authorization to proceed with the Phase II ESA was provided to Tetra Tech from YG-CS via government contract C00056362 with a dated contract start date of September 11, 2020.

1.1 Site Description

Legal Description and Location

The legal description, plan number and cartographic coordinates for the Site are summarized below.

- Legal Description: Lots 1-20, Block Q Ladue Estate, 8338A CLSR YT 8338A LTO YT
- Cartographic coordinates:
  - UTM Zone: 7 W
  - Northing: 7105056 m N
  - Easting: 576790 m E

Site Usage and Zoning

The Site is approximately 2.5 acres in size. According to the City of Dawson Zoning Bylaw No. 2018-2019 (City of Dawson 2019), the Site is zoned as R1 – single-detached/duplex residential. At the time of Tetra Tech’s field investigation, the Site was occupied by Goldrush Campground – an 82-spot campsite and RV park; however, the campground was closed for the season. Per the Phase I ESA, “a single structure (building with an office, gift shop, laundry room and washroom/shower facilities) [was] located on the southern [property] boundary near York Street” (Golder 2020). The remaining areas of the Site were largely gravelled and undeveloped, with the fill material reportedly comprised of locally-sourced gravel and channel rock (Golder 2020).

Surrounding Area Usage and Zoning

Per the City of Dawson (2019), the majority of the surrounding parcels are zoned R1 land use with the exception of two land parcels southeast of the Site which are zoned as P2 – Institutional; and portions of the parcels to the south and northwest which are zoned as R2 – multi-unit residential.

1.2 Phase I ESA Findings

Table A summarizes the APECs and associated potential contaminants of concern (PCOCs) identified during the Phase I ESA (Golder 2020).

Table A: 2020 Phase I ESA APEC and PCOCs

APEC	Rationale	PCOCs
APEC 1 Former land use for waste disposal activities	The current tenant and former tenant reported that waste disposal may have occurred on-Site prior to circa 1970s. Possible large equipment and associated fuel and lubricant may have been buried in place with fill material.	Metals, LEPH/HEPH, PAH, VOC, VPH, BTEXS, MTBE
APEC 2 Site-wide fill material	Large quantities of fill material of unknown origin was reportedly brought on-Site to infill a swamp. The quality of the fill is unknown; however, it was reported to be locally-sourced gravel and channel rock.	Metals, LEPH/HEPH, PAH, VOC, vPH, BTEXS, MTBE

Notes:
LEPH – Light Extractable Petroleum Hydrocarbons
HEPH – Heavy Extractable Petroleum Hydrocarbons
VPH – Volatile Petroleum Hydrocarbons
MTBE – methyl tert-butyl ether
PAH – Polycyclic Aromatic Hydrocarbons
VOC – Volatile Organic Compounds
BTEXS – benzene, toluene, ethylbenzene, xylene, styrene

1.3 Project Objective

The objective of this Phase II ESA was to assess the PCOCs in soil and groundwater in APECs 1 and 2 relative to the applicable Yukon Contaminated Sites Regulation (YCSR) standards.

2.0 SCOPE OF SERVICES

The scope of services for the Phase II ESA included the following tasks:

- Preparing a health and safety plan to be implemented during the field program.
- Contacting Northwestel and municipal public works to have them carry out checks for any of their utility infrastructure that may exist at the planned borehole and testpit locations.
- Contacting the Site lease-holders regarding utility infrastructure that may exist on the Site.
- Retaining an independent utility locator, Arcrite Northern Ltd. (Arcrite) of Whitehorse, YT, to survey the planned borehole and testpit locations for the potential presence of underground utilities.
- As part of the geotechnical investigation, retaining Midnight Sun Drilling Inc. (Midnight Sun) of Whitehorse, YT, to advance three boreholes within the Site (BH20-01 through BH20-03) to a maximum depth of 16.2 metres below ground surface (mbgs) using an air rotary rig.
- Retaining Grenon Enterprises (Grenon) of Dawson City, YT, to advance seven testpits within the Site (TP20-01, TP20-03 through TP20-05, and TP20-07 through TP20-09) to a maximum depth of 2.5 mbgs using a rubber tire backhoe/loader.
- Completing the three boreholes as groundwater monitoring wells (MW20-01 through MW20-03) installed to a maximum depth of approximately 3.0 mbgs.

- Logging soil stratigraphy from each testpit and borehole location and collecting soil samples from the testpits at regular depth intervals and/or at changes in material type or color. Field screening the collected soil samples with a photo-ionization detector (PID) for potential volatile hydrocarbon impacts.
- Measuring depths to water in the monitoring wells to help assess groundwater flow direction and to observe the potential presence of free-phase liquid, if any, using an oil-water interface probe.
- Developing the monitoring wells using Waterra tubing and surge blocks. Purging all monitoring wells, prior to groundwater sampling, until field measurements of electrical conductivity, pH and temperature of groundwater met the stabilization criteria, or until water is purged dry. Following stabilizations or purging, collecting groundwater samples from the monitoring well locations using a low-flow sampling method with a peristaltic pump (MW20-01) or bailer (MW20-02 and MW20-03).
- Submitting selected soil samples (based on sample depth, stratigraphic changes, and PID readings) and groundwater samples to ALS Environmental (ALS) of Burnaby, British Columbia (BC), for analysis of the PCOCs.
- Retaining Lamerton Land Surveys of Dawson City, YT, to survey the locations and elevations of the monitoring well locations.
- Tabulating analytical results with comparison to the applicable standards outlined in the Yukon *Environment Act*, YCSR, O.I.C. 2002/171 dated September 30, 2002.
- Preparing this Phase II ESA report summarizing the activities completed during the Phase II ESA, the findings, conclusions and recommendations.

3.0 ASSESSMENT STANDARDS

Chemical contaminants in soil and groundwater quality are regulated under the YCSR (O.I.C. 2002/171, dated September 30, 2002). Applicable standards from the YCSR are detailed in the following subsections.

3.1 Soil Assessment Standards

Environmental standards for the assessment and remediation of soils are detailed in YCSR Schedules 1 and 2. Based on the proposed redevelopment of the Site as a community centre. Per the YCSR, commercial land use is defined as “the use of land for the purpose of buying, selling or trading merchandise or services and storage associated with these uses”, whereas residential (RL) land use is defined as “the use of land for the purpose of (a) a residence by persons on a permanent, temporary, or seasonal basis, or (b) institutional facilities” (Yukon Government 2002). Institutional facilities are not further defined within the YCSR, however, per the BC *Contaminated Sites Regulation*, community centres are identified as an institutional facility under the definition of RL land use (BC Ministry of Environment and Climate Change Strategy (ENV) 2019). Therefore, the YCSR RL land use standards were used for comparison to the analytical results.

Matrix-based numerical soil standards are listed in Schedule 2 of the YCSR and are applied based on groundwater use at the site and surrounding area and site-specific factors that consider contaminant migration routes and potential routes for human or environmental exposure to contaminants. By default, the following exposure factors apply to all sites:

- Human Health Protection – intake of contaminated soils; and
- Environmental Protection – toxicity to soil invertebrates and plants.

Yukon Environment *Protocol No. 6: Application of Water Quality Standards* (Protocol No. 6; 2012) sets out procedures for water use determination at contaminated sites. The following subsections detail the assessment to determine if soil standards protective of drinking water (DW), aquatic life (AW), irrigation (IR) and livestock water (LW) apply to the Site based on this protocol.

Per the Phase I ESA, 25 monitoring points were registered within 1.5 km of the Site. Most of the monitoring points were located primarily hydraulically down-gradient and cross-gradient of the Site (Golder 2020).

Matrix Soil Standards Protective of Drinking Water

Protocol No. 6 states that standards protective of DW apply to a site if an existing or probable DW source is located within a 1.5 km radius of the site. According the to the Yukon Water Data Catalogue map (Government of Yukon 2020), groundwater quality sites are located within a 1.5 km radius of the Site. Therefore, due to the potential for groundwater in the vicinity to be accessed for potable use, soil standards protective of groundwater use for DW apply to the Site.

Matrix Soil Standards Protective of Aquatic Life

Protocol No. 6 states that standards protective of AW applies to a site if the closest surface water potentially containing aquatic life is located within a 1 km radius of the site. Yukon River is located approximately 300 m west of the Site. Therefore, soil standards protective of surface water used by freshwater AW apply to the Site.

Matrix Soil Standards Protective of Irrigation and Livestock Water

Protocol No. 6 states that standards protective of IR and LW apply to a site if the closest surface water body used for an IR water source or drinking water for livestock is located within a 1.5 km radius of the site. Tetra Tech did not identify any surface water bodies used for IR or LW located within a 1.5 km radius of the Site. Therefore, soil standards protective of irrigation and livestock water have not been applied.

The applicable YCSR soil standards are included in the attached Table 1.

3.2 Groundwater Assessment Standards

Environmental standards for the assessment and remediation of groundwater are detailed in the YCSR Schedule 3. Groundwater numerical standards are based on water use rather than on land use. Groundwater analytical results have been compared to the Schedule 3 DW and freshwater AW water quality standards based on the assessment of water use by applying Protocol No. 6 guidelines outlined in Section 3.1 above.

The applicable YCSR groundwater standards are included in the attached Table 2.

4.0 METHODS

Tetra Tech completed the Phase II ESA field program between September 14 and 25, 2020. The Site activities and methods employed during the field program are detailed in the following subsections.

4.1 Sampling Locations

As part of the geotechnical investigation, boreholes completed as groundwater monitoring wells were advanced at three on-Site locations. As part of the Phase II ESA, testpits were advanced at seven on-Site locations. The sampling locations are shown on Figure 2.

Sample Locations

The borehole locations were primarily positioned to meet the objectives of the geotechnical investigation. Testpit locations were positioned throughout the Site to test geophysical anomalies identified by ground penetrating radar (GPR) which may be indicative of buried objects and to obtain coverage across the Site.

Locations and Summary of Placement Rationale

Phase II ESA monitoring well sampling locations were surveyed on October 19, 2020 by Lamerton Land Surveys (see Section 5.2 for elevation data). Table B below lists the testpit and borehole locations, and rationale for the selection of each investigation location.

Table B: Phase II ESA Sampling Locations and Rationale

Investigation Location	Associated APEC(s)	Rationale
BH/MW20-01	1, 2	Three boreholes were advanced to obtain geotechnical information. Monitoring wells were installed in the boreholes to address the possibility of surficial or subsurface contaminant migration related to the former waste disposal activities (APEC 1) and the unknown origin/quality fill (APEC 2).
BH/MW20-02		
BH/MW20-03		
TP20-01		Seven testpits were advanced to target GPR anomalies identified on-Site for the purpose of evaluating the reported historical waste disposal and possible large equipment (and associated fuel and lubricant) that may have been buried on-Site and the unknown origin/quality fill material.
TP20-03		
TP20-04		
TP20-05		
TP20-07		
TP20-08		
TP20-09		

4.2 Utility Locates

Tetra Tech contacted Northwestel, municipal public works and the current Site lease-holders to provide utility location information at/or near the planned drilling locations. No utilities were noted by Northwestel or municipal public works. The lease-holders provided Tetra Tech with information regarding underground utilities which was provided to Arcrite prior to the subsurface scan. Arcrite completed a scan of each drilling location on September 15-16, 2020 and confirmed the presence of tech cables, water lines, propane lines and other unidentified objects beneath the Site which were used to identify unknown anomalies that could be targeted through the testpitting investigation. GPR anomalies identified by Arcrite and field observations are shown on Figure 2.

4.3 Testpitting

On September 15, 2020, Tetra Tech monitored the excavation of seven testpits (TP20-01, TP20-03 through TP20-05, and TP20-07 through TP20-09) using a 430 rubber tire backhoe/loader supplied and operated by Grenon. The seven testpits were excavated to a maximum depth of 2.5 mbgs.

Note that the planned testpits TP20-02 and TP20-06 could not be excavated due to underground utilities (water/sewer line) identified during the GPR survey and time constraints, respectively.

Testpit logs are attached in Appendix B.

4.4 Borehole Drilling

Prior to drilling, Tetra Tech conducted a site- and task-specific safety meeting with the drill rig operators. On September 15 and 16, 2020, Tetra Tech monitored the advancement of three boreholes using the Prospector P1 RC/Geotechnical track-mounted solid-stem drill rig equipped with air rotary, supplied and operated by Midnight Sun. The three boreholes were advanced to a maximum depth of 16.2 mbgs.

Stratigraphic units encountered during the drilling program are shown on the borehole logs in Appendix B. Borehole details are shown in Table C below.

Note: no geoenvironmental soil samples were collected as part of the drilling program.

Table C: Borehole Details

Borehole	Completion Date	Depth (mbgs)	Status of Borehole	Rationale
BH20-01	September 15, 2020	16.2	Groundwater well installed	Encountered saturated soils indicative of groundwater
BH20-02	September 16, 2020	16.2	Groundwater well installed	Encountered saturated soils indicative of groundwater
BH20-03	September 16, 2020	2.1	Groundwater well installed	Did not reach the target depth due to a broken drill but encountered saturated soils indicative of groundwater

4.5 Testpit Soil Sampling

During the testpitting program, soil samples were collected directly from each testpit to a depth of 1.0 mbgs and from the backhoe bucket for all samples greater than 1.0 mbgs. Samples were collected at regular depth intervals of approximately 0.5 m to 1.0 m, at changes in soil conditions, and/or from depths where any potential contamination was suspected based on field observations. Prior to collecting the soil samples, the exposed soil surface at each sample location (testpit wall or excavator bucket) was scraped away so that an undisturbed sample could be collected. Soil sample intervals are shown on the attached testpit logs in Appendix B.

After the soil samples were collected, the testpits were backfilled with the soil that was excavated from the subsurface. Backfilled testpits were compacted using the excavator bucket.

Sampling intervals and the stratigraphic units encountered at each testpit are shown on the testpit logs in Appendix B.

For each soil sample, two soil plugs were obtained and placed into two clean, labelled, laboratory-supplied 40 mL glass vials containing 5 mL of methanol. In addition to the vial samples, two soil samples were obtained and placed into clean, labelled, laboratory-supplied Teflon™-lined glass jars for laboratory analysis. Tetra Tech field personnel changed nitrile gloves between each soil sample to prevent cross-contamination. Collected samples were stored in an ice-chilled cooler or a fridge, and then shipped under chain-of-custody protocol to ALS for analysis of PCOCs.

Soil samples were screened in the field for organic vapour emissions (OVE) using a PID which was calibrated daily using laboratory-provided 100 ppm isobutylene. Samples for OVE screening were placed into laboratory-supplied plastic sampling bags, sealed and allowed to volatilize at the ambient air temperature for at least 20 minutes. OVEs were measured and recorded on the testpit logs in parts per million volume (ppmv).

4.6 Groundwater Monitoring Well Installations

Groundwater monitoring wells were installed in all three boreholes (BH/MW20-01 through BH/MW20-03). Each monitoring well was installed using a slotted 51 mm polyvinyl chloride (PVC) standpipe installed at the bottom of the well. Unslotted PVC pipe was installed from the top of the slotted section to the surface. Slough material backfilled into boreholes BH20-01 and BH20-02 from the base of the borehole to a minimum depth of approximately 3.3 mbgs. Silica sand was placed from the base of the slotted interval to approximately 0.15 m to 0.3 m above the slotted interval of the standpipe within the borehole annulus at each borehole. The annulus of each monitoring well, above the screened section, was sealed with activated bentonite clay to a minimum depth of approximately 0.15 mbgs, and a mixture of sand and cement was placed above the bentonite to surface. At ground surface, the PVC pipe from the monitoring wells were set in flush-mounted protective casing and cemented into place.

Monitoring well installation details are shown on the borehole logs in Appendix B.

4.7 Monitoring Well Development and Groundwater Sampling

Monitoring well development took place September 22 and 24, 2020. Monitoring wells were developed prior to sampling to remove silt and debris from the well following drilling.

- Total well depth and depth to groundwater (measured from the top of casing) were measured within each monitoring well to determine the volume of water within the well; and
- All three wells were purged dry (minimum of 1 L volume of water removed per event) using dedicated high-density polyethylene (HDPE) tubing with a foot valve and surge block. Water was removed using a Waterra Pump, and the surge block and foot valve were moved along the entire length of the well screen to pump out surrounding silt and debris.

Table D provides specific development details for each groundwater monitoring well.

Table D: Groundwater Well Development Details

Monitoring Well	Approximate Well Volumes/ Litres of Groundwater Removed	Max. Screen Depth (mbgs)	Notes
MW20-01	5.4 well volumes/12 L (September 22, 2020) 5.4 well volumes/12 L (September 24, 2020)	3.05	September 22, 2020: ▪ Dark brown; well purged dry September 24, 2020: ▪ Brown; well purged dry
MW20-02	0.7 well volumes/1 L (September 22, 2020) 7.1 well volumes/5 L (September 24, 2020)	3.05	September 22, 2020: ▪ Dark brown; well purged dry September 24, 2020: ▪ Brown, frothy; well purged dry
MW20-03	0.9 well volumes/1 L (September 24, 2020) 3.4 well volumes/3 L (September 24, 2020)	2.1	September 24, 2020: ▪ Dark brown; well purged dry September 24, 2020: ▪ Brown, frothy; well purged dry

Tetra Tech completed the groundwater sampling September 25, 2020. Prior to sampling, depth to water and depth to the bottom of the wells were measured and each groundwater well was inspected.

The groundwater in well MW20-01 was sampled using a low-flow sampling technique with a peristaltic pump. The low-flow sampling technique was carried out by inserting new 6.3 mm diameter HDPE tubing into each well with its intake at the midpoint of the well screen. The tubing was attached to a flow cell unit attached to the field monitoring equipment. The groundwater in wells MW20-02 and MW20-03 was sampled using a dedicated, disposable bailer.

Field parameters were measured during sampling with a YSI ProDSS multi-parameter water quality meter (YSI). Physical parameters including pH, temperature, conductivity, dissolved oxygen and oxidation-reduction potential were measured and recorded during the sampling process. Groundwater samples were collected from MW20-01 once all physical parameters stabilized within 10% of previous values. Due to insufficient water within monitoring wells MW20-02 and MW20-03, groundwater samples were collected immediately from the wells once the initial parameters were recorded, using a dedicated, disposable bailer.

Groundwater samples were collected into clean, labelled, laboratory-supplied bottles and preserved as directed by ALS for laboratory analysis. Groundwater samples collected for dissolved metals analysis were field-filtered through a new, disposable 0.45 µm in-line filter attached to the peristaltic pump discharge tubing or through a fitted adapter attached to the bottom of the bailer, and preserved with laboratory-supplied nitric acid. Samples were stored in ice-filled coolers or a fridge and then shipped under chain-of-custody protocol to ALS.

4.8 Analytical Testing

Groundwater and selected soil samples were submitted to ALS, a Canadian Association of Laboratory Accreditation (CALA)-accredited laboratory, that is qualified to analyze the samples using Yukon Environment-approved procedures.

At testpit locations, soil samples were collected from multiple depth intervals (see testpit logs in Appendix B). Soil samples were selected for specific laboratory testing of PCOCs associated with the targeted APECs, based on field screening, field observations and professional judgement. Groundwater samples were selected for laboratory testing based on PCOCs associated with the targeted APECs. Analytical testing at each APEC is summarized in Table E.

Table E: Summary of Analytical Testing

APECs		PCOCs Analyzed	
		Soil	**Groundwater**
APEC 1	Former land use for waste disposal activities	Metals, LEPH, HEPH, PAH, VPH, VOC, BTEXS, MTBE glycols	Dissolved metals, LEPH, HEPH, PAH, VPH, VH, VOC, BTEXS, MTBE, glycols
APEC 2	Site-wide fill material	Metals, LEPH, HEPH, PAH, VPH, VOC, BTEXS, MTBE	Dissolved metals, LEPH, HEPH, PAH, VPH, VH, VOC, BTEXS, MTBE

Notes:
LEPH – light extractable petroleum hydrocarbons
PAH – polycyclic aromatic hydrocarbons
VH – volatile hydrocarbons
BTEXS – benzene, toluene, ethylbenzene, xylene, styrene
HEPH – heavy extractable petroleum hydrocarbons
VPH – volatile petroleum hydrocarbons
VOC – volatile organic compounds
MTBE – methyl tert-butyl ether

Although not identified in the Phase I ESA (Golder 2020), Tetra Tech included glycols as a PCOC due to its association with coolants and antifreeze in machinery which may have been buried on-Site (APEC 1).

Soil and groundwater analytical results from ALS are summarized in Tables 1 and 2, respectively.

4.9 Quality Assurance/Quality Control

During the Phase II ESA, Tetra Tech implemented a quality assurance/quality control (QA/QC) program to ensure the integrity of the sampling methods and analytical testing. The QA/QC program adhered to Tetra Tech's in-house Quality Management System (QMS), which was designed to generate representative samples, minimize the potential for cross-contamination between sampling locations and samples, and reduce the potential for systematic bias. A summary of the QA/QC program tasks conducted by Tetra Tech is provided in Appendix C.

To assess analytical accuracy, it is recommended that one of every ten samples be analyzed in duplicate (i.e., sampling duplicate frequency of 10%). During the Phase II ESA, Tetra Tech submitted 14 soil samples and 1 duplicate, and 3 groundwater samples and 1 duplicate for laboratory analysis for an overall duplicate frequency of 9.5%. The following duplicate pairs were submitted for laboratory testing:

- Soil duplicates:
  - TP20-05-1.25m (duplicate designated TP00-05-1.25m) – analyzed for metals, light extractable petroleum hydrocarbons (LEPH), heavy extractable petroleum hydrocarbons (HEPH), polycyclic aromatic hydrocarbons (PAH) and speciated chromium
- Groundwater duplicate:
  - MW20-01 (duplicate designated DUP) – analyzed for dissolved metals, volatile organic carbons (VOCs), LEPH, HEPH, PAH, benzene, toluene, ethylbenzene, xylene, and styrene (BTEXS), volatile petroleum hydrocarbons (VPH), volatile hydrocarbons (VH) and glycols

Tetra Tech formed the duplicate soil and groundwater samples by alternately placing approximately 10% of the sample volume into the original sample container and then placing the same amount into the duplicate sample container. Tetra Tech continued placing additional aliquots of approximately 10% of the sample volume into each container until both containers were filled.

5.0 SUBSURFACE OBSERVATIONS

5.1 Soil Conditions

Detailed descriptions of the soil stratigraphy encountered at each borehole and testpit location are presented on the attached logs in Appendix B. Based on the observed soil conditions, overall soil units encountered at the Site were generally as follows:

- **Unit 1**: SAND (FILL) gravelly or SAND and GRAVEL, no silt to silty, no clay to clayey, no cobbles to cobbly, no boulders to bouldery, dry with numerous suspect inclusions including wires, metal, bones, glass bottles, and a boot. Unit 1 was encountered from surface to a maximum depth of approximately 1.75 mbgs.
- **Unit 2**: SILT and ORGANICS or SILT, no clay to clayey with variable moisture content from damp to wet. Unit 2 was encountered underlying Unit 1 at a minimum depth of approximately 0.3 mbgs to 4.5 mbgs.
- **Unit 3**: SAND and GRAVEL, damp. Unit 3 was encountered underlying Unit 2 at a minimum depth of approximately 4.0 mbgs to 14.0 mbgs.
- **Unit 4**: BEDROCK. Unit 4 was encountered underlying Unit 3 at a minimum depth of approximately 13.7 mbgs to a maximum depth of approximately 16.2 mbgs.

PID headspace measurements for the soil samples varied from 0 ppmv to 2.2 ppmv – values that are consistent with those typically found as background levels. Field screening tests are subject to confirmation by laboratory analytical results.

5.2 Hydrogeology

Light non-aqueous phase liquid (LNAPL) was not detected in the Phase II ESA monitoring wells. Table F shows the piezometric elevations and depth to groundwater for each monitoring well location.

Table F: Groundwater Elevations at Monitoring Well Locations

Monitoring Location	Elevations (masl)		Flush-mount Casing (mbgs)	Groundwater Depth (mbTOC)	Groundwater Depth (mbgs)	Groundwater Elevation (masl)
	Ground Surface	TOC				
MW20-01	319.93	319.92	0.01	1.984	1.994	319.936
MW20-02	320.28	320.29	0.01	2.328	2.338	317.942
MW20-03	319.69	319.68	0.01	1.784	1.794	317.896

Notes: TOC – top of monitoring well casing
mbTOC – metres below top of monitoring well casing
masl – metres above sea level
mbgs – metres below ground surface

The depth to groundwater as measured on September 25, 2020, ranged from a minimum depth of approximately 1.784 mbgs (MW20-03) to a maximum depth of approximately 2.328 mbgs (MW20-02). The direction of groundwater flow below the Site is inferred to be northwest towards the Yukon River.

A groundwater contour map is attached as Figure 3.

6.0 ANALYTICAL RESULTS AND DISCUSSION

The following subsections summarize the comparison of the Phase II ESA laboratory results to the applicable YCSR standards and the QA/QC program laboratory results. Laboratory testing results are summarized in Tables 1 and 2 and on Figures 4 and 5. Laboratory certificates are attached in Appendix D.

6.1 Soil Analytical Results

The following subsection summarizes the comparison of soil analytical results obtained during this Phase II ESA to the YCSR RL standards.

Table G summarizes the comparison of soil analytical results obtained for both APECs during this Phase II ESA to the YCSR RL standards.

Table G: Soil Analytical Results

Location ID	Soil Sample Depth (mbgs)	Analyzed Parameters	Analytical Results
TP20-01	0.5	Metals, LEPH, HEPH, PAH, speciated chromium	▪ **> YCSR RL for chromium trivalent** ▪ < YCSR RL for all other parameters analyzed
	1.0	BTEXS, MTBE, VPH, VH	▪ < YCSR RL for all parameters analyzed
	1.75	Speciated chromium	▪ **> YCSR RL for chromium trivalent** ▪ < YCSR RL for chromium hexavalent
TP20-03	0.5	Metals	▪ < YCSR RL for all parameters analyzed
	1.3	Metals, LEPH, HEPH, PAH, VPH, VH, VOC, BTEXS, MTBE, glycols, speciated chromium	▪ < YCSR RL for all other parameters analyzed
TP20-04	1.25	Metals, LEPH, HEPH, PAH, BTEXS, MTBE, VPH, VH, speciated chromium	▪ **> YCSR RL for chromium trivalent** ▪ < YCSR RL for all other parameters analyzed
	2.0	Speciated chromium	▪ **> YCSR RL for chromium trivalent** ▪ < YCSR RL for all other parameters analyzed
TP20-05	0.75	Nickel	▪ **> YCSR RL for nickel**
	1.25	Metals, LEPH, HEPH, PAH, speciated chromium	▪ **> YCSR RL for chromium trivalent and nickel** ▪ <YCSR RL for all other parameters analyzed
	1.25 (DUP)	Metals, LEPH, HEPH, PAH, speciated chromium	▪ **> YCSR RL for chromium trivalent and nickel** ▪ < YCSR RL for all other parameters analyzed
TP20-07	0.3	Metals, LEPH, HEPH, PAH, BTEXS, MTBE, VPH, VH	▪ <YCSR RL for all parameters analyzed
TP20-08	0.5	Metals, LEPH, HEPH, PAH	▪ <YCSR RL for all parameters analyzed
	1.7	VOC, VPH, VH, BTEXS, MTBE	▪ <YCSR RL for all parameters analyzed
TP20-09	0.5	Metals, LEPH, HEPH, PAH	▪ <YCSR RL for all parameters analyzed
	1.25	BTEXS, MTBE, VPH, VH	▪ <YCSR RL for all parameters analyzed

Notes:	<YCSR RL – less than the YCSR RL standard	**>YCSR RL – greater than the YCSR RL standard**
	LEPH – light extractable petroleum hydrocarbons	HEPH – heavy extractable petroleum hydrocarbons
	PAH – polycyclic aromatic hydrocarbons	VPH – volatile petroleum hydrocarbons
	VH – volatile hydrocarbons	VOC – volatile organic compound
	MTBE – methyl tert-butyl ether	BTEXS – benzene, toluene, ethylbenzene, styrene and styrene

A total of 14 soil samples and one duplicate soil sample collected from testpits TP20-01, TP20-03 through TP20-05, and TP20-07 through TP20-09, were analyzed for PCOCs consisting of metals, hydrocarbons and glycols. Reported concentrations for hydrocarbons and glycols at the locations analyzed were less than the reportable method detection limit (MDL). Reported concentrations of select metals at select locations were greater than the applicable standards. Chromium concentrations were greater than the YCSR RL standard at TP20-01 and TP20-03 through TP20-05 in either or both the fill unit and/or the native silt with organics unit. Following chromium speciation, the reported concentrations of the trivalent and hexavalent species were less than the YCSR RL standards at TP20-03. Reported concentrations of the trivalent species were, however, greater than the YCSR RL standard for groundwater flow to surface water used by AW at TP20-01, TP20-04 and TP20-05. The reported concentrations of the hexavalent species were less than the YCSR RL standard at those three locations. Reported concentrations of nickel at TP20-05 at 0.75 m in the fill unit, and at 1.25 m (and its duplicate pair) in the silt and organics unit were greater than the YCSR RL standard. Soil analytical testing results are included in the attached Table 1 and summarized on Figure 4.

6.2 Groundwater Analytical Results

The following subsection summarizes the comparison of the groundwater analytical results obtained during this Phase II ESA to the YCSR DW and AW standards.

Table H summarizes the comparison of groundwater analytical results obtained during this Phase II ESA to the YCSR DW and freshwater AW standards.

Table H: Groundwater Analytical Results

Location ID	Analyzed Parameters	Analytical Results
MW20-01	Dissolved metals, LEPH, HEPH, PAH, VPH, VH, VOC, BTEXS, MTBE, glycols, EPH by silica-gel cleanup	▪ **> YCSR AW standards for cobalt** ▪ **> YCSR DW standards for iron and manganese** ▪ **> YCSR AW standards for LEPH** but < YCSR AW standards for LEPH following silica-gel cleanup ▪ Detectable concentration of 1-methylnaphthalene, 2-methylnaphthalene and naphthalene but less than YCSR AW and DW standards ▪ < YCSR AW and DW standards for all other parameters analyzed
MW20-02	Dissolved metals, LEPH, HEPH, PAH, VPH, VH, VOC, BTEXS, MTBE, glycols	▪ **> YCSR AW standards for chromium and cobalt** ▪ **> YCSR DW standards for arsenic, iron and manganese** ▪ < YCSR AW and DW standards for all other parameters analyzed
MW20-03	Dissolved metals, LEPH, HEPH, PAH, VPH, VH, VOC, BTEXS, MTBE, glycols	▪ **> YCSR AW standards for cadmium, chromium and cobalt** ▪ **> YCSR DW standards for aluminum, arsenic, barium, iron, lead and manganese** ▪ Detectable concentrations of benz(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, fluorene, 1-methylnaphthalene, 2-methylnaphthalene, naphthalene, phenanthrene and pyrene but <YCSR AW and DW standards ▪ <YCSR AW and DW standards for all other parameters analyzed

Notes:
<YCSR AW and DW – less than the YCSR AW and DW standards
>YCSR DW – greater than the YCSR DW standard
>YCSR AW – greater than the YCSR AW standard
LEPH – light extractable petroleum hydrocarbons
HEPH – heavy extractable petroleum hydrocarbons
PAH – polycyclic aromatic hydrocarbons
VPH – volatile petroleum hydrocarbons
VH – volatile hydrocarbons
VOC – volatile organic compounds
BTEXS – benzene, toluene, ethylbenzene, xylene, styrene
MTBE – methyl tert-butyl ether
EPH – extractable petroleum hydrocarbons

In summary, groundwater analytical results were less than the applicable YCSR freshwater AW and DW standards except for the following:

- Reported concentrations of dissolved cobalt in the three samples were greater than the YCSR AW standard.
- Reported concentrations of dissolved iron and manganese in the three samples were greater than the YCSR DW standard.
- Reported concentrations of chromium in MW20-02 and MW20-03 were greater than the YCSR AW standards.
- Reported concentrations of arsenic in MW20-02, and arsenic, barium and lead in MW20-03 were greater than the YCSR DW standards.

Other dissolved metals and hydrocarbon concentrations were less than the DW and AW standards; however, detectable concentrations of ethylbenzene, toluene and PAH parameters of benz(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, fluorene, 1-methylnaphthalene, 2-methylnaphthalene and naphthalene, phenanthrene and pyrene were detected in groundwater, indicates hydrocarbon contamination associated with APEC 1 may be impacting groundwater quality on-Site.

Reported concentrations of LEPH in MW20-01 were greater than the YCSR AW standards in the parent sample but were less than the detection limit in the duplicate pair. Given the high organic content noted within soils on-Site, Tetra Tech conducted a silica-gel cleanup for the analysis of extractable petroleum hydrocarbons (EPH) on the parent sample. Lacking a comparable methodology document in the Yukon, Tetra Tech has referenced the document "Silica Gel Cleanup of [EPH] - Prescriptive" found in Section D of the BC Environmental Laboratory Manual produced by the BC ENV (ENV 2020). In this document, the silica-gel cleanup is a method which "can exclude biogenic organics from quantitative EPH results, based on the premise that most naturally occurring hydrocarbons are polar, and so will be irreversibly retained by activated silica gel." This document further states that "[s]ilica gel cleanup is appropriate for use when the end user of the analytical data has good reason to suspect that naturally occurring organics are present at the site, to an extent where EPH results would likely be significantly elevated."

Based on the stratigraphy encountered at the Site (consisting of high organic content as shown on the testpit and borehole logs in Appendix B), there is sufficient evidence to support that naturally occurring organics are present in soils immediately below the Site. In addition, the olfactory and visual field observations made during the investigation and the soil and groundwater analytical data suggest the elevated EPH is anomalous.

Following the silica-gel cleanup, the EPH analytical results were below the MDL. Therefore, the elevated concentrations of LEPH above the YCSR AW standards are considered to have been caused by the naturally occurring organics present at the Site. Therefore, LEPH is not considered a contaminant of concern at the Site.

Groundwater analytical results are included in the attached Table 2 and summarized on Figure 5.

6.3 Quality Assurance/Quality Control Results

During the Phase II ESA, the accuracy of laboratory analyses was assessed by calculating relative percent difference (RPD) values for duplicate pairs when the result of each analysis was greater than a multiple of five of the laboratory MDL. Elevated analytical variability is common when analyte concentrations are within a factor of five of the MDL. The screening thresholds were applied as stated in Appendix C and the calculated RPD values for soil and groundwater are presented in Tables 3 and 4, respectively.

To assess the overall accuracy of the sampling and analytical program, Tetra Tech submitted two soil duplicates and one groundwater duplicate. Duplicate values were considered having passed the QA/QC reproducibility goal if the RPD is less than or equal to the trigger value of 30%, indicating a close correlation between the sample-duplicate pair. The calculated RPD values are summarized Table I.

Table I: RPD Summary

Duplicate Pairs		Matrix	Analyzed Parameters	RPD Results
Sample	**Duplicate**			
TP20-05-1.25	TP00-05-1.25	Soil	Metals, LEPH, HEPH, PAH, speciated chromium	▪ **>RPD discussion trigger for chromium trivalent (60%) and magnesium (47%)** ▪ <RPD discussion trigger for remaining 20 out of 22 calculated RPD values
MW20-01	DUP	Groundwater	dissolved metals, LEPH, HEPH, PAH, VPH, VH, VOC, BTEXS, MTBE, glycols	▪ **>RPD discussion trigger for copper (32%)** ▪ <RPD discussion trigger for remaining 27 out of 28 calculated RPD values

Notes:		
	<RPD discussion trigger – less than RPD discussion trigger	**>RPD discussion trigger** – greater than RPD discussion trigger
	RPD – relative percent difference	LEPH – light extractable petroleum hydrocarbons
	HEPH – heavy extractable petroleum hydrocarbons	PAH – polycyclic aromatic hydrocarbons
	VPH – volatile petroleum hydrocarbons	VH – volatile hydrocarbons
	VOC – volatile organic compounds	BTEXS – benzene, toluene, ethylbenzene, xylene, styrene
	MTBE – methyl tert-butyl ether	

In summary, the majority (47 out of 50) calculated RPD values met the RPD value of 30%. Tetra Tech requested ALS investigate the reason for each of the exceeding RPD values. Results of ALS' QA/QC investigation confirmed that:

- The samples were labelled correctly;
- All preparation and analysis procedures were completed within ALS' standard operating procedures;
- The calibration and quality control measures for the laboratory analysis were correct and adequate;
- No errors occurred within data calculations;
- No interferences or issues occurred with the laboratory exceedances; and
- Sample heterogeneity is the likely source for the high RPD values.

Correspondence with ALS regarding the analytical variability is included in Appendix D.

In addition, ALS conducts an internal QA/QC check on the laboratory analysis for samples and found that results were within acceptable limits. Tetra Tech performed a review of the laboratory reports to identify whether or not potential sample qualifiers had impacted the results. The following qualifiers were identified in the ALS laboratory report:

- The lab duplicate was outside ALS' data quality objective (DQO) for antimony and arsenic for an anonymous sample;
- The lab duplicate was outside ALS' DQO for nickel, phosphorus, and titanium for sample TP20-01-0.5m;
- The reference material (RM) soil sample recovery for antimony and molybdenum was above the ALS DQO; however, the reported non-detect results for associated samples are considered reliable;
- The lab control sample recovery for EPH (silica gel treated) was slightly outside ALS' DQO; however, reported non-detect results for associated samples were unaffected;

- The regular soil sample hydrocarbon surrogate recovery was less than ALS' lower DQO for 3,4-dichlorotoluene in TP20-04-1.25m; and
- The lab regular water sample glycol surrogate recovery was less than lower DQO for 1,3-propanediol in samples MW20-02 and MW20-03.

Overall, no qualifiers were reported to have affected the integrity of the analytical results. Thus, the analytical results were considered representative of the soil samples and groundwater samples obtained from the Site. ALS' internal QA/QC results are found within Appendix D.

7.0 CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

Key findings from the Phase II ESA are provided below.

- Soil samples collected from the testpits (TP20-01, TP20-03 through TP20-05, and TP20-07 through TP20-09) were analyzed for PCOCs consisting of metals, hydrocarbons and glycols. Reported concentrations for hydrocarbons and glycols were less than the reportable MDL. Reported concentrations of select metals at select locations were greater than the applicable standards. Chromium concentrations were greater than the YCSR RL standard at TP20-01 and TP20-03 through TP20-05. Following chromium speciation, the reported concentrations of the hexavalent species were less than the YCSR RL standards at the four locations tested and reported concentrations of the trivalent species were less than the YCSR RL at TP20-03. However, reported concentrations of the trivalent species were greater than the YCSR RL standard for groundwater flow to surface water used by freshwater AW for samples collected from TP20-01, TP20-04 and TP20-05. In addition, reported concentrations of nickel at TP20-05 at 0.75 m in the fill unit, and at 1.25 m (an in the duplicate pair) in the silt and organics unit were greater than the YCSR RL standard. The source of the metals exceedances may in part be due to poor quality fill identified throughout the Site and/or elevated background concentrations for chromium and nickel.
- Groundwater samples collected from the Site were analyzed for metals, hydrocarbons and glycols. Reported concentrations of glycols at the three monitoring wells were less than the MDL. At the three monitoring wells, the reported concentrations of dissolved cobalt were greater than the YCSR AW standard, and the reported concentrations of dissolved iron and manganese were greater than the YCSR DW standard. Reported concentrations of chromium in MW20-02 and MW20-03 were greater than the YCSR AW standards. Reported concentrations of arsenic in MW20-02, and arsenic, barium and lead in MW20-03 were greater than the YCSR DW standards. All other dissolved metals concentrations were less than the YCSR AW and DW standards. Hydrocarbon concentrations were less than the YCSR AW and DW standards; however, detectable concentrations of ethylbenzene, toluene and PAH parameters of benz(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, fluorene, 1-methylnaphthalene, 2-methylnaphthalene and naphthalene, phenanthrene and pyrene were reported in groundwater.

  Reported concentrations of LEPH in MW20-01 were greater than the YCSR AW standards; however, given the high organic content noted within soils on-Site, Tetra Tech conducted a silica-gel cleanup for the analysis of EPH. Per the BC Environmental Laboratory Manual produced by the BC ENV (ENV 2020), the silica-gel cleanup is a method which "can exclude biogenic organics from quantitative EPH results, based on the premise that most naturally occurring hydrocarbons are polar, and so will be irreversibly retained by activated silica gel." Based on the stratigraphy encountered at the Site (consisting of high organic content), there is sufficient evidence to support that naturally occurring organics are present in soils immediately below the Site.

Following the silica-gel cleanup, the EPH analytical results came back below the MDL. Therefore, the concentrations of LEPH above the YCSR AW standards are considered to have been caused by the naturally occurring organics present at the Site. Therefore, LEPH is not considered a contaminant of concern at the Site.

- Trivalent chromium concentrations in soil exceeded the YCSR RL standard for groundwater flow to surface water used by freshwater AW. For comparison purposes, the BC *Contaminated Site Regulation* (ENV 2019) standard for this site-specific factor is 60 mg/g for hexavalent chromium (a known toxic substance) and > 1,000 mg/g for trivalent chromium. The speciated chromium at the Site was shown to be entirely trivalent.

7.2 Recommendations

Tetra Tech recommends at least one more groundwater monitoring event be conducted, preferably during the spring as water quality may fluctuate seasonally. Given that clear groundwater could not be sampled from any of the monitoring wells, Tetra Tech recommends sampling when the groundwater table is likely to be higher (i.e. during the early spring) so that more groundwater is available within the wells for purging and subsequent sampling. The intent of the groundwater monitoring event(s) is to further characterize the subsurface groundwater conditions on-Site and assess whether metals concentrations on-Site are greater than the YCSR standards or if they were caused by silty groundwater samples. Future water quality monitoring should consist of the PCOCs tested in this Phase II ESA. Future monitoring events should include soil vapour modelling of detectable volatile hydrocarbon concentrations for residential indoor and outdoor exposure per BC ENV *Technical Guidance 4 – Vapour Investigation and Remediation (2017)*. In addition, if drinking water wells are installed on-Site, these wells should be tested for potable water quality including metals and hydrocarbons prior to use to confirm water quality is suitable for consumption.

Tetra Tech also recommends additional soil sampling in proximity to the identified soil exceedances in order to delineate the chromium and nickel exceedances in soil found at these locations.

8.0 CLOSURE

This report has been prepared based on the scope of services and for the use of the Government of Yukon, Community Services, Land Development Branch, which includes distribution as required for the purposes for which this assessment was commissioned. The assessment has been carried out in accordance with generally accepted engineering practices. No other warranty is made, either express or implied. Professional judgement has been applied in developing the recommendations in this report.

We trust this report meets your present requirements. If you have any questions or comments please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

ISSUED FOR REVIEW
FILE: 704-ENW.PENW03102-01
FILE: 704-ENW.PENW03102-01
FILE: 704-ENW.PENW03102-01

Prepared by:
Roxanne Croxall, B.Sc. GIT
Environmental Scientist
Environment and Water Practice
Direct Line: 250.714.2760
Roxanne.Croxall@tetratech.com

ISSUED FOR REVIEW
FILE: 704-ENW.PENW03102-01
FILE: 704-ENW.PENW03102-01
FILE: 704-ENW.PENW03102-01

Reviewed by:
Erin O’Brien, M.Sc., P.Geo.
Senior Contaminated Sites Specialist
Environment and Water Practice
Direct Line: 778.945.5752
Erin.OBrien@tetratech.com

/sy

REFERENCES

BC Ministry of Environment and Climate Change Strategy (ENV). 2017. Technical Guidance 4 on Contaminated Sites: Vapour Investigation and Remediation, version 2, effective November 1, 2017, retrieved from https://www2.gov.bc.ca/assets/gov/environment/air-land-water/site-remediation/docs/technical-guidance/tg04.pdf

BC Ministry of Environment and Climate Change Strategy (ENV). 2019. Contaminated Sites Regulation, BC Reg. 375/96, including amendments up to BC Reg 13/2019, January 24, 2019. Retrieved from https://www.bclaws.ca/civix/document/id/complete/statreg/375_96_00

BC Ministry of Environment and Climate Change Strategy (ENV). 2020. BC Environmental Laboratory Manual. 2020 Edition. Retrieved from https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-environmental-laboratory-manual

City of Dawson. 2019. Zoning Bylaw. Bylaw No. 2018-2019. Retrieved from https://www.cityofdawson.ca/p/bylaws

Golder Associates Ltd. 2020. Phase I Environmental Site Assessment, Lots 1-20, Block Q Ladue Estate, 8338A CLSR, Dawson City, Yukon (Gold Rush Campground), submitted July 31, 2020. File number: 20144800-001-Rev-01

Yukon Contaminated Sites Regulation (YCSR), Yukon Environment Act, OIC 2002/171, last updated September 30, 2002.

Yukon Environment. 2012. Protocol No. 6: Application of Water Quality Standards, prepared pursuant to Part 6 – Administration, Section 21, Contaminated Sites Regulation, OIC 2002/171

Yukon Government. 2020. Water Data Catalogue map, accessed October 2020. Retrieved from https://yukon.maps.arcgis.com/apps/webappviewer/index.html?id=2365a4c0b8744f34be7f1451a38493d2

TABLES

Table 1: Soil Analytical Results

		Location	TP20-01			TP20-03		TP20-04		TP20-05			TP20-07	TP20-08		TP20-09	
		Field ID	TP20-01-0.5m	TP20-01-1.0m	TP20-01-1.75m	TP20-03-0.5m	TP20-03-1.3m	TP20-04-1.25m	TP20-04-2.0m	TP20-05-0.75m	TP20-05-1.25m	TP00-05-1.25	TP20-07-0.3m	TP20-08-0.5m	TP20-08-1.7m	TP20-9-0.5m	TP20-09-1.25m
		Sample Depth	0.50	1.0	1.75	0.50	1.30	1.25	2.0	0.75	1.25	1.25	0.30	0.50	1.70	0.50	1.25
		Sample Date	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
		Laboratory Report Number	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970
		Laboratory ID	WR2000970-001	WR2000970-002	WR2000970-003	WR2000970-016	WR2000970-017	WR2000970-005	WR2000970-006	WR2000970-014	WR2000970-015	WR2000970-022	WR2000970-010	WR2000970-019	WR2000970-021	WR2000970-007	WR2000970-008
Parameter	**Unit**	**Yukon CSR ^{1,2}**															
Physical Parameters																	
pH (1:2 soil:water)	pH Units	-	8.88	-	-	8.84	8.21	8.42	-	-	7.64	7.87	8.51	8.99	-	7.83	-
Moisture	%	-	5.49	8.92	32.6	-	8.27	13.4	40.5	-	17.4	18.2	3.66	4.69	39.3	4.26	10.6
Metals																	
Aluminum	µg/g	-	9530	-	-	2610	14,100	34,100	-	-	14,500	19,000	2840	3260	-	2880	-
Antimony	µg/g	20	<0.40	-	-	<0.30	<0.80	<0.40	-	-	<0.80	<0.80	<0.30	<0.40	-	<0.30	-
Arsenic	µg/g	15	4.23	-	-	2.74	7.90	3.54	-	-	7.01	6.58	2.74	3.14	-	2.18	-
Barium	µg/g	500	78.8	-	-	57.6	200	44.2	-	-	257	212	71.4	106	-	106	-
Beryllium	µg/g	4	0.18	-	-	0.13	0.35	0.28	-	-	0.29	0.27	0.13	0.15	-	0.11	-
Bismuth	µg/g	-	<0.20	-	-	<0.20	<0.20	<0.20	-	-	<0.20	<0.20	<0.20	<0.20	-	<0.20	-
Boron	µg/g	-	<5.0	-	-	<5.0	<5.0	<5.0	-	-	<5.0	<5.0	<5.0	<5.0	-	<5.0	-
Cadmium	µg/g	25 - 35 ^{3}	0.110	-	-	0.098	0.236	0.022	-	-	0.118	0.108	0.075	0.107	-	0.061	-
Calcium	µg/g	-	2020	-	-	633	2790	5910	-	-	5300	5730	852	1840	-	678	-
Chromium	µg/g	60	**116**	-	**165**	5.61	**63.4**	**177**	**168**	-	**196**	**364**	8.19	10.9	-	28.2	-
Chromium (Hexavalent)	µg/g	60	<0.10	-	<0.20	-	<0.10	<0.10	<0.20	-	<0.10	<0.10	-	-	-	-	-
Chromium (Trivalent)	µg/g	65	**116**	-	**165**	-	63.4	**177**	**168**	-	**196**	**364**	-	-	-	-	-
Cobalt	µg/g	50	9.19	-	-	1.82	12.6	31.4	-	-	24.7	29.1	1.85	2.18	-	2.66	-
Copper	µg/g	150 ^{3}	15.6	-	-	8.52	30.6	39.3	-	-	24.0	24.7	8.39	9.14	-	7.50	-
Iron	µg/g	-	14,000	-	-	3950	23,300	49,700	-	-	25,500	29,600	4180	4620	-	3670	-
Lead	µg/g	500 ^{3}	4.91	-	-	6.99	6.83	2.11	-	-	5.66	4.71	6.51	9.27	-	5.30	-
Lithium	µg/g	-	9.4	-	-	3.2	10.8	30.4	-	-	12.8	15.9	3.6	4.2	-	3.3	-
Magnesium	µg/g	-	9650	-	-	1200	10,400	30,300	-	-	19,600	31,700	1320	1650	-	2880	-
Manganese	µg/g	-	169	-	-	40	305	508	-	-	371	472	44.7	52.9	-	42.8	-
Mercury	µg/g	15	0.0201	-	-	<0.050	<0.050	<0.050	-	-	<0.050	<0.050	<0.050	<0.050	-	<0.050	-
Molybdenum	µg/g	10	0.27	-	-	0.23	0.78	<0.10	-	-	0.34	0.38	0.22	0.26	-	0.15	-
Nickel	µg/g	100	46.0	-	-	5.96	38.9	85.5	-	**188**	**316**	**352**	10.4	12.5	-	29.3	-
Phosphorus	µg/g	-	339	-	-	117	396	88	-	-	520	417	150	576	-	135	-
Potassium	µg/g	-	550	-	-	540	590	370	-	-	390	340	530	560	-	570	-
Selenium	µg/g	3	<0.20	-	-	<0.20	0.22	<0.20	-	-	<0.20	<0.20	<0.20	<0.20	-	<0.20	-
Silver	µg/g	20	<0.10	-	-	<0.10	0.11	<0.10	-	-	<0.10	<0.10	<0.10	<0.10	-	<0.10	-
Sodium	µg/g	-	<50	-	-	80	70	114	-	-	195	152	<50	<50	-	<50	-
Strontium	µg/g	-	11.9	-	-	5.94	16.1	19.8	-	-	26.4	25.3	6.64	19.7	-	5.12	-
Sulphur	µg/g	-	<1000	-	-	<1000	<1000	<1000	-	-	<1000	<1000	<1000	<1000	-	<1000	-
Thallium	µg/g	-	<0.050	-	-	<0.050	0.066	<0.050	-	-	<0.050	<0.050	<0.050	<0.050	-	<0.050	-
Tin	µg/g	50	<2.0	-	-	<2.0	<2.0	<2.0	-	-	<2.0	<2.0	<2.0	<2.0	-	<2.0	-
Titanium	µg/g	-	245	-	-	102	370	1100	-	-	565	640	99.4	110	-	89	-
Tungsten	µg/g	-	<0.50	-	-	<0.50	<0.50	<0.50	-	-	<0.50	<0.50	<0.50	<0.50	-	<0.50	-
Uranium	µg/g	-	0.51	-	-	0.642	0.911	0.215	-	-	0.575	0.616	0.484	1.03	-	0.446	-
Vanadium	µg/g	200	29.6	-	-	9.72	47.0	102	-	-	52.4	64.5	8.77	17.7	-	7.53	-
Zinc	µg/g	450 ^{3}	28.0	-	-	22.2	44.8	43.9	-	-	50.2	43.5	17.6	18.9	-	16.7	-
Zirconium	µg/g	-	2.6	-	-	3.4	3.8	1.1	-	-	4.6	4.6	2.8	3.0	-	2.4	-

Notes:

[1] Environment Act. Contaminated Sites Regulation (CSR) (2002/171). Schedule 1 - Generic Numerical Soil Standards and Schedule 2 - Matrix Numerical Soil Standards for Residential (RL) land use

[2] Schedule 2 Parameter. Pathways included:

Intake of contaminated soil
Groundwater used for drinking water
Toxicity to soil invertebrates and plants
Groundwater flow to surface water used by freshwater aquatic life

[3] Standard is pH dependent. Most conservative value shown based on site pH range of 7.64 to 8.99.

"-" No applicable standard or not analyzed

BOLD - Greater than Guideline

N/A - Not applicable

Table 1: Soil Analytical Results

Location			TP20-01			TP20-03		TP20-04		TP20-05			TP20-07	TP20-08		TP20-09	
Field ID			TP20-01-0.5m	TP20-01-1.0m	TP20-01-1.75m	TP20-03-0.5m	TP20-03-1.3m	TP20-04-1.25m	TP20-04-2.0m	TP20-05-0.75m	TP20-05-1.25m	TP00-05-1.25	TP20-07-0.3m	TP20-08-0.5m	TP20-08-1.7m	TP20-9-0.5m	TP20-09-1.25m
Sample Depth			0.50	1.0	1.75	0.50	1.30	1.25	2.0	0.75	1.25	1.25	0.30	0.50	1.70	0.50	1.25
Sample Date			23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
Laboratory Report Number			WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970
Laboratory ID			WR2000970-001	WR2000970-002	WR2000970-003	WR2000970-016	WR2000970-017	WR2000970-005	WR2000970-006	WR2000970-014	WR2000970-015	WR2000970-022	WR2000970-010	WR2000970-019	WR2000970-021	WR2000970-007	WR2000970-008
Parameter	**Unit**	**Yukon CSR** ^{1,2}															
BTEXS & MTBE																	
Benzene	µg/g	0.04	-	<0.0050	-	-	<0.0050	<0.0050	-	-	-	-	<0.0050	-	<0.0050	-	<0.0050
Toluene	µg/g	1.5	-	<0.050	-	-	<0.050	<0.050	-	-	-	-	<0.050	-	<0.050	-	<0.050
Ethylbenzene	µg/g	1	-	<0.015	-	-	<0.015	<0.015	-	-	-	-	<0.015	-	<0.015	-	<0.015
Xylenes (m & p)	µg/g	-	-	<0.050	-	-	<0.050	<0.050	-	-	-	-	<0.050	-	<0.050	-	<0.050
Xylene (o)	µg/g	-	-	<0.050	-	-	<0.050	<0.050	-	-	-	-	<0.050	-	<0.050	-	<0.050
Xylenes Total	µg/g	5	-	<0.075	-	-	<0.075	<0.075	-	-	-	-	<0.075	-	<0.075	-	<0.075
Styrene	µg/g	5	-	<0.050	-	-	<0.050	<0.050	-	-	-	-	<0.050	-	<0.050	-	<0.050
Methyl t-butyl ether (MTBE)	µg/g	-	-	<0.200	-	-	<0.050	<0.200	-	-	-	-	<0.200	-	<0.050	-	<0.200
Extractable Petroleum Hydrocarbons																	
EPH_{10-19}	µg/g	-	<200	-	-	-	<200	<200	-	-	<200	<200	<200	<200	-	<200	-
EPH_{19-32}	µg/g	-	<200	-	-	-	<200	<200	-	-	<200	<200	<200	<200	-	<200	-
LEPH	µg/g	1000	<200	-	-	-	<200	<200	-	-	<200	<200	<200	<200	-	<200	-
HEPH	µg/g	1000	<200	-	-	-	<200	<200	-	-	<200	<200	<200	<200	-	<200	-
Volatile Hydrocarbons																	
VH_{6-10}	µg/g	-	-	<10	-	-	<10	<10	-	-	-	-	<10	-	<10	-	<10
VPHs	µg/g	200	-	<10	-	-	<10	<10	-	-	-	-	<10	-	<10	-	<10
Glycols																	
Diethylene glycol	µg/g	-	-	-	-	-	<10	-	-	-	-	-	-	-	-	-	-
Ethylene glycol	µg/g	1500	-	-	-	-	<10	-	-	-	-	-	-	-	-	-	-
Propylene glycol	µg/g	-	-	-	-	-	<10	-	-	-	-	-	-	-	-	-	-
Triethylene Glycol	µg/g	-	-	-	-	-	<10	-	-	-	-	-	-	-	-	-	-
Polycyclic Aromatic Hydrocarbons (PAHs)																	
B(a)P Total Potency Equivalent	N/A	-	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
IACR (CCME)	N/A	-	<0.11	-	-	-	<0.11	<0.11	-	-	<0.11	<0.11	<0.11	<0.11	-	<0.11	-
Acenaphthene	µg/g	-	<0.0050	-	-	-	<0.0050	<0.0050	-	-	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050	-
Acenaphthylene	µg/g	-	<0.0050	-	-	-	<0.0050	<0.0050	-	-	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050	-
Acridine	µg/g	-	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
Anthracene	µg/g	-	<0.0040	-	-	-	<0.0040	<0.0040	-	-	<0.0040	<0.0040	<0.0040	<0.0040	-	<0.0040	-
Benz(a)anthracene	µg/g	1	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
Benzo(a)pyrene	µg/g	1	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
Benzo(b,j,k)fluoranthene	µg/g	-	<0.015	-	-	-	<0.015	<0.015	-	-	<0.015	<0.015	<0.015	<0.015	-	<0.015	-
Benzo(b+j)fluoranthene	µg/g	-	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
Benzo(g,h,i)perylene	µg/g	-	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
Benzo(k)fluoranthene	µg/g	1	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
Chrysene	µg/g	-	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
Dibenz(a,h)anthracene	µg/g	1	<0.0050	-	-	-	<0.0050	<0.0050	-	-	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050	-
Fluoranthene	µg/g	-	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
Fluorene	µg/g	-	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
Indeno(1,2,3-c,d)pyrene	µg/g	1	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
1-Methylnaphthalene	µg/g	-	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
2-Methylnaphthalene	µg/g	-	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
Naphthalene	µg/g	5	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
Phenanthrene	µg/g	5	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
Pyrene	µg/g	10	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-
Quinoline	µg/g	-	<0.010	-	-	-	<0.010	<0.010	-	-	<0.010	<0.010	<0.010	<0.010	-	<0.010	-

Notes:

[1] Environment Act. Contaminated Sites Regulation (CSR) (2002/171). Schedule 1 - Generic Numerical Soil Standards and Schedule 2 - Matrix Numerical Soil Standards for Residential (RL) land use

[2] Schedule 2 Parameter. Pathways included:

Intake of contaminated soil
Groundwater used for drinking water
Toxicity to soil invertebrates and plants
Groundwater flow to surface water used by freshwater aquatic life

[3] Standard is pH dependent. Most conservative value shown based on site pH range of 7.64 to 8.99.

"-" No applicable standard or not analyzed

BOLD - Greater than Guideline

N/A - Not applicable

Table 1: Soil Analytical Results

Location			TP20-01			TP20-03		TP20-04		TP20-05			TP20-07	TP20-08		TP20-09	
Field ID			TP20-01-0.5m	TP20-01-1.0m	TP20-01-1.75m	TP20-03-0.5m	TP20-03-1.3m	TP20-04-1.25m	TP20-04-2.0m	TP20-05-0.75m	TP20-05-1.25m	TP00-05-1.25	TP20-07-0.3m	TP20-08-0.5m	TP20-08-1.7m	TP20-9-0.5m	TP20-09-1.25m
Sample Depth			0.50	1.0	1.75	0.50	1.30	1.25	2.0	0.75	1.25	1.25	0.30	0.50	1.70	0.50	1.25
Sample Date			23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
Laboratory Report Number			WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970	WR2000970
Laboratory ID			WR2000970-001	WR2000970-002	WR2000970-003	WR2000970-016	WR2000970-017	WR2000970-005	WR2000970-006	WR2000970-014	WR2000970-015	WR2000970-022	WR2000970-010	WR2000970-019	WR2000970-021	WR2000970-007	WR2000970-008
Parameter	**Unit**	**Yukon CSR [1,2]**															
Volatile Organic Compounds (VOCs)																	
Bromodichloromethane	µg/g	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
Bromoform	µg/g	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
Carbon tetrachloride	µg/g	5	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
Chlorobenzene	µg/g	1	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
Chloroethane	µg/g	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
Chloroform	µg/g	5	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
Chloromethane	µg/g	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
Dibromochloromethane	µg/g	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,2-Dichlorobenzene	µg/g	1	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,3-Dichlorobenzene	µg/g	1	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,4-Dichlorobenzene	µg/g	1	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,1-Dichloroethane	µg/g	5	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,2-Dichloroethane	µg/g	5	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,1-Dichloroethene	µg/g	5	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,2-Dichloroethene (cis)	µg/g	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,2-Dichloroethene (trans)	µg/g	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,2-Dichloropropane	µg/g	5	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,3-Dichloropropene	µg/g	5	-	-	-	-	<0.075	-	-	-	-	-	-	-	<0.075	-	-
1,3-Dichloropropene [cis]	µg/g	5	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,3-Dichloropropene [trans]	µg/g	5	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
Methylene Chloride	µg/g	5	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,1,1,2-Tetrachloroethane	µg/g	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,1,2,2-Tetrachloroethane	µg/g	5	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
Tetrachloroethene	µg/g	5	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,1,1-Trichloroethane	µg/g	5	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
1,1,2-Trichloroethane	µg/g	5	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
Trichloroethene	µg/g	0.15	-	-	-	-	<0.010	-	-	-	-	-	-	-	<0.010	-	-
Trichlorofluoromethane	µg/g	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-
Vinyl chloride	µg/g	-	-	-	-	-	<0.050	-	-	-	-	-	-	-	<0.050	-	-

Notes:

[1] Environment Act. Contaminated Sites Regulation (CSR) (2002/171). Schedule 1 - Generic Numerical Soil Standards and Schedule 2 - Matrix Numerical Soil Standards for Residential (RL) land use

[2] Schedule 2 Parameter. Pathways included:
Intake of contaminated soil
Groundwater used for drinking water
Toxicity to soil invertebrates and plants
Groundwater flow to surface water used by freshwater aquatic life

[3] Standard is pH dependent. Most conservative value shown based on site pH range of 7.64 to 8.99.

"-" No applicable standard or not analyzed

BOLD - Greater than Guideline

N/A - Not applicable

Table 2: Groundwater Analytical Results

Location				MW20-01		MW20-02	MW20-03
Field ID				MW20-01	DUP	MW20-02	MW20-03
Sample Date				25-Sep-2020	25-Sep-2020	25-Sep-2020	25-Sep-2020
Laboratory Report Number				WR2000970	WR2000970	WR2000970	WR2000970
Laboratory ID				WR2000970-023	WR2000970-026	WR2000970-024	WR2000970-025
Parameter	**Unit**	**Yukon CSR**[1]					
		AW (Fresh)	**DW**				
Physical Parameters							
Dissolved Hardness as CaCO$_3$	µg/L	-	-	573,000	564,000	769,000	719,000
Dissolved Metals							
Aluminum	µg/L	-	200	11.9	11.2	106	**12,000**
Antimony	µg/L	200	6	1.17	1.19	0.92	1.49
Arsenic	µg/L	50	25	12.4	12.5	**44.7**	**30.0**
Barium	µg/L	10,000	1000	577	580	883	**1030**
Beryllium	µg/L	53	-	<0.100	<0.100	<0.100	0.818
Bismuth	µg/L	-	-	<0.050	<0.050	<0.050	0.124
Boron	µg/L	50,000	5000	38	37	12	33
Cadmium	µg/L	0.6[2]	5	0.0417	0.0387	0.0930	**2.42**
Calcium	µg/L	-	-	143,000	141,000	211,000	201,000
Cesium	µg/L	-	-	<0.010	0.010	<0.010	0.828
Chromium	µg/L	10[3]	50	2.27	2.30	**13.4**	**39.3**
Cobalt	µg/L	9	-	**14.0**	**13.7**	**31.3**	**93**
Copper	µg/L	90[2]	1000	4.16	5.75	6.96	70.5
Iron	µg/L	-	300	**1680**	**1700**	**32,400**	**43,500**
Lead	µg/L	160[2]	10	0.083	0.123	0.771	**20.4**
Lithium	µg/L	-	-	7.7	7.3	4.0	15
Magnesium	µg/L	-	100,000	52,700	51,200	59,000	52,700
Manganese	µg/L	-	50	**2750**	**2680**	**4760**	**7990**
Mercury	µg/L	1	1	0.0064	0.0057	<0.0050	<0.050
Molybdenum	µg/L	10,000	250	10.3	10.3	5.18	2.16
Nickel	µg/L	1500[2]	-	28.8	28.5	112	223
Phosphorus	µg/L	-	-	86	63	495	1460
Potassium	µg/L	-	-	5710	5770	2970	8520
Rubidium	µg/L	-	-	2.77	2.64	1.60	15.3
Selenium	µg/L	10	10	0.842	0.850	2.33	2.30
Silicon	µg/L	-	-	10,900	10,800	19,100	44,800
Silver	µg/L	15[2]	-	0.028	0.028	0.049	0.28
Sodium	µg/L	-	200,000	17,800	17,600	14,900	19,000
Strontium	µg/L	-	-	570	579	772	694
Sulphur	µg/L	-	-	19,400	19,700	11,800	13,500
Tellurium	µg/L	-	-	<0.20	<0.20	<0.20	<0.40
Thallium	µg/L	3	-	0.026	0.026	0.012	0.339
Thorium	µg/L	-	-	<0.10	<0.10	0.14	4.3
Tin	µg/L	-	-	0.24	0.26	1.87	4.02
Titanium	µg/L	1000	-	2.15	1.98	18.4	305
Tungsten	µg/L	-	-	<0.10	<0.10	0.13	0.67
Uranium	µg/L	3000	100	6.67	6.58	2.81	5.93
Vanadium	µg/L	-	-	2.84	2.90	8.98	42.2
Zinc	µg/L	2400[2]	5000	15.1	15.8	10.8	145
Zirconium	µg/L	-	-	2.45	2.46	4.82	25.8
BTEXS & MTBE							
Benzene	µg/L	4000	5	<0.50	<0.50	<0.50	<0.50
Toluene	µg/L	390	24	<0.40	<0.40	<0.40	<0.40
Ethylbenzene	µg/L	2000	2.4	<0.50	<0.50	<0.50	<0.50
Xylenes (m & p)	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
Xylene (o)	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
Xylenes Total	µg/L	-	300	<0.75	<0.75	<0.75	<0.75
Styrene	µg/L	720	-	<0.50	<0.50	<0.50	<0.50
Methyl t-butyl ether (MTBE)	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
TPH (C_{10}-C_{32})-sg	µg/L	-	-	<500	-	-	-
Extractable Petroleum Hydrocarbons							
EPH$_{10\text{-}19}$	µg/L	5000	5000	1420	<250	<250	<250
EPH$_{19\text{-}32}$	µg/L	-	-	<250	<250	<250	<250
EPH$_{10\text{-}19}$ - sg	µg/L	5000	5000	<250	-	-	-
EPH$_{19\text{-}32}$ - sg	µg/L	-	-	<250	-	-	-
LEPH	µg/L	500	-	**1420**	<250	<250	<250
HEPH	µg/L	-	-	<250	<250	<250	<250
LEPH-sg	µg/L	500	-	<250	-	-	-
HEPH-sg	µg/L	-	-	<250	-	-	-
Volatile Hydrocarbons							
VH$_{6\text{-}10}$	µg/L	15,000	15,000	<100	<100	<100	<100
VPHw	µg/L	1500	-	<100	<100	<100	<100
Glycols							
Diethylene glycol	µg/L	-	-	<5000	<5000	<5000	<5000
Ethylene glycol	µg/L	1,920,000	-	<5000	<5000	<5000	<5000
Propylene glycol	µg/L	5,000,000	-	<5000	<5000	<5000	<5000
Triethylene Glycol	µg/L	-	-	<5000	<5000	<5000	<5000
Polycyclic Aromatic Hydrocarbons (PAHs)							
Acenaphthene	µg/L	60	-	<0.010	<0.010	<0.010	<0.010
Acenaphthylene	µg/L	-	-	<0.010	<0.010	<0.010	<0.010
Acridine	µg/L	0.5	-	<0.010	<0.010	<0.010	<0.010
Anthracene	µg/L	1	-	<0.010	<0.010	<0.010	<0.010
Benz(a)anthracene	µg/L	1	-	<0.010	<0.010	<0.010	0.012
Benzo(a)pyrene	µg/L	0.1	0.01	<0.0050	<0.0050	<0.0050	0.0050
Benzo(b,j,k)fluoranthene	µg/L	-	-	<0.015	<0.015	<0.015	<0.015
Benzo(b+j)fluoranthene	µg/L	-	-	<0.010	<0.010	<0.010	<0.010
Benzo(g,h,i)perylene	µg/L	-	-	<0.010	<0.010	<0.010	<0.010
Benzo(k)fluoranthene	µg/L	-	-	<0.010	<0.010	<0.010	<0.010
Chrysene	µg/L	-	-	<0.010	<0.010	<0.010	0.014
Dibenz(a,h)anthracene	µg/L	-	-	<0.0050	<0.0050	<0.0050	<0.0050
Fluoranthene	µg/L	2	-	<0.010	<0.010	<0.010	0.021
Fluorene	µg/L	120	-	<0.010	<0.010	<0.010	0.019
Indeno(1,2,3-c,d)pyrene	µg/L	-	-	<0.010	<0.010	<0.010	<0.010
1-Methylnaphthalene	µg/L	-	-	0.018	0.017	<0.010	0.027
2-Methylnaphthalene	µg/L	-	-	0.028	0.026	<0.010	0.049
Naphthalene	µg/L	10	-	0.066	0.065	<0.050	0.065
Phenanthrene	µg/L	3	-	<0.020	<0.020	<0.020	0.05
Pyrene	µg/L	0.2	-	<0.010	<0.010	<0.010	0.031
Quinoline	µg/L	34	-	<0.050	<0.050	<0.050	<0.050
Volatile Organic Compounds (VOCs)							
Bromodichloromethane	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
Bromoform	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
Carbon tetrachloride	µg/L	130	5	<0.50	<0.50	<0.50	<0.50
Chlorobenzene	µg/L	13	30	<0.50	<0.50	<0.50	<0.50
Chloroethane	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
Chloroform	µg/L	20	100	<0.50	<0.50	<0.50	<0.50
Chloromethane	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
Dibromochloromethane	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
1,2-Dichlorobenzene	µg/L	-	3	<0.50	<0.50	<0.50	<0.50
1,3-Dichlorobenzene	µg/L	1500	-	<0.50	<0.50	<0.50	<0.50
1,4-Dichlorobenzene	µg/L	260	1	<0.50	<0.50	<0.50	<0.50
1,1-Dichloroethane	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
1,2-Dichloroethane	µg/L	1000	5	<0.50	<0.50	<0.50	<0.50
1,1-Dichloroethene	µg/L	-	14	<0.50	<0.50	<0.50	<0.50
1,2-Dichloroethene (cis)	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
1,2-Dichloroethene (trans)	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
1,2-Dichloropropane	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
1,3-Dichloropropene	µg/L	-	-	<0.75	<0.75	<0.75	<0.75
1,3-Dichloropropene [cis]	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
1,3-Dichloropropene [trans]	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
Methylene Chloride	µg/L	980	50	<0.50	<0.50	<0.50	<0.50
1,1,1,2-Tetrachloroethane	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	µg/L	-	-	<0.20	<0.20	<0.20	<0.20
Tetrachloroethene	µg/L	1100	30	<0.50	<0.50	<0.50	<0.50
1,1,1-Trichloroethane	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
1,1,2-Trichloroethane	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
Trichloroethene	µg/L	200	50	<0.50	<0.50	<0.50	<0.50
Trichlorofluoromethane	µg/L	-	-	<0.50	<0.50	<0.50	<0.50
Vinyl chloride	µg/L	-	2	<0.40	<0.40	<0.40	<0.40

Notes:

[1] Environment Act. Contaminated Sites Regulation (CSR) (2002/171). Schedule 3, Generic Numerical Water Standards for Freshwater Aquatic Life (AW) and Drinking Water (DW)

[2] Standard varies with hardness. Values shown based on hardness range of 564 mg/L to 769 mg/L.

[3] Standard is for Chromium VI

"-" No applicable standard

BOLD - Greater than Guideline

Table 3: Soil Quality Assurance/Quality Control Analytical Results

Field ID			TP20-05	TP00-05	RPD (%)
Sample Depth			1.25	1.25	
Sample Date			23-Sep-2020	23-Sep-2020	
Laboratory Report Number			WR2000970	WR2000970	
Laboratory ID			WR2000970-015	WR2000970-022	
Parameter	**Unit**	**RDL**			
Physical Parameters					
pH (1:2 soil:water)	pH Units	0.1	7.64	7.87	3
Moisture	%	0.25	17.4	18.2	4
Metals					
Aluminum	µg/g	50	14,500	19,000	27
Antimony	µg/g	0.3	<0.80	<0.80	-
Arsenic	µg/g	0.1	7.01	6.58	6
Barium	µg/g	0.5	257	212	19
Beryllium	µg/g	0.1	0.29	0.27	-
Bismuth	µg/g	0.2	<0.20	<0.20	-
Boron	µg/g	5	<5.0	<5.0	-
Cadmium	µg/g	0.02	0.118	0.108	9
Calcium	µg/g	50	5300	5730	8
Chromium	µg/g	0.5	196	364	**60**
Chromium (Hexavalent)	µg/g	0.1	<0.10	<0.10	-
Chromium (Trivalent)	µg/g	14.3	196	364	**60**
Cobalt	µg/g	0.1	24.7	29.1	16
Copper	µg/g	0.5	24.0	24.7	3
Iron	µg/g	50	25,500	29,600	15
Lead	µg/g	0.5	5.66	4.71	18
Lithium	µg/g	2	12.8	15.9	22
Magnesium	µg/g	20	19,600	31,700	**47**
Manganese	µg/g	1	371	472	24
Mercury	µg/g	0.005	<0.050	<0.050	-
Molybdenum	µg/g	0.1	0.34	0.38	-
Nickel	µg/g	0.5	316	352	11
Phosphorus	µg/g	50	520	417	22
Potassium	µg/g	100	390	340	-
Selenium	µg/g	0.2	<0.20	<0.20	-
Silver	µg/g	0.1	<0.10	<0.10	-
Sodium	µg/g	50	195	152	-
Strontium	µg/g	0.5	26.4	25.3	4
Sulphur	µg/g	1000	<1000	<1000	-
Thallium	µg/g	0.05	<0.050	<0.050	-
Tin	µg/g	2	<2.0	<2.0	-
Titanium	µg/g	1	565	640	12
Tungsten	µg/g	0.5	<0.50	<0.50	-
Uranium	µg/g	0.05	0.575	0.616	7
Vanadium	µg/g	0.2	52.4	64.5	21
Zinc	µg/g	2	50.2	43.5	14
Zirconium	µg/g	1	4.6	4.6	-
Extractable Petroleum Hydrocarbons					
EPH$_{10-19}$	µg/g	200	<200	<200	-
EPH$_{19-32}$	µg/g	200	<200	<200	-
LEPH	µg/g	200	<200	<200	-
HEPH	µg/g	200	<200	<200	-
Polycyclic Aromatic Hydrocarbons (PAHs)					
B(a)P Total Potency Equivalent	N/A	0.01	<0.010	<0.010	-
IACR (CCME)	N/A	0.11	<0.11	<0.11	-
Acenaphthene	µg/g	0.005	<0.0050	<0.0050	-
Acenaphthylene	µg/g	0.005	<0.0050	<0.0050	-
Acridine	µg/g	0.01	<0.010	<0.010	-
Anthracene	µg/g	0.004	<0.0040	<0.0040	-
Benz(a)anthracene	µg/g	0.01	<0.010	<0.010	-
Benzo(a)pyrene	µg/g	0.01	<0.010	<0.010	-
Benzo(b,j,k)fluoranthene	µg/g	0.015	<0.015	<0.015	-
Benzo(b+j)fluoranthene	µg/g	0.01	<0.010	<0.010	-
Benzo(g,h,i)perylene	µg/g	0.01	<0.010	<0.010	-
Benzo(k)fluoranthene	µg/g	0.01	<0.010	<0.010	-
Chrysene	µg/g	0.01	<0.010	<0.010	-
Dibenz(a,h)anthracene	µg/g	0.005	<0.0050	<0.0050	-
Fluoranthene	µg/g	0.01	<0.010	<0.010	-
Fluorene	µg/g	0.01	<0.010	<0.010	-
Indeno(1,2,3-c,d)pyrene	µg/g	0.01	<0.010	<0.010	-
1-Methylnaphthalene	µg/g	0.01	<0.010	<0.010	-
2-Methylnaphthalene	µg/g	0.01	<0.010	<0.010	-
Naphthalene	µg/g	0.01	<0.010	<0.010	-
Phenanthrene	µg/g	0.01	<0.010	<0.010	-
Pyrene	µg/g	0.01	<0.010	<0.010	-
Quinoline	µg/g	0.01	<0.010	<0.010	-

Notes:

RDL - Reportable detection limit

RPD - Relative Percentage Difference calculated as RPD(%)=(|V1-V2|)/[(V1+V2)/2])*100 where V1,V2 = concentrations of parent and duplicate sample, respectively.

"-" Indicates RPD not calculated. RPDs have only been calculated where a concentration is greater than 5 times the RDL

N/A - Not applicable

BOLD - RPD value greater than 30%

Table 4: Groundwater Quality Assurance/Quality Control Analytical Results

		QAQC Type	Blanks	Duplicate		
		Field ID	Field Blank	MW20-01	DUP	RPD (%)
		Sample Date	25-Sep-2020	25-Sep-2020	25-Sep-2020	
		Laboratory Report Number	WR2000970	WR2000970	WR2000970	
		Laboratory ID	WR2000970-027	WR2000970-023	WR2000970-026	
Parameter	**Unit**	**RDL**				
Physical Parameters						
Dissolved Hardness as $CaCO_3$	µg/L	600	<600	573,000	564,000	2
Dissolved Metals						
Aluminum	µg/L	1	<1.0	11.9	11.2	6
Antimony	µg/L	0.1	<0.10	1.17	1.19	2
Arsenic	µg/L	0.1	<0.10	12.4	12.5	1
Barium	µg/L	0.1	<0.10	577	580	1
Beryllium	µg/L	0.1	<0.100	<0.100	<0.100	-
Bismuth	µg/L	0.05	<0.050	<0.050	<0.050	-
Boron	µg/L	10	<10	38	37	-
Cadmium	µg/L	0.005	<0.0050	0.0417	0.0387	7
Calcium	µg/L	50	<50	143,000	141,000	1
Cesium	µg/L	0.01	<0.010	<0.010	0.010	-
Chromium	µg/L	0.1	<0.10	2.27	2.30	1
Cobalt	µg/L	0.1	<0.10	14.0	13.7	2
Copper	µg/L	0.2	<0.20	4.16	5.75	**32**
Iron	µg/L	10	<10	1680	1700	1
Lead	µg/L	0.05	<0.050	0.083	0.123	-
Lithium	µg/L	1	<1.0	7.7	7.3	5
Magnesium	µg/L	5	<5.0	52,700	51,200	3
Manganese	µg/L	0.1	<0.10	2750	2680	3
Mercury	µg/L	0.005	<0.0050	0.0064	0.0057	-
Molybdenum	µg/L	0.05	<0.050	10.3	10.3	0
Nickel	µg/L	0.5	<0.50	28.8	28.5	1
Phosphorus	µg/L	50	<50	86	63	-
Potassium	µg/L	50	<50	5710	5770	1
Rubidium	µg/L	0.2	<0.20	2.77	2.64	5
Selenium	µg/L	0.05	<0.050	0.842	0.850	1
Silicon	µg/L	50	<50	10,900	10,800	1
Silver	µg/L	0.01	<0.010	0.028	0.028	-
Sodium	µg/L	50	<50	17,800	17,600	1
Strontium	µg/L	0.2	<0.20	570	579	2
Sulphur	µg/L	500	<500	19,400	19,700	2
Tellurium	µg/L	0.2	<0.20	<0.20	<0.20	-
Thallium	µg/L	0.01	<0.010	0.026	0.026	-
Thorium	µg/L	0.1	<0.10	<0.10	<0.10	-
Tin	µg/L	0.1	<0.10	0.24	0.26	-
Titanium	µg/L	0.3	<0.30	2.15	1.98	8
Tungsten	µg/L	0.1	<0.10	<0.10	<0.10	-
Uranium	µg/L	0.01	<0.010	6.67	6.58	1
Vanadium	µg/L	0.5	<0.50	2.84	2.90	2
Zinc	µg/L	1	<1.0	15.1	15.8	5
Zirconium	µg/L	0.2	<0.20	2.45	2.46	0.4
BTEXS & MTBE						
Benzene	µg/L	0.5	<0.50	<0.50	<0.50	-
Toluene	µg/L	0.4	<0.40	<0.40	<0.40	-
Ethylbenzene	µg/L	0.5	<0.50	<0.50	<0.50	-
Xylenes (m & p)	µg/L	0.5	<0.50	<0.50	<0.50	-
Xylene (o)	µg/L	0.5	<0.50	<0.50	<0.50	-
Xylenes Total	µg/L	0.75	<0.75	<0.75	<0.75	-
Styrene	µg/L	0.5	<0.50	<0.50	<0.50	-
Methyl t-butyl ether (MTBE)	µg/L	0.5	<0.50	<0.50	<0.50	-
Extractable Petroleum Hydrocarbons						
EPH_{10-19}	µg/L	250	<250	1420	<250	-
EPH_{19-32}	µg/L	250	<250	<250	<250	-
LEPH	µg/L	250	<250	1420	<250	-
HEPH	µg/L	250	<250	<250	<250	-
Volatile Hydrocarbons						
VH_{6-10}	µg/L	100	<100	<100	<100	-
VPHw	µg/L	100	<100	<100	<100	-
Glycols						
Diethylene glycol	µg/L	5000	<5000	<5000	<5000	-
Ethylene glycol	µg/L	5000	<5000	<5000	<5000	-
Propylene glycol	µg/L	5000	<5000	<5000	<5000	-
Triethylene Glycol	µg/L	5000	<5000	<5000	<5000	-
Polycyclic Aromatic Hydrocarbons (PAHs)						
Acenaphthene	µg/L	0.01	<0.010	<0.010	<0.010	-
Acenaphthylene	µg/L	0.01	<0.010	<0.010	<0.010	-
Acridine	µg/L	0.01	<0.010	<0.010	<0.010	-
Anthracene	µg/L	0.01	<0.010	<0.010	<0.010	-
Benz(a)anthracene	µg/L	0.01	<0.010	<0.010	<0.010	-
Benzo(a)pyrene	µg/L	0.005	<0.0050	<0.0050	<0.0050	-
Benzo(b,j,k)fluoranthene	µg/L	0.015	<0.015	<0.015	<0.015	-
Benzo(b+j)fluoranthene	µg/L	0.01	<0.010	<0.010	<0.010	-
Benzo(g,h,i)perylene	µg/L	0.01	<0.010	<0.010	<0.010	-
Benzo(k)fluoranthene	µg/L	0.01	<0.010	<0.010	<0.010	-
Chrysene	µg/L	0.01	<0.010	<0.010	<0.010	-
Dibenz(a,h)anthracene	µg/L	0.005	<0.0050	<0.0050	<0.0050	-
Fluoranthene	µg/L	0.01	<0.010	<0.010	<0.010	-
Fluorene	µg/L	0.01	<0.010	<0.010	<0.010	-
Indeno(1,2,3-c,d)pyrene	µg/L	0.01	<0.010	<0.010	<0.010	-
1-Methylnaphthalene	µg/L	0.01	<0.010	0.018	0.017	-
2-Methylnaphthalene	µg/L	0.01	<0.010	0.028	0.026	-
Naphthalene	µg/L	0.05	<0.050	0.066	0.065	-
Phenanthrene	µg/L	0.02	<0.020	<0.020	<0.020	-
Pyrene	µg/L	0.01	<0.010	<0.010	<0.010	-
Quinoline	µg/L	0.05	<0.050	<0.050	<0.050	-
Volatile Organic Compounds (VOCs)						
Bromodichloromethane	µg/L	0.5	<0.50	<0.50	<0.50	-
Bromoform	µg/L	0.5	<0.50	<0.50	<0.50	-
Carbon tetrachloride	µg/L	0.5	<0.50	<0.50	<0.50	-
Chlorobenzene	µg/L	0.5	<0.50	<0.50	<0.50	-
Chloroethane	µg/L	0.5	<0.50	<0.50	<0.50	-
Chloroform	µg/L	0.5	<0.50	<0.50	<0.50	-
Chloromethane	µg/L	0.5	<0.50	<0.50	<0.50	-
Dibromochloromethane	µg/L	0.5	<0.50	<0.50	<0.50	-
1,2-Dichlorobenzene	µg/L	0.5	<0.50	<0.50	<0.50	-
1,3-Dichlorobenzene	µg/L	0.5	<0.50	<0.50	<0.50	-
1,4-Dichlorobenzene	µg/L	0.5	<0.50	<0.50	<0.50	-
1,1-Dichloroethane	µg/L	0.5	<0.50	<0.50	<0.50	-
1,2-Dichloroethane	µg/L	0.5	<0.50	<0.50	<0.50	-
1,1-Dichloroethene	µg/L	0.5	<0.50	<0.50	<0.50	-
1,2-Dichloroethene (cis)	µg/L	0.5	<0.50	<0.50	<0.50	-
1,2-Dichloroethene (trans)	µg/L	0.5	<0.50	<0.50	<0.50	-
1,2-Dichloropropane	µg/L	0.5	<0.50	<0.50	<0.50	-
1,3-Dichloropropene	µg/L	0.75	<0.75	<0.75	<0.75	-
1,3-Dichloropropene [cis]	µg/L	0.5	<0.50	<0.50	<0.50	-
1,3-Dichloropropene [trans]	µg/L	0.5	<0.50	<0.50	<0.50	-
Methylene Chloride	µg/L	0.5	<0.50	<0.50	<0.50	-
1,1,1,2-Tetrachloroethane	µg/L	0.5	<0.50	<0.50	<0.50	-
1,1,2,2-Tetrachloroethane	µg/L	0.2	<0.20	<0.20	<0.20	-
Tetrachloroethene	µg/L	0.5	<0.50	<0.50	<0.50	-
1,1,1-Trichloroethane	µg/L	0.5	<0.50	<0.50	<0.50	-
1,1,2-Trichloroethane	µg/L	0.5	<0.50	<0.50	<0.50	-
Trichloroethene	µg/L	0.5	<0.50	<0.50	<0.50	-
Trichlorofluoromethane	µg/L	0.5	<0.50	<0.50	<0.50	-
Vinyl chloride	µg/L	0.4	<0.40	<0.40	<0.40	-

Notes:

RDL - Reportable detection limit

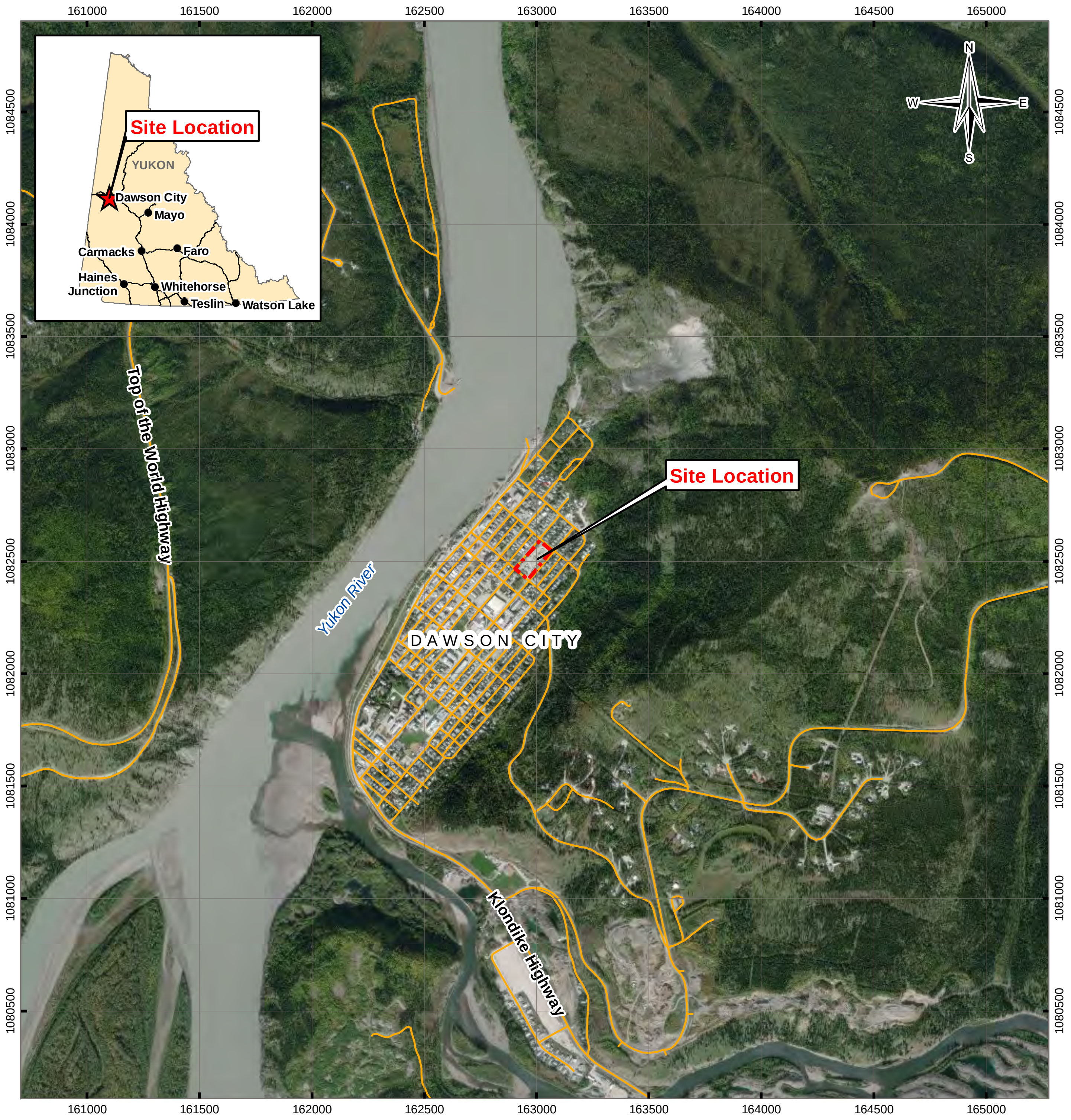
RPD - Relative Percentage Difference calculated as RPD(%)=(|V1-V2|)/[(V1+V2)/2])*100 where V1,V2 = concentrations of parent and duplicate sample, respectively.

"-" Indicates RPD not calculated. RPDs have only been calculated where a concentration is greater than 5 times the RDL

BOLD - RPD value greater than 30%

Shaded- Detect Value in Blank Sample

FIGURES



LEGEND

- 🟥 Site Boundary
- — Road

NOTES
Base data source:
Canvec (2019)
Imagery source: ESRI-Maxar (2017)

STATUS
ISSUED FOR REVIEW

PHASE II ENVIRONMENTAL SITE ASSESSMENT
1207 FIFTH AVENUE
DAWSON CITY, YUKON

Site Location

PROJECTION	DATUM	CLIENT
Yukon Albers	NAD83	Yukon

Scale: 1:25,000
500 250 0 500
Metres

FILE NO.
PENW03102-01_Figure1_SiteLoc.mxd

TETRA TECH

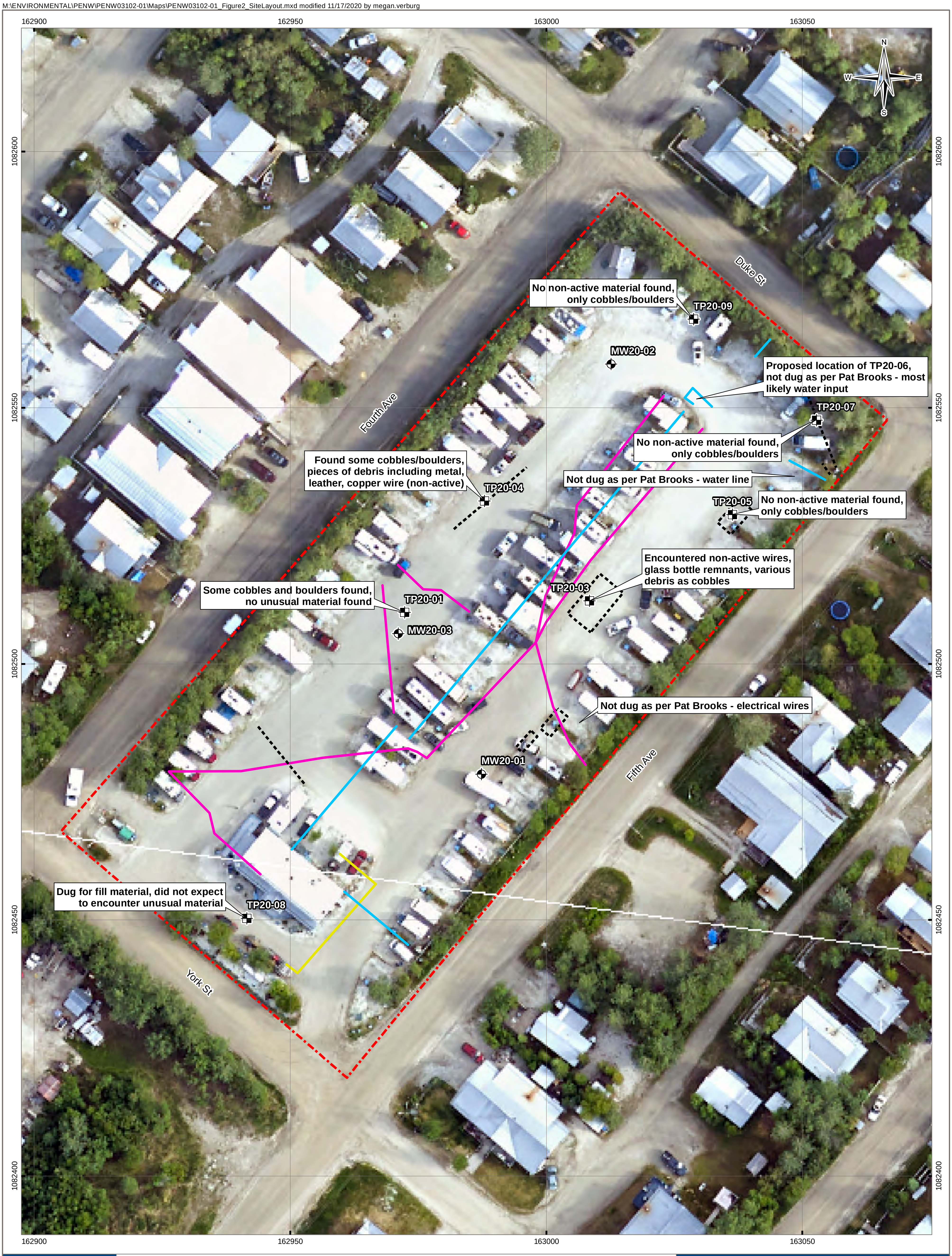
OFFICE	DWN	CKD	APVD	REV
Tt-CAL	RG	SL	RC	0

DATE	PROJECT NO.
October 28, 2020	ENW.PENW03102-01

Figure 1

M:\ENVIRONMENTAL\PENW\PENW03102-01\Maps\PENW03102-01_Figure1_SiteLoc.mxd modified 2020-10-28 by rhia.goo

M:\ENVIRONMENTAL\PENW\PENW03102-01\Maps\PENW03102-01_Figure2_SiteLayout.mxd modified 11/17/2020 by megan.verburg



LEGEND

- Site Boundary
- Monitoring Well
- Testpit
- Propane Line
- Water/Sewer Line
- Teck Cable
- Unidentified Object

NOTES
Base data source: Imagery provided by GeoYukon (June 11, 2019)

STATUS
ISSUED FOR REVIEW

PHASE II ENVIRONMENTAL SITE ASSESSMENT
1207 FIFTH AVENUE
DAWSON CITY, YUKON

Site Layout Plan

PROJECTION
Yukon Albers

DATUM
NAD83

CLIENT
Yukon

Scale: 1:700
10 5 0 10
Metres

TETRA TECH

FILE NO.
PENW03102-01_Figure2_SiteLayout.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-CAL	RG	SL	SK	0

DATE
November 17, 2020

PROJECT NO.
ENW.PENW03102-01

Figure 2

LEGEND

- Site Boundary
- Monitoring Well
- Groundwater Elevation Contour (masl)
- Inferred Groundwater Flow Direction
- (319.936 masl) Groundwater Elevation (metres above sea level)

NOTES
Base data source: Imagery provided by GeoYukon (June 11, 2019)

PHASE II ENVIRONMENTAL SITE ASSESSMENT
1207 FIFTH AVENUE
DAWSON CITY, YUKON

Groundwater Elevation Contour Map
September 25, 2020

PROJECTION Yukon Albers

DATUM NAD83

CLIENT Yukon

Scale: 1:700
10 5 0 10
Metres

TETRA TECH

FILE NO.
PENW03102-01_Figure3_GWcontour_Sept2020.mxd

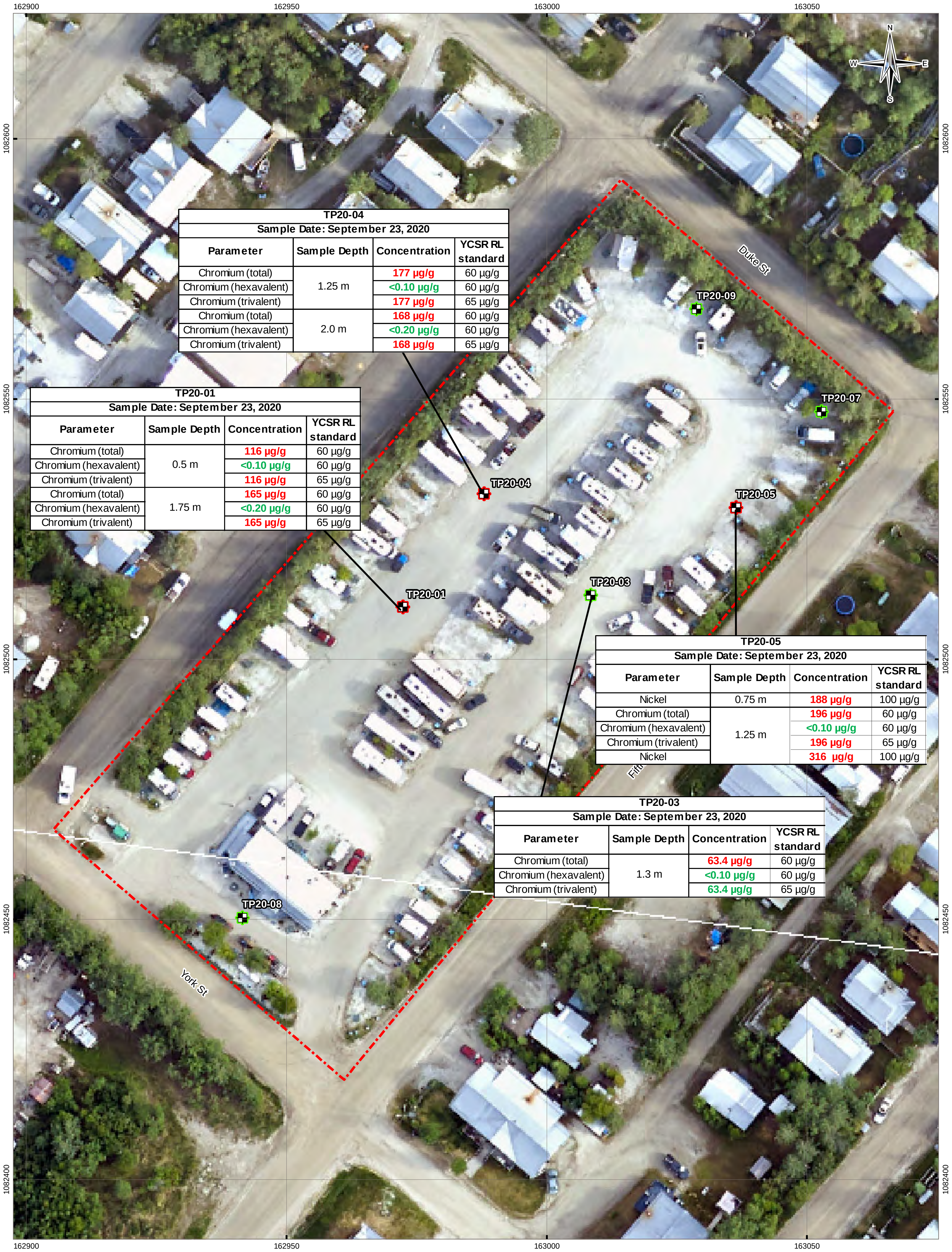
OFFICE	DWN	CKD	APVD	REV
Tt-CAL	RG	SL	SK	0

DATE October 28, 2020

PROJECT NO. ENW.PENW03102-01

Figure 3

STATUS
ISSUED FOR REVIEW



TP20-04

Sample Date: September 23, 2020

Parameter	Sample Depth	Concentration	YCSR RL standard
Chromium (total)	1.25 m	177 µg/g	60 µg/g
Chromium (hexavalent)		<0.10 µg/g	60 µg/g
Chromium (trivalent)		177 µg/g	65 µg/g
Chromium (total)	2.0 m	168 µg/g	60 µg/g
Chromium (hexavalent)		<0.20 µg/g	60 µg/g
Chromium (trivalent)		168 µg/g	65 µg/g

TP20-01

Sample Date: September 23, 2020

Parameter	Sample Depth	Concentration	YCSR RL standard
Chromium (total)	0.5 m	116 µg/g	60 µg/g
Chromium (hexavalent)		<0.10 µg/g	60 µg/g
Chromium (trivalent)		116 µg/g	65 µg/g
Chromium (total)	1.75 m	165 µg/g	60 µg/g
Chromium (hexavalent)		<0.20 µg/g	60 µg/g
Chromium (trivalent)		165 µg/g	65 µg/g

TP20-05

Sample Date: September 23, 2020

Parameter	Sample Depth	Concentration	YCSR RL standard
Nickel	0.75 m	188 µg/g	100 µg/g
Chromium (total)	1.25 m	196 µg/g	60 µg/g
Chromium (hexavalent)		<0.10 µg/g	60 µg/g
Chromium (trivalent)		196 µg/g	65 µg/g
Nickel		316 µg/g	100 µg/g

TP20-03

Sample Date: September 23, 2020

Parameter	Sample Depth	Concentration	YCSR RL standard
Chromium (total)	1.3 m	63.4 µg/g	60 µg/g
Chromium (hexavalent)		<0.10 µg/g	60 µg/g
Chromium (trivalent)		63.4 µg/g	65 µg/g

LEGEND

▭	Site Boundary
⊞	Testpit
🟥	Soil samples contain parameters with concentrations that exceeded the Yukon Contaminated Sites Regulation (YCSR) standards for residential (RL) land use
🟩	Soil samples contain parameters with concentrations that meet the YCSR standards for RL land use

NOTES
Base data source: Imagery provided by GeoYukon (June 11, 2019)

STATUS
ISSUED FOR REVIEW

PHASE II ENVIRONMENTAL SITE ASSESSMENT
1207 FIFTH AVENUE
DAWSON CITY, YUKON

Soil Analytical Results

PROJECTION Yukon Albers

DATUM NAD83

CLIENT Yukon

Scale: 1:700
10 5 0 10
Metres

FILE NO.
PENW03102-01_Figure4_SoilAnalytical_Sept2020.mxd

TETRA TECH

OFFICE	DWN	CKD	APVD	REV
Tt-CAL	RG	SL	SK	0

DATE October 28, 2020

PROJECT NO. ENW.PENW03102-01

Figure 4

M:\ENVIRONMENTAL\PENW\PENW03102-01\Maps\PENW03102-01_Figure5_GWAnalytical_Sept2020.mxd modified 2020-10-28 by rhia.goo

MW20-02
Sample Date: September 25, 2020

Parameter	Concentration	YCSR DW standard	YCSR AW standard
Arsenic	44.7 µg/L	25 µg/L	50 µg/L
Chromium	13.4 µg/L	50 µg/L	10 µg/L
Cobalt	31.3 µg/L	-	9 µg/L
Iron	32,400 µg/L	300 µg/L	-
Manganese	4760 µg/L	50 µg/L	-

MW20-03
Sample Date: September 25, 2020

Parameter	Concentration	YCSR DW standard	YCSR AW standard
Aluminum	12,000 µg/L	200 µg/L	-
Arsenic	30 µg/L	25 µg/L	50 µg/L
Barium	1030 µg/L	1000 µg/L	10,000 µg/L
Cadmium	2.42 µg/L	5 µg/L	0.6 µg/L
Chromium	39.3 µg/L	50 µg/L	10 µg/L
Cobalt	93 µg/L	-	9 µg/L
Iron	43,000 µg/L	300 µg/L	-
Lead	20.4 µg/L	10 µg/L	160 µg/L
Manganese	7990 µg/L	50 µg/L	-

MW20-01
Sample Date: September 25, 2020

Parameter	Concentration	YCSR DW standard	YCSR AW standard
Cobalt	14.0 µg/L	-	9 µg/L
Iron	1680 µg/L	300 µg/L	-
Manganese	2750 µg/L	50 µg/L	-
LEPH	1420 µg/L	-	500 µg/L
LEPH-sg	<250 µg/L	-	500 µg/L

LEGEND

- ▭ Site Boundary
- ⌖ Monitoring Well
- 🟥 Groundwater samples contain parameters with concentrations that exceeded the Yukon Contaminated Sites Regulation (YCSR) standards for drinking water (DW) and/or aquatic life (AW)
- 🟪 Groundwater samples contain parameters with concentrations that exceeded the YCSR standards for DW
- 🟧 Groundwater samples contain parameters with concentrations that exceeded the YCSR standards for AW
- 🟩 Groundwater samples contain parameters with concentrations that met the YCSR standards for DW and AW

NOTES
Base data source: Imagery provided by GeoYukon (June 11, 2019)

STATUS
ISSUED FOR REVIEW

PHASE II ENVIRONMENTAL SITE ASSESSMENT
1207 FIFTH AVENUE
DAWSON CITY, YUKON

Groundwater Analytical Results

PROJECTION
Yukon Albers

DATUM
NAD83

Scale: 1:700
10 5 0 10
Metres

FILE NO.
PENW03102-01_Figure5_GWAnalytical_Sept2020.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-CAL	RG	SL	SK	0

DATE
October 28, 2020

PROJECT NO.
ENW.PENW03102-01

CLIENT
Yukon

TETRA TECH

Figure 5

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the “Professional Document”).

The Professional Document is intended for the sole use of TETRA TECH’s Client (the “Client”) as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the “Contract” herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Professional Document is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Professional Document.

Where TETRA TECH has expressly authorized the use of the Professional Document by a third party (an “Authorized Party”), consideration for such authorization is the Authorized Party’s acceptance of these Limitations on Use of this Document as well as any limitations on liability contained in the Contract with the Client (all of which is collectively termed the “Limitations on Liability”). The Authorized Party should carefully review both these Limitations on Use of this Document and the Contract prior to making any use of the Professional Document. Any use made of the Professional Document by an Authorized Party constitutes the Authorized Party’s express acceptance of, and agreement to, the Limitations on Liability.

The Professional Document and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH’s professional work product and shall remain the copyright property of TETRA TECH.

The Professional Document is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Document, if required, may be obtained upon request.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH’s “Instruments of Professional Service”), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH’s Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH’s Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client’s current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by persons other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary investigation and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

APPENDIX B

BOREHOLE LOGS

BOREHOLE KEYSHEET

Water Level Measurement

- ▼ Measured in standpipe, piezometer or well
- ▽ Inferred

Sample Types

- ☰ A-Casing
- ◫ Core
- ■ Disturbed, Bag, Grab
- ▮ HQ Core
- ⧅ Jar
- ⧅ Jar and Bag
- ⧓ 75 mm SPT
- ◢ No Recovery
- ☒ Split Spoon/SPT
- ▥ Tube
- ◥ CRREL Core

Backfill Materials

- ■ Asphalt
- ■ Bentonite
- ▒ Cement/ Grout
- ▧ Drill Cuttings
- ⁘ Grout
- ⁘ Gravel
- ⁛ Sand
- ▥ Slough
- ▒ Topsoil Backfill

Lithology - Graphical Legend[1]

- ■ Asphalt
- ▧ Bedrock
- ○ Cobbles/Boulders
- ▨ Clay
- ■ Coal
- ▒ Concrete
- ▩ Fill
- ○ Gravel
- ▦ Limestone
- ◇ Mudstone
- ≋ Organics
- ⁂ Peat
- ⁛ Sand
- ⊠ Sandstone
- ☰ Shale
- ▥ Silt
- ⊠ Siltstone
- ⊠ Conglomerate
- ▒ Topsoil
- ▩ Till

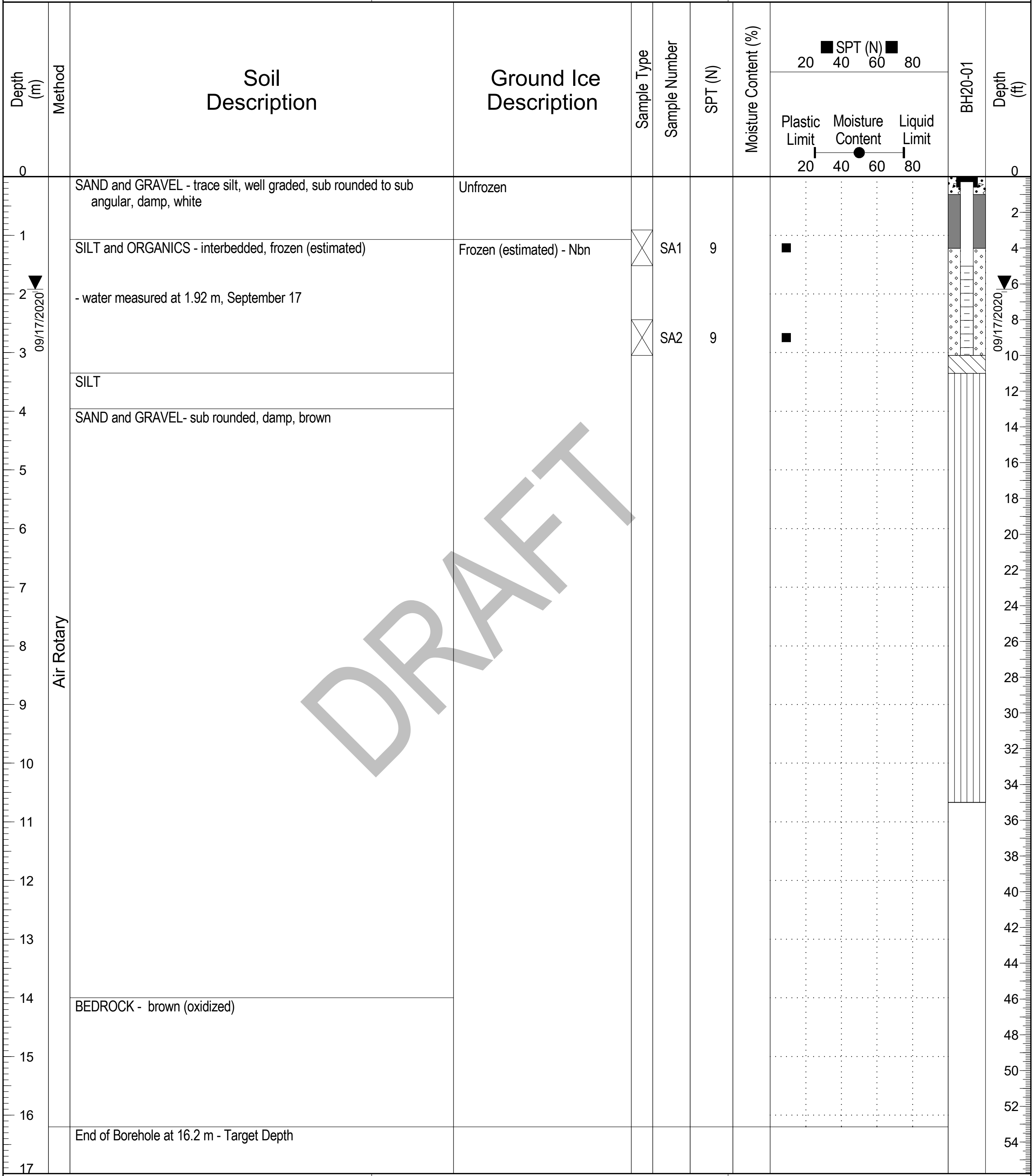
1. The graphical legend is an approximation and for visual representation only. Soil strata may comprise a combination of the basic symbols shown above. Particle sizes are not drawn to scale

TETRA TECH

Borehole No: **BH20-01**

Project: Detailed Recreation Center Evaluation	Project No: 704-ENG.WARC03386-65
Location: Gold Rush Campground	
Dawson City	UTM: 576781 E; 7105019 N; Z 7 NAD83

Method	Soil Description	Ground Ice Description	Sample Type	Sample Number	SPT (N)	Moisture Content (%)
Air Rotary	SAND and GRAVEL - trace silt, well graded, sub rounded to sub angular, damp, white	Unfrozen				
	SILT and ORGANICS - interbedded, frozen (estimated) - water measured at 1.92 m, September 17	Frozen (estimated) - Nbn	☒ ☒	SA1 SA2	9 9	
	SILT					
	SAND and GRAVEL- sub rounded, damp, brown					
	BEDROCK - brown (oxidized)					
	End of Borehole at 16.2 m - Target Depth					



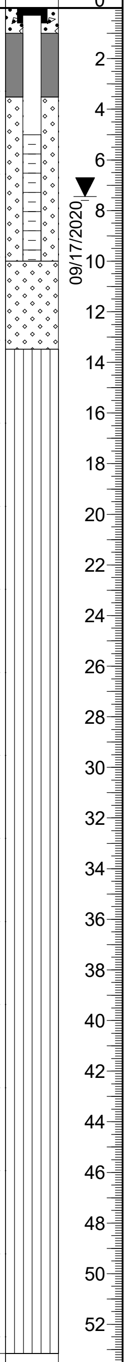
Contractor: Midnight Sun Drilling	Completion Depth: 16.2 m
Drilling Rig Type: Rig 5	Start Date: 2020 September 15
Logged By: TTP	Completion Date: 2020 September 15
Reviewed By: JRT	Page 1 of 1

Borehole No: **BH20-02**

Project: Detailed Recreation Center Evaluation	Project No: 704-ENG.WARC03386-65
Location: Gold Rush Campground	
Dawson City	UTM: 576798 E; 7105105 N; Z 7 NAD83

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)
0	Air Rotary	SAND and GRAVEL - trace silt, well graded, sub rounded to sub angular, damp, white	Unfrozen	
		SILT and ORGANICS - interbedded, frozen (estimated)	Frozen (estimated) - Nbn	
09/17/2020		- water measured at 2.27, September 17		
		SAND and GRAVEL- sub rounded, damp, brown		
		BEDROCK - brown - grey - light brown		
		End of Borehole at 16.2 m - Target Depth		

Plastic Limit — Moisture Content — Liquid Limit: 20, 40, 60, 80

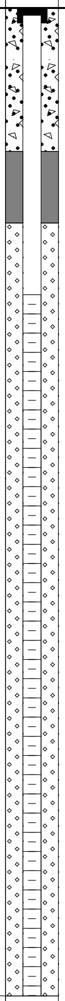


Contractor: Midnight Sun Drilling	Completion Depth: 16.2 m
Drilling Rig Type: Rig 5	Start Date: 2020 September 15
Logged By: TTP	Completion Date: 2020 September 16
Reviewed By: JRT	Page 1 of 1

Borehole No: **BH20-03**

Project: Detailed Recreation Center Evaluation	Project No: 704-ENG.WARC03386-65
Location: Gold Rush Campground	
Dawson City	UTM: 576766 E; 7105049 N; Z 7 NAD83

Depth (m)	Method	Soil Description	Ground Ice Description	Moisture Content (%)	Plastic Limit / Moisture Content / Liquid Limit 20 40 60 80	BH20-03	Depth (ft)
0	Air Rotary	SAND and GRAVEL - trace silt, well graded, sub rounded to sub angular, damp, white	Unfrozen				0
1							1 2 3
		SILT and ORGANICS - interbedded, frozen (estimated)	Frozen (estimated) - Nbn				4 5
09/17/2020		- water measured at 1.7 m, September 17					09/17/2020 6
2		End of Borehole at 2.1 m - Broken Drill					7 8 9
3							

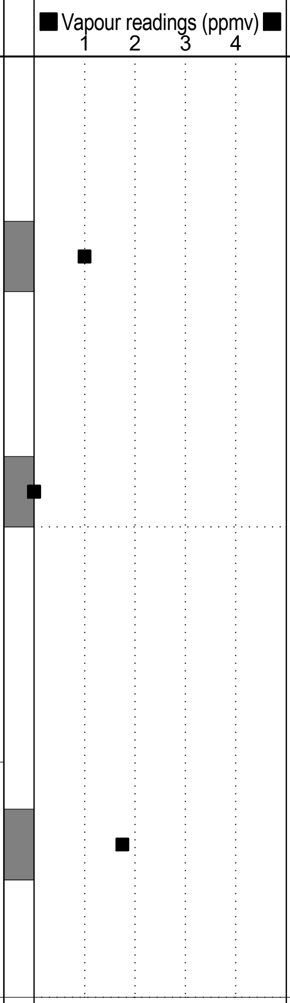


Contractor: Midnight Sun Drilling	Completion Depth: 2.1 m
Drilling Rig Type: Rig 5	Start Date: 2020 September 16
Logged By: TTP	Completion Date: 2020 September 16
Reviewed By: JRT	Page 1 of 1

Testpit No: **TP20-01**

Project: Phase II Environmental Site Assessment	Project No: ENW.PENW03102-01
Location: 1207 Fifth Avenue (Goldrush Campground)	
Dawson City, Yukon	

Depth (m)	Method	Soil Description	Notes and Comments	Depth (ft)
0	Excavated	SAND (FILL) - gravelly, some cobbles, trace boulders, damp, light brown, coarse sand		0
			Analyzed for LEPH, HEPH, PAH and metals	1
		- grey green, medium sand		2
1			Analyzed for BTEXS, MTBE, VPH and VH	3
				4
		SILT AND ORGANICS - clayey, roots, moist, non plastic, dark brown		5
			Analyzed for speciated chromium	6
2		END OF TESTPIT (2.0 metres) Note: Reached target depth		7
				8
				9
3				

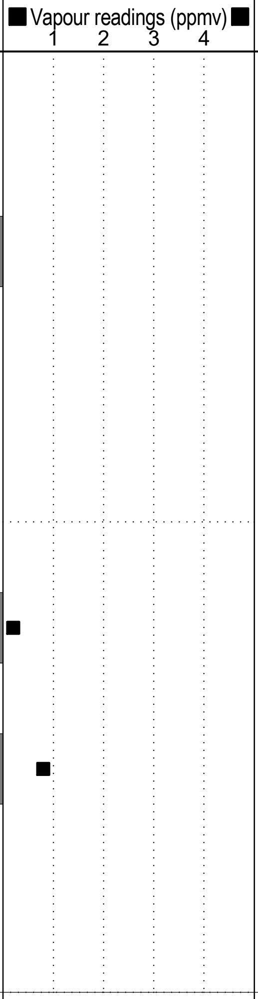


Contractor: Grenon	Completion Depth: 2 m
Drilling Rig Type: 416 Rubber Tire Backhoe/Loader	Start Date: 2020 September 23
Logged By: KS	Completion Date: 2020 September 23
Reviewed By: EOB	Page 1 of 1

Testpit No: **TP20-03**

Project: Phase II Environmental Site Assessment	Project No: ENW.PENW03102-01
Location: 1207 Fifth Avenue (Goldrush Campground)	
Dawson City, Yukon	

Depth (m)	Method	Soil Description	Sample Type	Vapour readings (ppmv)	Notes and Comments	Depth (ft)
0	Excavated	SAND (FILL) - gravelly, some cobbles, trace boulders, damp, light brown, contains wires, old metal, glass bottles and butcher bones				0
			▨		Analyzed for metals	1
						2
						3
1						
		- silty, trace cobbles, grey green, contains metal wiring	▨	■	Analyzed for LEPH, HEPH, PAH, VPH, VH, VOC, glycols and metals	4
		SILT AND ORGANICS - clayey, moist, non plastic, dark brown, organics lenses	▨	■		5
						6
2		END OF TESTPIT (2.0 metres) Note: Reached target depth				
						7
						8
						9
3						



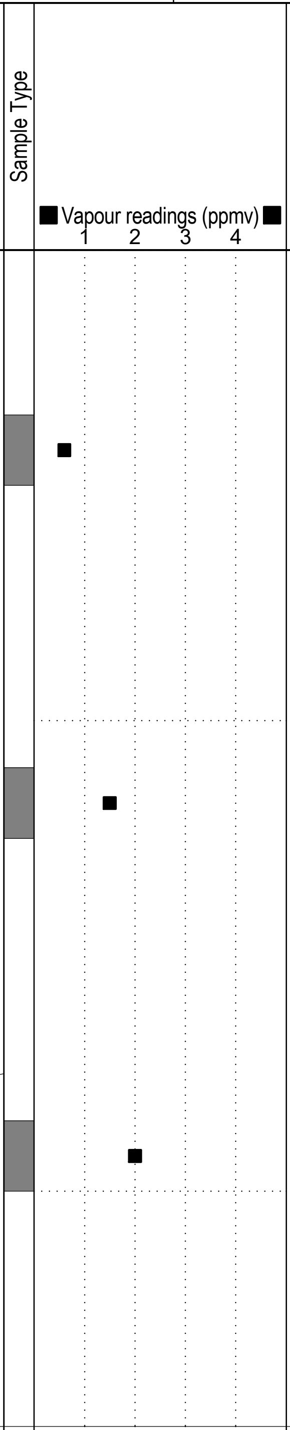
Contractor: Grenon	Completion Depth: 2 m
Drilling Rig Type: 416 Rubber Tire Backhoe/Loader	Start Date: 2020 September 23
Logged By: KS	Completion Date: 2020 September 23
Reviewed By: EOB	Page 1 of 1

Yukon

Testpit No: **TP20-04**

Project: Phase II Environmental Site Assessment	Project No: ENW.PENW03102-01
Location: 1207 Fifth Avenue (Goldrush Campground)	
Dawson City, Yukon	

Depth (m)	Method	Soil Description	Notes and Comments	Depth (ft)
0	Excavated	SAND (FILL) - gravelly, some cobbles, trace boulders, damp, light brown, coarse sand		0
			Analyzed for LEPH, HEPH, PAH, BTEXS, MTBE, VPH, VH and metals	1 2
		- silty, trace cobbles, grey green		3
1				4 5
		- insulated copper wire, tin sheet, old leather boot		
		SILT AND ORGANICS - clayey, moist, non plastic, dark brown	Analyzed for speciated chromium	6
2				7 8
		END OF TESTPIT (2.5 metres) Note: Reached target depth		9
3				



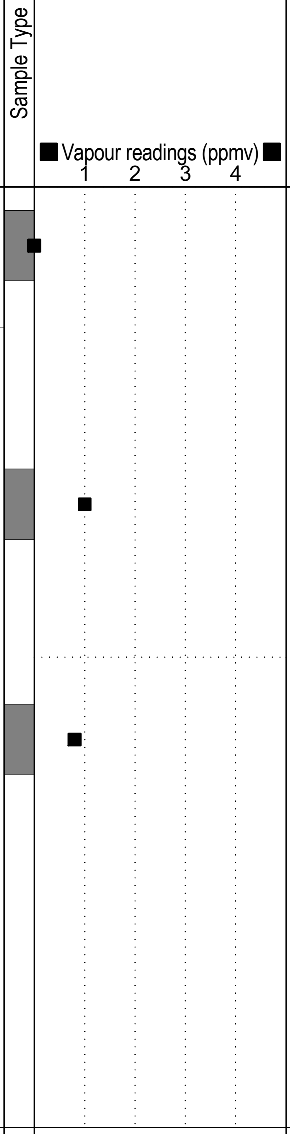
TETRA TECH

Contractor: Grenon	Completion Depth: 2.5 m
Drilling Rig Type: 416 Rubber Tire Backhoe/Loader	Start Date: 2020 September 23
Logged By: KS	Completion Date: 2020 September 23
Reviewed By: EOB	Page 1 of 1

Testpit No: **TP20-05**

Project: Phase II Environmental Site Assessment	Project No: ENW.PENW03102-01
Location: 1207 Fifth Avenue (Goldrush Campground)	
Dawson City, Yukon	

Depth (m)	Method	Soil Description	Notes and Comments
0	Excavated	SAND (FILL) - gravelly, some cobbles, some boulders, damp, light brown, coarse sand, boulders to 500 mm diameter	
		SILT AND ORGANICS - clayey, damp, non plastic, dark brown, organic lenses	Analyzed for nickel Analyzed for LEPH, HEPH, PAH and metals
2		END OF TESTPIT (2.0 metres) Note: Reached target depth	
3			



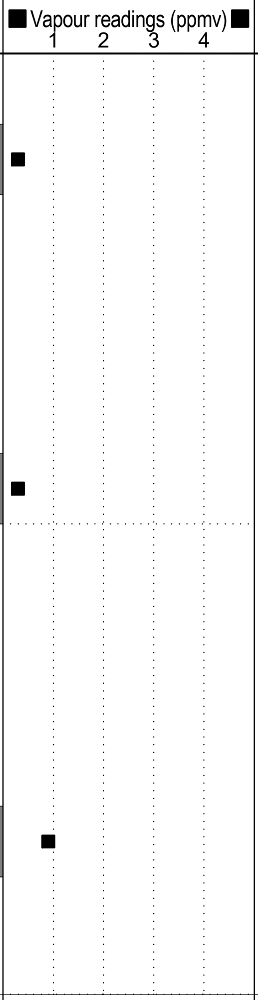
Depth (ft): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

Contractor: Grenon	Completion Depth: 2 m
Drilling Rig Type: 416 Rubber Tire Backhoe/Loader	Start Date: 2020 September 23
Logged By: KS	Completion Date: 2020 September 23
Reviewed By: EOB	Page 1 of 1

Testpit No: **TP20-07**

Project: Phase II Environmental Site Assessment	Project No: ENW.PENW03102-01
Location: 1207 Fifth Avenue (Goldrush Campground)	
Dawson City, Yukon	

Depth (m)	Method	Soil Description	Sample Type	Notes and Comments	Depth (ft)
0	Excavated	SAND (FILL) - gravelly, some cobbles, damp, light brown, coarse sand	▨	Analyzed for LEPH, HEPH, PAH, BTEXS, MTBE, VPH, VH and metals	0 1
		SILT AND ORGANICS - clayey, some cobbles, damp, non plastic, brown, subangular cobbles	▨		2 3
1		- no visible cobbles, darker brown	▨		4 5 6
2		END OF TESTPIT (2.0 metres) Note: Reached target depth			7 8 9
3					

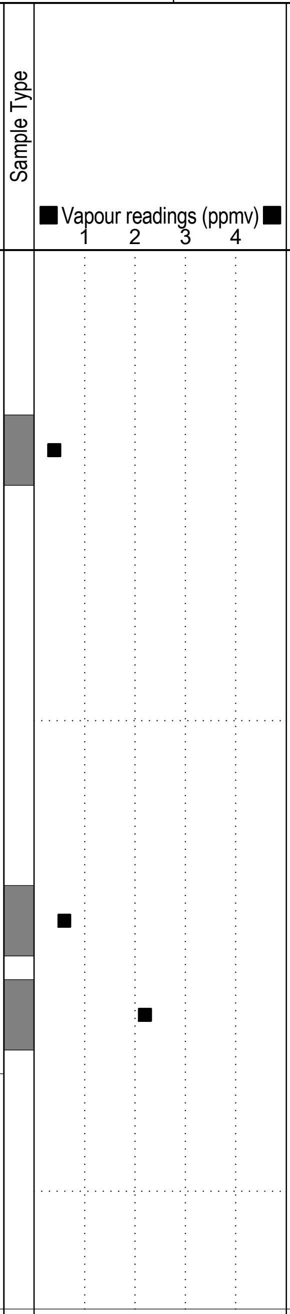


Contractor: Grenon	Completion Depth: 2 m
Drilling Rig Type: 416 Rubber Tire Backhoe/Loader	Start Date: 2020 September 23
Logged By: KS	Completion Date: 2020 September 23
Reviewed By: EOB	Page 1 of 1

Testpit No: **TP20-08**

Project: Phase II Environmental Site Assessment
Project No: ENW.PENW03102-01
Location: 1207 Fifth Avenue (Goldrush Campground)
Dawson City, Yukon

Depth (m)	Method	Soil Description	Notes and Comments	Depth (ft)
0	Excavated	SAND (FILL) - gravelly, some cobbles, damp, light brown, coarse sand	Analyzed for LEPH, HEPH, PAH and metals	0
1		- silty, some gravel, brown	Analyzed for VOC, VPH and VH	
2		SILT AND ORGANICS - clayey, moist, firm, non plastic, dark brown		
3		END OF TESTPIT (2.25 metres) Note: Reached target depth		9

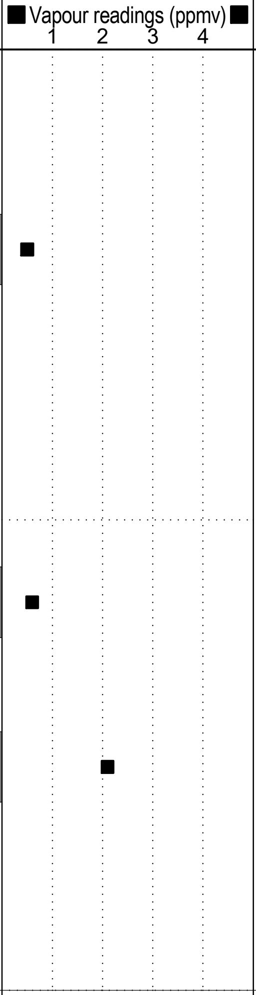


Contractor: Grenon
Completion Depth: 2.25 m
Drilling Rig Type: 416 Rubber Tire Backhoe/Loader
Start Date: 2020 September 23
Logged By: KS
Completion Date: 2020 September 23
Reviewed By: EOB

Testpit No: **TP20-09**

Project: Phase II Environmental Site Assessment	Project No: ENW.PENW03102-01
Location: 1207 Fifth Avenue (Goldrush Campground)	
Dawson City, Yukon	

Depth (m)	Method	Soil Description	Sample Type	Notes and Comments	Depth (ft)
0	Excavated	SAND (FILL) - gravelly, some cobbles, trace boulders, damp, light brown, coarse sand			0
			▨	Analyzed for LEPH, HEPH, PAH and metals	1
		- no visible gravel, grey brown, medium sand, subangular cobbles and boulders			2 3
1			▨	Analyzed for BTEXS, MTBE, VPH and VH	4
		SILT AND ORGANICS - clayey, moist, non plastic, dark brown	▨		5 6
2		END OF TESTPIT (2.0 metres) Note: Reached target depth			7 8 9
3					



Contractor: Grenon	Completion Depth: 2 m
Drilling Rig Type: 416 Rubber Tire Backhoe/Loader	Start Date: 2020 September 23
Logged By: KS	Completion Date: 2020 September 23
Reviewed By: EOB	Page 1 of 1

APPENDIX C

QUALITY ASSURANCE/QUALITY CONTROL SUMMARY

Tetra Tech Quality Assurance/Quality Control Program

During the Phase II ESA, Tetra Tech implemented a Quality Assurance/Quality Control (QA/QC) program to ensure the integrity of the sampling methods and analytical testing. The QA/QC program adhered to Tetra Tech's in-house Quality Management System (QMS), which was designed to generate representative samples, minimize the potential for cross-contamination between sampling locations and samples, and reduce the potential for systematic bias.

The QA/QC program included the following tasks:

- Logging subsurface conditions and sampling of environmental media;
- Recording the results of field activities in the field concurrent with the activities;
- Use of clean, new sampling gloves at each sampling location;
- Placing samples into new, labelled laboratory-supplied containers;
- Transporting temperature-sensitive samples to ALS in chilled coolers using chain-of-custody procedures;
- Using a Canadian Association for Laboratory Accreditation (CALA)-accredited laboratory that is qualified to analyze the samples using Yukon Environment-approved procedures;
- Requiring that one person who did not compile the tables appearing in this report review the tables and compare the tabulated analytical results with the original information appearing on the laboratory certificates to verify the accuracy of the information in the tables; and
- Conducting a review of this report by a qualified senior Tetra Tech professional to ensure that the report meets Tetra Tech technical and reporting requirements.

The duplicate pairs submitted for laboratory testing were as follows:

- Soil duplicates:
  - TP20-05-1.25m (duplicate designated TP00-05-1.25m) – analyzed for metals, LEPH, HEPH, PAH and speciated chromium
- Groundwater duplicate:
  - MW20-01 (duplicate designated DUP) – analyzed for dissolved metals, VOCs, LEPH, HEPH, PAH, VPH, VH and glycols

Tetra Tech formed the duplicate sample by alternately placing approximately 10% of the sample volume into the original sample container and then placing the same amount into the duplicate sample container. Tetra Tech continued placing additional aliquots of approximately 10% of the sample volume into each container until both containers were filled.

Part of the QA/QC program involved calculating the RPD between sample concentrations of paired blind duplicates. Results were calculated as follows:

$$\text{RPD (\%)} = 2 \times 100 \times |X - Y| / (X + Y)$$

Where:

X = the measured concentration in the original sample; and
Y = the measured concentration in the duplicate sample.

RPDs should be calculated and assessed only when both the sample and the duplicate concentration is greater than five times the method detection limit (MDL), referred to as the Practical Quantification Limit (PQL).

Duplicate results were considered as having passed the QA/QC reproducibility goal if the RPD is less than or equal to the trigger value of 30%, indicating a close correlation between the sample-duplicate pair. Should the RPD exceed the recommended value, an explanation for the variation is required.

APPENDIX D

LABORATORY CERTIFICATES

Yeung, Shelila

From: Brent Mack <Brent.Mack@ALSGlobal.com>
Sent: October 20, 2020 3:38 PM
To: Croxall, Roxanne
Subject: RE: [EXTERNAL] - High Variability

Hi Roxanne,

Looking at our own Lab Dups for this report we noted Sample Heterogeneity as well, so that's your likely source for the RPDs for these Metals below. All QA/QC, calculations, labels, etc. in the batch looks good.

Brent

Brent Mack
Account Manager, Environmental
Vancouver Laboratory

T +1 604 253 4188 **D** +1 778 370 3279
F +1 604 253 6700
brent.mack@alsglobal.com
8081 Lougheed Hwy
Burnaby, BC, Canada, V5A 1W9

From: Croxall, Roxanne [mailto:Roxanne.Croxall@tetratech.com]
Sent: Tuesday, October 20, 2020 2:13 PM
To: Brent Mack <Brent.Mack@ALSGlobal.com>
Subject: [EXTERNAL] - High Variability

Hi Brent,

We are currently completing the QA/QC section of our report for PN: ENW.PENW03102-01 and noticed quite a bit of variability between the following duplicate samples:

- TP20-05-1.25 (WR2000970-015) and TP00-03 (WR2000970-022)
    - Chromium relative percent difference (RPD) = 60%
    - Magnesium RPD = 47%
- MW20-01 (WR2000970-023) and DUP (WR2000970-026)
    - Copper RPD = 32%

Can you confirm/discuss the following for these samples:

- All samples were labelled correctly;
- All preparation and analysis procedures were completed within ALS' standard operating procedures;
- The calibration and quality control measured for the laboratory analysis were correct and adequate;
- No errors occurred within data calculations; and
- No interferences or issues occurred with laboratory instruments.

We are not requesting any material be reanalyzed but instead just hoping to get a response to help address the poor QA/QC results associated with the ALS lab results in the report.

Thanks again,

Roxanne Croxall, B.Sc., GIT | Environmental Scientist
Direct **+1 (778) 744-5938**| Mobile **+1 (250) 714-2760**| Roxanne.Croxall@tetratech.com

Tetra Tech | Complex World, Clear Solutions™ |
Unit 1 – 4376 Boban Dr., Nanaimo, BC V9T 6A7 | tetratech.com

CERTIFICATE OF ANALYSIS

Work Order	: **WR2000970**	Page	: 1 of 19
Amendment	: **4**		
Client	: **Tetra Tech Canada Inc.**	Laboratory	: Whitehorse - Environmental
Contact	: Kristina Schmidt	Account Manager	: Brent Mack
Address	: 61 Wasson Place Whitehorse YT Canada Y1A 0H7	Address	: #12 151 Industrial Road Whitehorse YT Canada Y1A 2V3
Telephone	: ----	Telephone	: +1 867 668 6689
Project	: 704-ENW.PENW03102-01	Date Samples Received	: 29-Sep-2020 16:20
PO	: ----	Date Analysis Commenced	: 03-Oct-2020
C-O-C number	: ----	Issue Date	: 27-Oct-2020 10:26
Sampler	: KS		
Site	: ----		
Quote number	: Standard Client Price List (BC & YK)		
No. of samples received	: 27		
No. of samples analysed	: 20		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Drake	Lab Analyst	Inorganics, Edmonton, Alberta
Ann Ho	Laboratory Analyst	Metals, Burnaby, British Columbia
Brieanna Allen	Department Manager - Organics	Organics, Burnaby, British Columbia
Gloria Chan	Lab Analyst	Metals, Burnaby, British Columbia
Jashan Kaur	Lab Assistant	Metals, Burnaby, British Columbia
Jeanie Mark		Organics, Calgary, Alberta
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Ophelia Chiu	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Ping Yeung	Team Leader - Inorganics	Inorganics, Edmonton, Alberta
Ping Yeung	Team Leader - Inorganics	Metals, Edmonton, Alberta
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Shaneel Dayal	Analyst	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in reports identified as "Preliminary Report" are considered authorized for use.

Workorder Comments

RRR = Detection limits raised for Antimony due to a high Antimony recovery in the reference material. Non-detect results for Antimony are considered reliable.

Qualifiers

Qualifier	*Description*
DLA	*Detection Limit adjusted for required dilution.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
RRR	*Refer to report remarks for issues regarding this analysis.*
SUR-ND	*Surrogate recovery marginally exceeded ALS DQO. Reported non-detect results for associated samples were deemed to be unaffected.*

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

				Client sample ID	**TP20-01-0.5m**	**TP20-01-1.0m**	**TP20-01-1.75m**	**TP20-04-1.25m**	**TP20-04-2.0m**
				Client sampling date / time	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
Analyte	CAS Number	Method	LOR	Unit	**WR2000970-001**	**WR2000970-002**	**WR2000970-003**	**WR2000970-005**	**WR2000970-006**
					Result	Result	Result	Result	Result
Physical Tests									
moisture	----	E144	0.25	%	5.49	8.92	32.6	13.4	40.5
pH (1:2 soil:water)	----	E108	0.10	pH units	8.88	----	----	8.42	----
Metals									
aluminum	7429-90-5	E440	50	mg/kg	9530	----	----	34100	----
antimony	7440-36-0	E440	0.10	mg/kg	<0.40 RRR	----	----	<0.40 RRR	----
arsenic	7440-38-2	E440	0.10	mg/kg	4.23	----	----	3.54	----
barium	7440-39-3	E440	0.50	mg/kg	78.8	----	----	44.2	----
beryllium	7440-41-7	E440	0.10	mg/kg	0.18	----	----	0.28	----
bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	----	----	<0.20	----
boron	7440-42-8	E440	5.0	mg/kg	<5.0	----	----	<5.0	----
cadmium	7440-43-9	E440	0.020	mg/kg	0.110	----	----	0.022	----
calcium	7440-70-2	E440	50	mg/kg	2020	----	----	5910	----
chromium	7440-47-3	E440	0.50	mg/kg	116	----	165	177	168
cobalt	7440-48-4	E440	0.10	mg/kg	9.19	----	----	31.4	----
copper	7440-50-8	E440	0.50	mg/kg	15.6	----	----	39.3	----
iron	7439-89-6	E440	50	mg/kg	14000	----	----	49700	----
lead	7439-92-1	E440	0.50	mg/kg	4.91	----	----	2.11	----
lithium	7439-93-2	E440	2.0	mg/kg	9.4	----	----	30.4	----
magnesium	7439-95-4	E440	20	mg/kg	9650	----	----	30300	----
manganese	7439-96-5	E440	1.0	mg/kg	169	----	----	508	----
mercury	7439-97-6	E510	0.0050	mg/kg	0.0201	----	----	----	----
mercury	7439-97-6	E510	0.0500	mg/kg	----	----	----	<0.0500	----
molybdenum	7439-98-7	E440	0.10	mg/kg	0.27	----	----	<0.10	----
nickel	7440-02-0	E440	0.50	mg/kg	46.0	----	----	85.5	----
phosphorus	7723-14-0	E440	50	mg/kg	339	----	----	88	----
potassium	7440-09-7	E440	100	mg/kg	550	----	----	370	----
selenium	7782-49-2	E440	0.20	mg/kg	<0.20	----	----	<0.20	----
silver	7440-22-4	E440	0.10	mg/kg	<0.10	----	----	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----	----	114	----
strontium	7440-24-6	E440	0.50	mg/kg	11.9	----	----	19.8	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----	----	<1000	----

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid)**

				Client sample ID	TP20-01-0.5m	TP20-01-1.0m	TP20-01-1.75m	TP20-04-1.25m	TP20-04-2.0m
				Client sampling date / time	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
Analyte	CAS Number	Method	LOR	Unit	WR2000970-001	WR2000970-002	WR2000970-003	WR2000970-005	WR2000970-006
					Result	Result	Result	Result	Result
Metals									
thallium	7440-28-0	E440	0.050	mg/kg	<0.050	----	----	<0.050	----
tin	7440-31-5	E440	2.0	mg/kg	<2.0	----	----	<2.0	----
titanium	7440-32-6	E440	1.0	mg/kg	245	----	----	1100	----
tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	----	----	<0.50	----
uranium	7440-61-1	E440	0.050	mg/kg	0.510	----	----	0.215	----
vanadium	7440-62-2	E440	0.20	mg/kg	29.6	----	----	102	----
zinc	7440-66-6	E440	2.0	mg/kg	28.0	----	----	43.9	----
zirconium	7440-67-7	E440	1.0	mg/kg	2.6	----	----	1.1	----
Speciated Metals									
chromium, hexavalent [Cr VI]	18540-29-9	E532	0.10	mg/kg	<0.10	----	<0.20 DLM	<0.10	<0.20 DLM
chromium, trivalent [Cr III]	16065-83-1	EC535C	0.030	mg/kg	116	----	165	177	168
Volatile Organic Compounds [BTEXS+MTBE]									
benzene	71-43-2	E611A	0.0050	mg/kg	----	<0.0050	----	<0.0050	----
ethylbenzene	100-41-4	E611A	0.015	mg/kg	----	<0.015	----	<0.015	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.200	mg/kg	----	<0.200	----	<0.200	----
styrene	100-42-5	E611A	0.050	mg/kg	----	<0.050	----	<0.050	----
toluene	108-88-3	E611A	0.050	mg/kg	----	<0.050	----	<0.050	----
xylene, m+p-	179601-23-1	E611A	0.050	mg/kg	----	<0.050	----	<0.050	----
xylene, o-	95-47-6	E611A	0.050	mg/kg	----	<0.050	----	<0.050	----
xylenes, total	1330-20-7	E611A	0.075	mg/kg	----	<0.075	----	<0.075	----
Volatile Organic Compounds Surrogates									
bromofluorobenzene, 4-	460-00-4	E611A	0.050	%	----	98.6	----	93.7	----
difluorobenzene, 1,4-	540-36-3	E611A	0.050	%	----	106	----	118	----
Hydrocarbons									
EPH (C10-C19)	----	E601A	200	mg/kg	<200	----	----	<200	----
EPH (C19-C32)	----	E601A	200	mg/kg	<200	----	----	<200	----
VHs (C6-C10)	----	E581.VH+F1	10	mg/kg	----	<10	----	<10	----
HEPHs	----	EC600A	200	mg/kg	<200	----	----	<200	----
LEPHs	----	EC600A	200	mg/kg	<200	----	----	<200	----
VPHs	----	EC580A	10	mg/kg	----	<10	----	<10	----
Hydrocarbons Surrogates									
bromobenzotrifluoride, 2- (EPH surr)	392-83-6	E601A	5.0	%	95.3	----	----	92.5	----

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

Client sample ID					**TP20-01-0.5m**	**TP20-01-1.0m**	**TP20-01-1.75m**	**TP20-04-1.25m**	**TP20-04-2.0m**
Client sampling date / time					23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**WR2000970-001**	**WR2000970-002**	**WR2000970-003**	**WR2000970-005**	**WR2000970-006**
					Result	Result	Result	Result	Result
Hydrocarbons Surrogates									
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%	----	106	----	68.4 SUR-ND	----
Polycyclic Aromatic Hydrocarbons									
acenaphthene	83-32-9	E641A-L	0.0050	mg/kg	<0.0050	----	----	<0.0050	----
acenaphthylene	208-96-8	E641A-L	0.0050	mg/kg	<0.0050	----	----	<0.0050	----
acridine	260-94-6	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
anthracene	120-12-7	E641A-L	0.0040	mg/kg	<0.0040	----	----	<0.0040	----
benz(a)anthracene	56-55-3	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
benzo(a)pyrene	50-32-8	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
benzo(b+j)fluoranthene	----	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
benzo(b+j+k)fluoranthene	----	E641A-L	0.015	mg/kg	<0.015	----	----	<0.015	----
benzo(g,h,i)perylene	191-24-2	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
benzo(k)fluoranthene	207-08-9	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
chrysene	218-01-9	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
dibenz(a,h)anthracene	53-70-3	E641A-L	0.0050	mg/kg	<0.0050	----	----	<0.0050	----
fluoranthene	206-44-0	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
fluorene	86-73-7	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
methylnaphthalene, 1-	90-12-0	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
methylnaphthalene, 2-	91-57-6	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
naphthalene	91-20-3	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
phenanthrene	85-01-8	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
pyrene	129-00-0	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
quinoline	6027-02-7	E641A-L	0.010	mg/kg	<0.010	----	----	<0.010	----
B(a)P total potency equivalents [B(a)P TPE]	----	E641A-L	0.020	mg/kg	<0.010	----	----	<0.010	----
IACR (CCME)	----	E641A-L	0.15	mg/kg	<0.11	----	----	<0.11	----
Polycyclic Aromatic Hydrocarbons Surrogates									
acridine-d9	34749-75-2	E641A-L	0.010	%	92.6	----	----	78.6	----
chrysene-d12	1719-03-5	E641A-L	0.010	%	111	----	----	94.1	----
naphthalene-d8	1146-65-2	E641A-L	0.010	%	105	----	----	86.1	----
phenanthrene-d10	1517-22-2	E641A-L	0.010	%	107	----	----	90.8	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

				Client sample ID	**TP20-9-0.5m**	**TP20-09-1.25m**	**TP20-07-0.3m**	**TP20-05-0.75m**	**TP20-05-1.25m**
				Client sampling date / time	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**WR2000970-007**	**WR2000970-008**	**WR2000970-010**	**WR2000970-014**	**WR2000970-015**
					Result	Result	Result	Result	Result
Physical Tests									
moisture	----	E144	0.25	%	4.26	10.6	3.66	----	17.4
pH (1:2 soil:water)	----	E108	0.10	pH units	7.83	----	8.51	----	7.64
Metals									
aluminum	7429-90-5	E440	50	mg/kg	2880	----	2840	----	14500
antimony	7440-36-0	E440	0.10	mg/kg	<0.30 RRR	----	<0.30 RRR	----	<0.80 RRR
arsenic	7440-38-2	E440	0.10	mg/kg	2.18	----	2.74	----	7.01
barium	7440-39-3	E440	0.50	mg/kg	106	----	71.4	----	257
beryllium	7440-41-7	E440	0.10	mg/kg	0.11	----	0.13	----	0.29
bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	----	<0.20	----	<0.20
boron	7440-42-8	E440	5.0	mg/kg	<5.0	----	<5.0	----	<5.0
cadmium	7440-43-9	E440	0.020	mg/kg	0.061	----	0.075	----	0.118
calcium	7440-70-2	E440	50	mg/kg	678	----	852	----	5300
chromium	7440-47-3	E440	0.50	mg/kg	28.2	----	8.19	----	196
cobalt	7440-48-4	E440	0.10	mg/kg	2.66	----	1.85	----	24.7
copper	7440-50-8	E440	0.50	mg/kg	7.50	----	8.39	----	24.0
iron	7439-89-6	E440	50	mg/kg	3670	----	4180	----	25500
lead	7439-92-1	E440	0.50	mg/kg	5.30	----	6.51	----	5.66
lithium	7439-93-2	E440	2.0	mg/kg	3.3	----	3.6	----	12.8
magnesium	7439-95-4	E440	20	mg/kg	2880	----	1320	----	19600
manganese	7439-96-5	E440	1.0	mg/kg	42.8	----	44.7	----	371
mercury	7439-97-6	E510	0.0500	mg/kg	<0.0500	----	<0.0500	----	<0.0500
molybdenum	7439-98-7	E440	0.10	mg/kg	0.15	----	0.22	----	0.34
nickel	7440-02-0	E440	0.50	mg/kg	29.3	----	10.4	188	316
phosphorus	7723-14-0	E440	50	mg/kg	135	----	150	----	520
potassium	7440-09-7	E440	100	mg/kg	570	----	530	----	390
selenium	7782-49-2	E440	0.20	mg/kg	<0.20	----	<0.20	----	<0.20
silver	7440-22-4	E440	0.10	mg/kg	<0.10	----	<0.10	----	<0.10
sodium	7440-23-5	E440	50	mg/kg	<50	----	<50	----	195
strontium	7440-24-6	E440	0.50	mg/kg	5.12	----	6.64	----	26.4
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----	<1000	----	<1000
thallium	7440-28-0	E440	0.050	mg/kg	<0.050	----	<0.050	----	<0.050
tin	7440-31-5	E440	2.0	mg/kg	<2.0	----	<2.0	----	<2.0

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

				Client sample ID	**TP20-9-0.5m**	**TP20-09-1.25m**	**TP20-07-0.3m**	**TP20-05-0.75m**	**TP20-05-1.25m**
				Client sampling date / time	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**WR2000970-007**	**WR2000970-008**	**WR2000970-010**	**WR2000970-014**	**WR2000970-015**
					Result	Result	Result	Result	Result
Metals									
titanium	7440-32-6	E440	1.0	mg/kg	89.0	----	99.4	----	565
tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	----	<0.50	----	<0.50
uranium	7440-61-1	E440	0.050	mg/kg	0.446	----	0.484	----	0.575
vanadium	7440-62-2	E440	0.20	mg/kg	7.53	----	8.77	----	52.4
zinc	7440-66-6	E440	2.0	mg/kg	16.7	----	17.6	----	50.2
zirconium	7440-67-7	E440	1.0	mg/kg	2.4	----	2.8	----	4.6
Speciated Metals									
chromium, hexavalent [Cr VI]	18540-29-9	E532	0.10	mg/kg	----	----	----	----	<0.10
chromium, trivalent [Cr III]	16065-83-1	EC535C	0.030	mg/kg	----	----	----	----	196
Volatile Organic Compounds [BTEXS+MTBE]									
benzene	71-43-2	E611A	0.0050	mg/kg	----	<0.0050	<0.0050	----	----
ethylbenzene	100-41-4	E611A	0.015	mg/kg	----	<0.015	<0.015	----	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.200	mg/kg	----	<0.200	<0.200	----	----
styrene	100-42-5	E611A	0.050	mg/kg	----	<0.050	<0.050	----	----
toluene	108-88-3	E611A	0.050	mg/kg	----	<0.050	<0.050	----	----
xylene, m+p-	179601-23-1	E611A	0.050	mg/kg	----	<0.050	<0.050	----	----
xylene, o-	95-47-6	E611A	0.050	mg/kg	----	<0.050	<0.050	----	----
xylenes, total	1330-20-7	E611A	0.075	mg/kg	----	<0.075	<0.075	----	----
Volatile Organic Compounds Surrogates									
bromofluorobenzene, 4-	460-00-4	E611A	0.050	%	----	96.0	104	----	----
difluorobenzene, 1,4-	540-36-3	E611A	0.050	%	----	103	120	----	----
Hydrocarbons									
EPH (C10-C19)	----	E601A	200	mg/kg	<200	----	<200	----	<200
EPH (C19-C32)	----	E601A	200	mg/kg	<200	----	<200	----	<200
VHs (C6-C10)	----	E581.VH+F1	10	mg/kg	----	<10	<10	----	----
HEPHs	----	EC600A	200	mg/kg	<200	----	<200	----	<200
LEPHs	----	EC600A	200	mg/kg	<200	----	<200	----	<200
VPHs	----	EC580A	10	mg/kg	----	<10	<10	----	----
Hydrocarbons Surrogates									
bromobenzotrifluoride, 2- (EPH surr)	392-83-6	E601A	5.0	%	95.2	----	85.3	----	92.4
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%	----	101	102	----	----
Polycyclic Aromatic Hydrocarbons									

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

				Client sample ID	**TP20-9-0.5m**	**TP20-09-1.25m**	**TP20-07-0.3m**	**TP20-05-0.75m**	**TP20-05-1.25m**
				Client sampling date / time	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**WR2000970-007**	**WR2000970-008**	**WR2000970-010**	**WR2000970-014**	**WR2000970-015**
					Result	Result	Result	Result	Result
Polycyclic Aromatic Hydrocarbons									
acenaphthene	83-32-9	E641A-L	0.0050	mg/kg	<0.0050	----	<0.0050	----	<0.0050
acenaphthylene	208-96-8	E641A-L	0.0050	mg/kg	<0.0050	----	<0.0050	----	<0.0050
acridine	260-94-6	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
anthracene	120-12-7	E641A-L	0.0040	mg/kg	<0.0040	----	<0.0040	----	<0.0040
benz(a)anthracene	56-55-3	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
benzo(a)pyrene	50-32-8	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
benzo(b+j)fluoranthene	----	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
benzo(b+j+k)fluoranthene	----	E641A-L	0.015	mg/kg	<0.015	----	<0.015	----	<0.015
benzo(g,h,i)perylene	191-24-2	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
benzo(k)fluoranthene	207-08-9	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
chrysene	218-01-9	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
dibenz(a,h)anthracene	53-70-3	E641A-L	0.0050	mg/kg	<0.0050	----	<0.0050	----	<0.0050
fluoranthene	206-44-0	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
fluorene	86-73-7	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
methylnaphthalene, 1-	90-12-0	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
methylnaphthalene, 2-	91-57-6	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
naphthalene	91-20-3	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
phenanthrene	85-01-8	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
pyrene	129-00-0	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
quinoline	6027-02-7	E641A-L	0.010	mg/kg	<0.010	----	<0.010	----	<0.010
B(a)P total potency equivalents [B(a)P TPE]	----	E641A-L	0.020	mg/kg	<0.010	----	<0.010	----	<0.010
IACR (CCME)	----	E641A-L	0.15	mg/kg	<0.11	----	<0.11	----	<0.11
Polycyclic Aromatic Hydrocarbons Surrogates									
acridine-d9	34749-75-2	E641A-L	0.010	%	85.2	----	81.8	----	85.4
chrysene-d12	1719-03-5	E641A-L	0.010	%	104	----	95.3	----	100.0
naphthalene-d8	1146-65-2	E641A-L	0.010	%	96.3	----	87.9	----	94.3
phenanthrene-d10	1517-22-2	E641A-L	0.010	%	101	----	91.6	----	97.2

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

				Client sample ID	**TP20-03-0.5m**	**TP20-03-1.3m**	**TP20-08-0.5m**	**TP20-08-1.7m**	**TP00-05-1.25m**
				Client sampling date / time	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**WR2000970-016**	**WR2000970-017**	**WR2000970-019**	**WR2000970-021**	**WR2000970-022**
					Result	Result	Result	Result	Result
Physical Tests									
moisture	----	E144	0.25	%	----	8.27	4.69	39.3	18.2
pH (1:2 soil:water)	----	E108	0.10	pH units	8.84	8.21	8.99	----	7.87
Metals									
aluminum	7429-90-5	E440	50	mg/kg	2610	14100	3260	----	19000
antimony	7440-36-0	E440	0.10	mg/kg	<0.30 RRR	<0.80 RRR	<0.40 RRR	----	<0.80 RRR
arsenic	7440-38-2	E440	0.10	mg/kg	2.74	7.90	3.14	----	6.58
barium	7440-39-3	E440	0.50	mg/kg	57.6	200	106	----	212
beryllium	7440-41-7	E440	0.10	mg/kg	0.13	0.35	0.15	----	0.27
bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	<0.20	----	<0.20
boron	7440-42-8	E440	5.0	mg/kg	<5.0	<5.0	<5.0	----	<5.0
cadmium	7440-43-9	E440	0.020	mg/kg	0.098	0.236	0.107	----	0.108
calcium	7440-70-2	E440	50	mg/kg	633	2790	1840	----	5730
chromium	7440-47-3	E440	0.50	mg/kg	5.61	63.4	10.9	----	364
cobalt	7440-48-4	E440	0.10	mg/kg	1.82	12.6	2.18	----	29.1
copper	7440-50-8	E440	0.50	mg/kg	8.52	30.6	9.14	----	24.7
iron	7439-89-6	E440	50	mg/kg	3950	23300	4620	----	29600
lead	7439-92-1	E440	0.50	mg/kg	6.99	6.83	9.27	----	4.71
lithium	7439-93-2	E440	2.0	mg/kg	3.2	10.8	4.2	----	15.9
magnesium	7439-95-4	E440	20	mg/kg	1200	10400	1650	----	31700
manganese	7439-96-5	E440	1.0	mg/kg	40.0	305	52.9	----	472
mercury	7439-97-6	E510	0.0500	mg/kg	<0.0500	<0.0500	<0.0500	----	<0.0500
molybdenum	7439-98-7	E440	0.10	mg/kg	0.23	0.78	0.26	----	0.38
nickel	7440-02-0	E440	0.50	mg/kg	5.96	38.9	12.5	----	352
phosphorus	7723-14-0	E440	50	mg/kg	117	396	576	----	417
potassium	7440-09-7	E440	100	mg/kg	540	590	560	----	340
selenium	7782-49-2	E440	0.20	mg/kg	<0.20	0.22	<0.20	----	<0.20
silver	7440-22-4	E440	0.10	mg/kg	<0.10	0.11	<0.10	----	<0.10
sodium	7440-23-5	E440	50	mg/kg	80	70	<50	----	152
strontium	7440-24-6	E440	0.50	mg/kg	5.94	16.1	19.7	----	25.3
sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	<1000	----	<1000
thallium	7440-28-0	E440	0.050	mg/kg	<0.050	0.066	<0.050	----	<0.050
tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	<2.0	----	<2.0

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

				Client sample ID	**TP20-03-0.5m**	**TP20-03-1.3m**	**TP20-08-0.5m**	**TP20-08-1.7m**	**TP00-05-1.25m**
				Client sampling date / time	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**WR2000970-016**	**WR2000970-017**	**WR2000970-019**	**WR2000970-021**	**WR2000970-022**
					Result	Result	Result	Result	Result
Metals									
titanium	7440-32-6	E440	1.0	mg/kg	102	370	110	----	640
tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	<0.50	----	<0.50
uranium	7440-61-1	E440	0.050	mg/kg	0.642	0.911	1.03	----	0.616
vanadium	7440-62-2	E440	0.20	mg/kg	9.72	47.0	17.7	----	64.5
zinc	7440-66-6	E440	2.0	mg/kg	22.2	44.8	18.9	----	43.5
zirconium	7440-67-7	E440	1.0	mg/kg	3.4	3.8	3.0	----	4.6
Speciated Metals									
chromium, hexavalent [Cr VI]	18540-29-9	E532	0.10	mg/kg	----	<0.10	----	----	<0.10
chromium, trivalent [Cr III]	16065-83-1	EC535C	0.030	mg/kg	----	63.4	----	----	364
Volatile Organic Compounds									
chlorobenzene	108-90-7	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
chloromethane	74-87-3	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
dichlorobenzene, 1,2-	95-50-1	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
dichlorobenzene, 1,3-	541-73-1	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
dichlorobenzene, 1,4-	106-46-7	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
dichloropropane, 1,2-	78-87-5	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
dichloropropylene, cis+trans-1,3-	542-75-6	E611C	0.075	mg/kg	----	<0.075	----	<0.075	----
dichloropropylene, cis-1,3-	10061-01-5	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
trichloroethane, 1,1,2-	79-00-5	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
trichlorofluoromethane	75-69-4	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
Volatile Organic Compounds [BTEXS+MTBE]									
benzene	71-43-2	E611C	0.0050	mg/kg	----	<0.0050	----	<0.0050	----
ethylbenzene	100-41-4	E611C	0.015	mg/kg	----	<0.015	----	<0.015	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
styrene	100-42-5	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
toluene	108-88-3	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
xylene, m+p-	179601-23-1	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
xylene, o-	95-47-6	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
xylenes, total	1330-20-7	E611C	0.075	mg/kg	----	<0.075	----	<0.075	----
Volatile Organic Compounds [Drycleaning]									

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

				Client sample ID	**TP20-03-0.5m**	**TP20-03-1.3m**	**TP20-08-0.5m**	**TP20-08-1.7m**	**TP00-05-1.25m**
				Client sampling date / time	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**WR2000970-016**	**WR2000970-017**	**WR2000970-019**	**WR2000970-021**	**WR2000970-022**
					Result	Result	Result	Result	Result
Volatile Organic Compounds [Drycleaning]									
carbon tetrachloride	56-23-5	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
chloroethane	75-00-3	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
dichloroethane, 1,1-	75-34-3	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
dichloroethane, 1,2-	107-06-2	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
dichloroethylene, 1,1-	75-35-4	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
dichloroethylene, cis-1,2-	156-59-4	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
dichloroethylene, trans-1,2-	156-60-5	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
dichloromethane	75-09-2	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
dichloropropylene, trans-1,3-	10061-02-6	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
tetrachloroethylene	127-18-4	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
trichloroethane, 1,1,1-	71-55-6	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
trichloroethylene	79-01-6	E611C	0.010	mg/kg	----	<0.010	----	<0.010	----
vinyl chloride	75-01-4	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
Volatile Organic Compounds Surrogates									
bromofluorobenzene, 4-	460-00-4	E611C	0.050	%	----	92.5	----	76.3	----
difluorobenzene, 1,4-	540-36-3	E611C	0.050	%	----	96.7	----	78.5	----
Hydrocarbons									
EPH (C10-C19)	----	E601A	200	mg/kg	----	<200	<200	----	<200
EPH (C19-C32)	----	E601A	200	mg/kg	----	<200	<200	----	<200
VHs (C6-C10)	----	E581.VH+F1	10	mg/kg	----	<10	----	<10	----
HEPHs	----	EC600A	200	mg/kg	----	<200	<200	----	<200
LEPHs	----	EC600A	200	mg/kg	----	<200	<200	----	<200
VPHs	----	EC580A	10	mg/kg	----	<10	----	<10	----
Hydrocarbons Surrogates									
bromobenzotrifluoride, 2- (EPH surr)	392-83-6	E601A	5.0	%	----	89.0	90.6	----	86.8
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%	----	88.4	----	71.3	----
Polycyclic Aromatic Hydrocarbons									
acenaphthene	83-32-9	E641A-L	0.0050	mg/kg	----	<0.0050	<0.0050	----	<0.0050
acenaphthylene	208-96-8	E641A-L	0.0050	mg/kg	----	<0.0050	<0.0050	----	<0.0050
acridine	260-94-6	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
anthracene	120-12-7	E641A-L	0.0040	mg/kg	----	<0.0040	<0.0040	----	<0.0040
benz(a)anthracene	56-55-3	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

				Client sample ID	**TP20-03-0.5m**	**TP20-03-1.3m**	**TP20-08-0.5m**	**TP20-08-1.7m**	**TP00-05-1.25m**
				Client sampling date / time	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
Analyte	CAS Number	Method	LOR	Unit	**WR2000970-016**	**WR2000970-017**	**WR2000970-019**	**WR2000970-021**	**WR2000970-022**
					Result	Result	Result	Result	Result
Polycyclic Aromatic Hydrocarbons									
benzo(a)pyrene	50-32-8	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
benzo(b+j)fluoranthene	----	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
benzo(b+j+k)fluoranthene	----	E641A-L	0.015	mg/kg	----	<0.015	<0.015	----	<0.015
benzo(g,h,i)perylene	191-24-2	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
benzo(k)fluoranthene	207-08-9	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
chrysene	218-01-9	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
dibenz(a,h)anthracene	53-70-3	E641A-L	0.0050	mg/kg	----	<0.0050	<0.0050	----	<0.0050
fluoranthene	206-44-0	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
fluorene	86-73-7	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
methylnaphthalene, 1-	90-12-0	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
methylnaphthalene, 2-	91-57-6	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
naphthalene	91-20-3	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
phenanthrene	85-01-8	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
pyrene	129-00-0	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
quinoline	6027-02-7	E641A-L	0.010	mg/kg	----	<0.010	<0.010	----	<0.010
B(a)P total potency equivalents [B(a)P TPE]	----	E641A-L	0.020	mg/kg	----	<0.010	<0.010	----	<0.010
IACR (CCME)	----	E641A-L	0.15	mg/kg	----	<0.11	<0.11	----	<0.11
Polycyclic Aromatic Hydrocarbons Surrogates									
acridine-d9	34749-75-2	E641A-L	0.010	%	----	85.9	81.2	----	90.3
chrysene-d12	1719-03-5	E641A-L	0.010	%	----	105	98.7	----	104
naphthalene-d8	1146-65-2	E641A-L	0.010	%	----	97.2	90.9	----	97.4
phenanthrene-d10	1517-22-2	E641A-L	0.010	%	----	100	93.2	----	98.8
Volatile Organic Compounds [THMs]									
bromodichloromethane	75-27-4	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
bromoform	75-25-2	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
chloroform	67-66-3	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
dibromochloromethane	124-48-1	E611C	0.050	mg/kg	----	<0.050	----	<0.050	----
Glycols									
diethylene glycol	111-46-6	E680E	10	mg/kg	----	<10	----	----	----
ethylene glycol	107-21-1	E680E	10	mg/kg	----	<10	----	----	----
propylene glycol, 1,2-	57-55-6	E680E	10	mg/kg	----	<10	----	----	----

Analytical Results

Sub-Matrix: **Soil**

(Matrix: **Soil/Solid**)

				Client sample ID	**TP20-03-0.5m**	**TP20-03-1.3m**	**TP20-08-0.5m**	**TP20-08-1.7m**	**TP00-05-1.25m**
				Client sampling date / time	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020	23-Sep-2020
Analyte	CAS Number	Method	LOR	Unit	**WR2000970-016**	**WR2000970-017**	**WR2000970-019**	**WR2000970-021**	**WR2000970-022**
					Result	Result	Result	Result	Result
Glycols									
triethylene glycol	112-27-6	E680E	10	mg/kg	----	<10	----	----	----
Glycols Surrogates									
propanediol, 1,3-	504-63-2	E680E	10	%	----	80.9	----	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	MW20-01	MW20-02	MW20-03	DUP	FB
				Client sampling date / time	25-Sep-2020	25-Sep-2020	25-Sep-2020	25-Sep-2020	25-Sep-2020
Analyte	CAS Number	Method	LOR	Unit	WR2000970-023	WR2000970-024	WR2000970-025	WR2000970-026	WR2000970-027
					Result	Result	Result	Result	Result
Physical Tests									
hardness (as CaCO3), dissolved	----	EC100	0.60	mg/L	573	769	719	564	<0.60
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0119	0.106	12.0	0.0112	<0.0010
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00117	0.00092	0.00149	0.00119	<0.00010
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.0124	0.0447	0.0300	0.0125	<0.00010
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.577	0.883	1.03	0.580	<0.00010
beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	0.000818	<0.000100	<0.000100
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0.000124	<0.000050	<0.000050
boron, dissolved	7440-42-8	E421	0.010	mg/L	0.038	0.012	0.033	0.037	<0.010
cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0000417	0.0000930	0.00242	0.0000387	<0.0000050
calcium, dissolved	7440-70-2	E421	0.050	mg/L	143	211	201	141	<0.050
cesium, dissolved	7440-46-2	E421	0.000010	mg/L	<0.000010	<0.000010	0.000828	0.000010	<0.000010
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00227	0.0134	0.0393	0.00230	<0.00010
cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	0.0140	0.0313	0.0930	0.0137	<0.00010
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00416	0.00696	0.0705	0.00575	<0.00020
iron, dissolved	7439-89-6	E421	0.010	mg/L	1.68	32.4	43.5	1.70	<0.010
lead, dissolved	7439-92-1	E421	0.000050	mg/L	0.000083	0.000771	0.0204	0.000123	<0.000050
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0077	0.0040	0.0150	0.0073	<0.0010
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	52.7	59.0	52.7	51.2	<0.0050
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	2.75	4.76	7.99	2.68	<0.00010
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	0.0000064	<0.0000050	<0.0000500 DLM	0.0000057	<0.0000050
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.0103	0.00518	0.00216	0.0103	<0.000050
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.0288	0.112	0.223	0.0285	<0.00050
phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	0.086	0.495	1.46	0.063	<0.050
potassium, dissolved	7440-09-7	E421	0.050	mg/L	5.71	2.97	8.52	5.77	<0.050
rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	0.00277	0.00160	0.0153	0.00264	<0.00020
selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.000842	0.00233	0.00230	0.000850	<0.000050
silicon, dissolved	7440-21-3	E421	0.050	mg/L	10.9	19.1	44.8	10.8	<0.050
silver, dissolved	7440-22-4	E421	0.000010	mg/L	0.000028	0.000049	0.000280	0.000028	<0.000010
sodium, dissolved	17341-25-2	E421	0.050	mg/L	17.8	14.9	19.0	17.6	<0.050
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.570	0.772	0.694	0.579	<0.00020
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	19.4	11.8	13.5	19.7	<0.50

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	**MW20-01**	**MW20-02**	**MW20-03**	**DUP**	**FB**
				Client sampling date / time	25-Sep-2020	25-Sep-2020	25-Sep-2020	25-Sep-2020	25-Sep-2020
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**WR2000970-023**	**WR2000970-024**	**WR2000970-025**	**WR2000970-026**	**WR2000970-027**
					Result	Result	Result	Result	Result
Dissolved Metals									
tellurium, dissolved	13494-80-9	E421	0.00020	mg/L	<0.00020	<0.00020	<0.00040 DLA	<0.00020	<0.00020
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.000026	0.000012	0.000339	0.000026	<0.000010
thorium, dissolved	7440-29-1	E421	0.00010	mg/L	<0.00010	0.00014	0.00430	<0.00010	<0.00010
tin, dissolved	7440-31-5	E421	0.00010	mg/L	0.00024	0.00187	0.00402	0.00026	<0.00010
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	0.00215	0.0184	0.305	0.00198	<0.00030
tungsten, dissolved	7440-33-7	E421	0.00010	mg/L	<0.00010	0.00013	0.00067	<0.00010	<0.00010
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00667	0.00281	0.00593	0.00658	<0.000010
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	0.00284	0.00898	0.0422	0.00290	<0.00050
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0151	0.0108	0.145	0.0158	<0.0010
zirconium, dissolved	7440-67-7	E421	0.00020	mg/L	0.00245	0.00482	0.0258	0.00246	<0.00020
dissolved mercury filtration location	----	EP509	-	-	Field	Field	Laboratory	Field	Field
dissolved metals filtration location	----	EP421	-	-	Field	Field	Field	Field	Field
Volatile Organic Compounds									
chlorobenzene	108-90-7	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
chloromethane	74-87-3	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
dichlorobenzene, 1,2-	95-50-1	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
dichlorobenzene, 1,3-	541-73-1	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
dichlorobenzene, 1,4-	106-46-7	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
dichloropropane, 1,2-	78-87-5	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
dichloropropylene, cis+trans-1,3-	542-75-6	E611C	0.75	µg/L	<0.75	<0.75	<0.75	<0.75	<0.75
dichloropropylene, cis-1,3-	10061-01-5	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
tetrachloroethane, 1,1,1,2-	630-20-6	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
tetrachloroethane, 1,1,2,2-	79-34-5	E611C	0.20	µg/L	<0.20	<0.20	<0.20	<0.20	<0.20
trichloroethane, 1,1,2-	79-00-5	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
trichlorofluoromethane	75-69-4	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
Volatile Organic Compounds [BTEXS+MTBE]									
benzene	71-43-2	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
ethylbenzene	100-41-4	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
methyl-tert-butyl ether [MTBE]	1634-04-4	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
styrene	100-42-5	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
toluene	108-88-3	E611C	0.40	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
xylene, m+p-	179601-23-1	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	**MW20-01**	**MW20-02**	**MW20-03**	**DUP**	**FB**
				Client sampling date / time	25-Sep-2020	25-Sep-2020	25-Sep-2020	25-Sep-2020	25-Sep-2020
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**WR2000970-023**	**WR2000970-024**	**WR2000970-025**	**WR2000970-026**	**WR2000970-027**
					Result	Result	Result	Result	Result
Volatile Organic Compounds [BTEXS+MTBE]									
xylene, o-	95-47-6	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
xylenes, total	1330-20-7	E611C	0.75	µg/L	<0.75	<0.75	<0.75	<0.75	<0.75
Volatile Organic Compounds [Drycleaning]									
carbon tetrachloride	56-23-5	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
chloroethane	75-00-3	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
dichloroethane, 1,1-	75-34-3	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
dichloroethane, 1,2-	107-06-2	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
dichloroethylene, 1,1-	75-35-4	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
dichloroethylene, cis-1,2-	156-59-4	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
dichloroethylene, trans-1,2-	156-60-5	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
dichloromethane	75-09-2	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
dichloropropylene, trans-1,3-	10061-02-6	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
tetrachloroethylene	127-18-4	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
trichloroethane, 1,1,1-	71-55-6	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
trichloroethylene	79-01-6	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
vinyl chloride	75-01-4	E611C	0.40	µg/L	<0.40	<0.40	<0.40	<0.40	<0.40
Volatile Organic Compounds Surrogates									
bromofluorobenzene, 4-	460-00-4	E611C	0.50	%	102	99.2	102	98.8	99.0
difluorobenzene, 1,4-	540-36-3	E611C	0.50	%	104	118	108	99.8	108
Hydrocarbons									
EPH (C10-C19)	----	E601A	250	µg/L	1420	<250	<250	<250	<250
EPH (C10-C19), silica gel treated	----	E601A.SG	250	µg/L	<250	----	----	----	----
EPH (C19-C32)	----	E601A	250	µg/L	<250	<250	<250	<250	<250
EPH (C19-C32), silica gel treated	----	E601A.SG	250	µg/L	<250	----	----	----	----
HEPHw, silica gel treated	----	EC600A.SG	250	µg/L	<250	----	----	----	----
LEPHw, silica gel treated	----	EC600A.SG	250	µg/L	<250	----	----	----	----
VHw (C6-C10)	----	E581.VH+F1	100	µg/L	<100	<100	<100	<100	<100
HEPHw	----	EC600A	250	µg/L	<250	<250	<250	<250	<250
LEPHw	----	EC600A	250	µg/L	1420	<250	<250	<250	<250
VPHw	----	EC580A	100	µg/L	<100	<100	<100	<100	<100
Hydrocarbons Surrogates									
bromobenzotrifluoride, 2- (EPH surr)	392-83-6	E601A	50	%	90.0	95.8	106	87.1	78.3

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	MW20-01	MW20-02	MW20-03	DUP	FB
				Client sampling date / time	25-Sep-2020	25-Sep-2020	25-Sep-2020	25-Sep-2020	25-Sep-2020
Analyte	CAS Number	Method	LOR	Unit	WR2000970-023	WR2000970-024	WR2000970-025	WR2000970-026	WR2000970-027
					Result	Result	Result	Result	Result
Hydrocarbons Surrogates									
bromobenzotrifluoride, 2- (EPH-sg surr)	392-83-6	E601A.SG	50	%	61.0	----	----	----	----
dichlorotoluene, 3,4-	97-75-0	E581.VH+F1	1.0	%	89.1	83.0	77.4	83.6	89.4
Polycyclic Aromatic Hydrocarbons									
acenaphthene	83-32-9	E641A	0.010	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010
acenaphthylene	208-96-8	E641A	0.010	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010
acridine	260-94-6	E641A	0.010	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010
anthracene	120-12-7	E641A	0.010	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010
benz(a)anthracene	56-55-3	E641A	0.010	µg/L	<0.010	<0.010	0.012	<0.010	<0.010
benzo(a)pyrene	50-32-8	E641A	0.0050	µg/L	<0.0050	<0.0050	0.0050	<0.0050	<0.0050
benzo(b+j)fluoranthene	----	E641A	0.010	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010
benzo(b+j+k)fluoranthene	----	E641A	0.015	µg/L	<0.015	<0.015	<0.015	<0.015	<0.015
benzo(g,h,i)perylene	191-24-2	E641A	0.010	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010
benzo(k)fluoranthene	207-08-9	E641A	0.010	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010
chrysene	218-01-9	E641A	0.010	µg/L	<0.010	<0.010	0.014	<0.010	<0.010
dibenz(a,h)anthracene	53-70-3	E641A	0.0050	µg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
fluoranthene	206-44-0	E641A	0.010	µg/L	<0.010	<0.010	0.021	<0.010	<0.010
fluorene	86-73-7	E641A	0.010	µg/L	<0.010	<0.010	0.019	<0.010	<0.010
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.010	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010
methylnaphthalene, 1-	90-12-0	E641A	0.010	µg/L	0.018	<0.010	0.027	0.017	<0.010
methylnaphthalene, 2-	91-57-6	E641A	0.010	µg/L	0.028	<0.010	0.049	0.026	<0.010
naphthalene	91-20-3	E641A	0.050	µg/L	0.066	<0.050	0.065	0.065	<0.050
phenanthrene	85-01-8	E641A	0.020	µg/L	<0.020	<0.020	0.050	<0.020	<0.020
pyrene	129-00-0	E641A	0.010	µg/L	<0.010	<0.010	0.031	<0.010	<0.010
quinoline	6027-02-7	E641A	0.050	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Polycyclic Aromatic Hydrocarbons Surrogates									
acridine-d9	34749-75-2	E641A	0.010	%	86.7	74.0	69.8	89.3	101
chrysene-d12	1719-03-5	E641A	0.010	%	97.3	96.4	99.0	97.0	101
naphthalene-d8	1146-65-2	E641A	0.010	%	94.2	95.0	102	94.9	94.4
phenanthrene-d10	1517-22-2	E641A	0.010	%	104	103	113	99.4	97.1
Volatile Organic Compounds [THMs]									
bromodichloromethane	75-27-4	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
bromoform	75-25-2	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	**MW20-01**	**MW20-02**	**MW20-03**	**DUP**	**FB**
				Client sampling date / time	25-Sep-2020	25-Sep-2020	25-Sep-2020	25-Sep-2020	25-Sep-2020
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**WR2000970-023**	**WR2000970-024**	**WR2000970-025**	**WR2000970-026**	**WR2000970-027**
					Result	Result	Result	Result	Result
Volatile Organic Compounds [THMs]									
chloroform	67-66-3	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
dibromochloromethane	124-48-1	E611C	0.50	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50
Glycols									
diethylene glycol	111-46-6	E680E	5.0	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0
ethylene glycol	107-21-1	E680E	5.0	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0
propylene glycol, 1,2-	57-55-6	E680E	5.0	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0
triethylene glycol	112-27-6	E680E	5.0	mg/L	<5.0	<5.0	<5.0	<5.0	<5.0
Glycols Surrogates									
propanediol, 1,3-	504-63-2	E680E	5.0	%	94.4	47.2 SUR-ND	45.7 SUR-ND	91.6	101

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WR2000970**	Page	: 1 of 26
Amendment	: **4**		
Client	: **Tetra Tech Canada Inc.**	Laboratory	: Whitehorse - Environmental
Contact	: Kristina Schmidt	Account Manager	: Brent Mack
Address	: 61 Wasson Place Whitehorse YT Canada Y1A 0H7	Address	: #12 151 Industrial Road Whitehorse, Yukon Canada Y1A 2V3
Telephone	: ----	Telephone	: +1 867 668 6689
Project	: 704-ENW.PENW03102-01	Date Samples Received	: 29-Sep-2020 16:20
PO	: ----	Issue Date	: 27-Oct-2020 10:26
C-O-C number	: ----		
Sampler	: KS		
Site	: ----		
Quote number	: Standard Client Price List (BC & YK)		
No. of samples received	: 27		
No. of samples analysed	: 20		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Matrix Spike outliers occur.
- Duplicate outliers occur - please see following pages for full details.
- Laboratory Control Sample (LCS) outliers occur - please see following pages for full details.
- Test sample Surrogate recovery outliers exist for all regular sample matrices - please see following pages for full details.

Outliers: Reference Material (RM) Samples

- Reference Material (RM) Sample outliers occur - please see the following pages for full details.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	Anonymous	Anonymous	antimony	7440-36-0	E440	33.1 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	Anonymous	Anonymous	arsenic	7440-38-2	E440	33.9 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	WR2000970-001	TP20-01-0.5m	nickel	7440-02-0	E440	32.5 % DUP-H	30%	Duplicate RPD does not meet the DQO for this test.
Metals	WR2000970-001	TP20-01-0.5m	phosphorus	7723-14-0	E440	147 % DUP-H	Diff <2x LOR	Low Level DUP DQO exceeded (difference > 2 LOR).
Metals	WR2000970-001	TP20-01-0.5m	titanium	7440-32-6	E440	56.7 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Reference Material (RM) Sample								
Metals	QC-MRG2-97746003	----	antimony	7440-36-0	E440	158 % RM-H	70.0-130%	Recovery greater than upper control limit
Metals	QC-103114-003	----	molybdenum	7439-98-7	E440	135 % MES	70.0-130%	Recovery greater than upper control limit

Result Qualifiers

Qualifier	*Description*
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*
RM-H	*Reference Material recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified.*

Matrix: **Water**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result		Limits	Comment
Laboratory Control Sample (LCS) Recoveries									
Hydrocarbons	QC-103096-002	----	EPH (C19-C32), silica gel treated	----	E601A.SG	59.4 %	LCS-ND	70.0-130%	Recovery less than lower control limit

Result Qualifiers

Qualifier	*Description*
LCS-ND	*Lab Control Sample recovery was slightly outside ALS DQO. Reported non-detect results for associated samples were unaffected.*

Regular Sample Surrogates

Sub-Matrix: **Soil**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Result	Limits	Comment
Samples Submitted							
Hydrocarbons Surrogates	WR2000970-005	TP20-04-1.25m	dichlorotoluene, 3,4-	97-75-0	68.4 %	70.0-130 %	Recovery less than lower data quality objective

Sub-Matrix: **Water**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Result	Limits	Comment
Samples Submitted							
Glycols Surrogates	WR2000970-024	MW20-02	propanediol, 1,3-	504-63-2	47.2 %	70.0-130 %	Recovery less than lower data quality objective
Glycols Surrogates	WR2000970-025	MW20-03	propanediol, 1,3-	504-63-2	45.7 %	70.0-130 %	Recovery less than lower data quality objective

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 15:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 15:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: ✗ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Glycols : Glycols (BC List) by GC-FID										
Glass soil jar/Teflon lined cap TP20-03-1.3m	E680E	23-Sep-2020	03-Oct-2020	14 days	9 days	✓	05-Oct-2020	40 days	2 days	✓
Hydrocarbons : BC PHC - EPH by GC-FID										
Glass soil jar/Teflon lined cap TP00-05-1.25m	E601A	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	2 days	✓
Hydrocarbons : BC PHC - EPH by GC-FID										
Glass soil jar/Teflon lined cap TP20-01-0.5m	E601A	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	2 days	✓
Hydrocarbons : BC PHC - EPH by GC-FID										
Glass soil jar/Teflon lined cap TP20-03-1.3m	E601A	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	2 days	✓
Hydrocarbons : BC PHC - EPH by GC-FID										
Glass soil jar/Teflon lined cap TP20-04-1.25m	E601A	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	2 days	✓
Hydrocarbons : BC PHC - EPH by GC-FID										
Glass soil jar/Teflon lined cap TP20-05-1.25m	E601A	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	2 days	✓
Hydrocarbons : BC PHC - EPH by GC-FID										
Glass soil jar/Teflon lined cap TP20-07-0.3m	E601A	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	2 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Hydrocarbons : BC PHC - EPH by GC-FID										
Glass soil jar/Teflon lined cap TP20-08-0.5m	E601A	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	2 days	✓
Hydrocarbons : BC PHC - EPH by GC-FID										
Glass soil jar/Teflon lined cap TP20-9-0.5m	E601A	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	2 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass soil methanol vial TP20-03-1.3m	E581.VH+F1	23-Sep-2020	04-Oct-2020	40 days	10 days	✓	05-Oct-2020	29 days	0 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass soil methanol vial TP20-08-1.7m	E581.VH+F1	23-Sep-2020	04-Oct-2020	40 days	10 days	✓	05-Oct-2020	29 days	0 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass soil methanol vial TP20-01-1.0m	E581.VH+F1	23-Sep-2020	04-Oct-2020	40 days	10 days	✓	05-Oct-2020	29 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass soil methanol vial TP20-04-1.25m	E581.VH+F1	23-Sep-2020	04-Oct-2020	40 days	10 days	✓	05-Oct-2020	29 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass soil methanol vial TP20-07-0.3m	E581.VH+F1	23-Sep-2020	04-Oct-2020	40 days	10 days	✓	05-Oct-2020	29 days	1 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass soil methanol vial TP20-09-1.25m	E581.VH+F1	23-Sep-2020	04-Oct-2020	40 days	10 days	✓	05-Oct-2020	29 days	1 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap TP00-05-1.25m	E510	23-Sep-2020	07-Oct-2020	28 days	14 days	✓	08-Oct-2020	13 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap TP20-01-0.5m	E510	23-Sep-2020	07-Oct-2020	28 days	14 days	✓	08-Oct-2020	13 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap TP20-03-0.5m	E510	23-Sep-2020	07-Oct-2020	28 days	14 days	✓	08-Oct-2020	13 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap TP20-03-1.3m	E510	23-Sep-2020	07-Oct-2020	28 days	14 days	✓	08-Oct-2020	13 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap TP20-04-1.25m	E510	23-Sep-2020	07-Oct-2020	28 days	14 days	✓	08-Oct-2020	13 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap TP20-05-1.25m	E510	23-Sep-2020	07-Oct-2020	28 days	14 days	✓	08-Oct-2020	13 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap TP20-07-0.3m	E510	23-Sep-2020	07-Oct-2020	28 days	14 days	✓	08-Oct-2020	13 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap TP20-08-0.5m	E510	23-Sep-2020	07-Oct-2020	28 days	14 days	✓	08-Oct-2020	13 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap TP20-9-0.5m	E510	23-Sep-2020	07-Oct-2020	28 days	14 days	✓	08-Oct-2020	13 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap TP00-05-1.25m	E440	23-Sep-2020	07-Oct-2020	180 days	14 days	✓	08-Oct-2020	165 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap TP20-01-0.5m	E440	23-Sep-2020	07-Oct-2020	180 days	14 days	✓	08-Oct-2020	165 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap TP20-03-0.5m	E440	23-Sep-2020	07-Oct-2020	180 days	14 days	✓	08-Oct-2020	165 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap TP20-03-1.3m	E440	23-Sep-2020	07-Oct-2020	180 days	14 days	✓	08-Oct-2020	165 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap TP20-04-1.25m	E440	23-Sep-2020	07-Oct-2020	180 days	14 days	✓	08-Oct-2020	165 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap TP20-05-1.25m	E440	23-Sep-2020	07-Oct-2020	180 days	14 days	✓	08-Oct-2020	165 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap TP20-07-0.3m	E440	23-Sep-2020	07-Oct-2020	180 days	14 days	✓	08-Oct-2020	165 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap TP20-08-0.5m	E440	23-Sep-2020	07-Oct-2020	180 days	14 days	✓	08-Oct-2020	165 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap TP20-9-0.5m	E440	23-Sep-2020	07-Oct-2020	180 days	14 days	✓	08-Oct-2020	165 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap TP20-05-0.75m	E440	23-Sep-2020	16-Oct-2020	180 days	22 days	✓	16-Oct-2020	157 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap TP20-01-1.75m	E440	23-Sep-2020	24-Oct-2020	180 days	30 days	✓	24-Oct-2020	149 days	0 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap TP20-04-2.0m	E440	23-Sep-2020	24-Oct-2020	180 days	30 days	✓	24-Oct-2020	149 days	0 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap TP00-05-1.25m	E144	23-Sep-2020	----	----	----		06-Oct-2020	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap TP20-01-0.5m	E144	23-Sep-2020	----	----	----		06-Oct-2020	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap TP20-01-1.0m	E144	23-Sep-2020	----	----	----		08-Oct-2020	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap TP20-01-1.75m	E144	23-Sep-2020	----	----	----		23-Oct-2020	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap TP20-03-1.3m	E144	23-Sep-2020	----	----	----		06-Oct-2020	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap TP20-04-1.25m	E144	23-Sep-2020	----	----	----		06-Oct-2020	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap TP20-04-2.0m	E144	23-Sep-2020	----	----	----		23-Oct-2020	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap TP20-05-1.25m	E144	23-Sep-2020	----	----	----		06-Oct-2020	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap TP20-07-0.3m	E144	23-Sep-2020	----	----	----		06-Oct-2020	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap TP20-08-0.5m	E144	23-Sep-2020	----	----	----		06-Oct-2020	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap TP20-08-1.7m	E144	23-Sep-2020	----	----	----		08-Oct-2020	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap TP20-09-1.25m	E144	23-Sep-2020	----	----	----		08-Oct-2020	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap TP20-9-0.5m	E144	23-Sep-2020	----	----	----		06-Oct-2020	----	----	
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap TP00-05-1.25m	E108	23-Sep-2020	07-Oct-2020	30 days	14 days	✓	08-Oct-2020	15 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap TP20-01-0.5m	E108	23-Sep-2020	07-Oct-2020	30 days	14 days	✓	08-Oct-2020	15 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap TP20-03-0.5m	E108	23-Sep-2020	07-Oct-2020	30 days	14 days	✓	08-Oct-2020	15 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap TP20-03-1.3m	E108	23-Sep-2020	07-Oct-2020	30 days	14 days	✓	08-Oct-2020	15 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap TP20-04-1.25m	E108	23-Sep-2020	07-Oct-2020	30 days	14 days	✓	08-Oct-2020	15 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap TP20-05-1.25m	E108	23-Sep-2020	07-Oct-2020	30 days	14 days	✓	08-Oct-2020	15 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap TP20-07-0.3m	E108	23-Sep-2020	07-Oct-2020	30 days	14 days	✓	08-Oct-2020	15 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap TP20-08-0.5m	E108	23-Sep-2020	07-Oct-2020	30 days	14 days	✓	08-Oct-2020	15 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap TP20-9-0.5m	E108	23-Sep-2020	07-Oct-2020	30 days	14 days	✓	08-Oct-2020	15 days	0 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap TP00-05-1.25m	E641A-L	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap TP20-01-0.5m	E641A-L	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap TP20-03-1.3m	E641A-L	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap TP20-04-1.25m	E641A-L	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap TP20-05-1.25m	E641A-L	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap TP20-07-0.3m	E641A-L	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap TP20-08-0.5m	E641A-L	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hex:Ace GC-MS (Low Level CCME)										
Glass soil jar/Teflon lined cap TP20-9-0.5m	E641A-L	23-Sep-2020	06-Oct-2020	14 days	12 days	✓	08-Oct-2020	40 days	1 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap TP00-05-1.25m	E532	23-Sep-2020	18-Oct-2020	30 days	24 days	✓	20-Oct-2020	7 days	1 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap TP20-01-0.5m	E532	23-Sep-2020	18-Oct-2020	30 days	24 days	✓	20-Oct-2020	7 days	1 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap TP20-03-1.3m	E532	23-Sep-2020	18-Oct-2020	30 days	24 days	✓	20-Oct-2020	7 days	1 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap TP20-04-1.25m	E532	23-Sep-2020	18-Oct-2020	30 days	24 days	✓	20-Oct-2020	7 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap TP20-05-1.25m	E532	23-Sep-2020	18-Oct-2020	30 days	24 days	✓	20-Oct-2020	7 days	1 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap TP20-01-1.75m	E532	23-Sep-2020	24-Oct-2020	30 days	30 days	✓	24-Oct-2020	7 days	0 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap TP20-04-2.0m	E532	23-Sep-2020	24-Oct-2020	30 days	30 days	✓	24-Oct-2020	7 days	0 days	✓
Volatile Organic Compounds : VOCs (BC List) by Headspace GC-MS										
Glass soil methanol vial TP20-03-1.3m	E611C	23-Sep-2020	04-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds : VOCs (BC List) by Headspace GC-MS										
Glass soil methanol vial TP20-08-1.7m	E611C	23-Sep-2020	04-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds [BTEXS+MTBE] : BTEX by Headspace GC-MS										
Glass soil methanol vial TP20-01-1.0m	E611A	23-Sep-2020	04-Oct-2020	40 days	10 days	✓	05-Oct-2020	29 days	1 days	✓
Volatile Organic Compounds [BTEXS+MTBE] : BTEX by Headspace GC-MS										
Glass soil methanol vial TP20-04-1.25m	E611A	23-Sep-2020	04-Oct-2020	40 days	10 days	✓	05-Oct-2020	29 days	1 days	✓
Volatile Organic Compounds [BTEXS+MTBE] : BTEX by Headspace GC-MS										
Glass soil methanol vial TP20-07-0.3m	E611A	23-Sep-2020	04-Oct-2020	40 days	10 days	✓	05-Oct-2020	29 days	1 days	✓
Volatile Organic Compounds [BTEXS+MTBE] : BTEX by Headspace GC-MS										
Glass soil methanol vial TP20-09-1.25m	E611A	23-Sep-2020	04-Oct-2020	40 days	10 days	✓	05-Oct-2020	29 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Volatile Organic Compounds [BTEXS+MTBE] : VOCs (BC List) by Headspace GC-MS										
Glass soil methanol vial TP20-03-1.3m	E611C	23-Sep-2020	04-Oct-2020	40 days	10 days	✓	05-Oct-2020	29 days	0 days	✓
Volatile Organic Compounds [BTEXS+MTBE] : VOCs (BC List) by Headspace GC-MS										
Glass soil methanol vial TP20-08-1.7m	E611C	23-Sep-2020	04-Oct-2020	40 days	10 days	✓	05-Oct-2020	29 days	0 days	✓
Volatile Organic Compounds [Drycleaning] : VOCs (BC List) by Headspace GC-MS										
Glass soil methanol vial TP20-03-1.3m	E611C	23-Sep-2020	04-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds [Drycleaning] : VOCs (BC List) by Headspace GC-MS										
Glass soil methanol vial TP20-08-1.7m	E611C	23-Sep-2020	04-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds [THMs] : VOCs (BC List) by Headspace GC-MS										
Glass soil methanol vial TP20-03-1.3m	E611C	23-Sep-2020	04-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds [THMs] : VOCs (BC List) by Headspace GC-MS										
Glass soil methanol vial TP20-08-1.7m	E611C	23-Sep-2020	04-Oct-2020	----	----		05-Oct-2020	----	----	

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) DUP	E421.Cr-L	25-Sep-2020	05-Oct-2020	180 days	9 days	✓	06-Oct-2020	170 days	0 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) FB	E421.Cr-L	25-Sep-2020	05-Oct-2020	180 days	9 days	✓	06-Oct-2020	170 days	0 days	✓

Matrix: **Water**

Evaluation: ✗ = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) MW20-01	E421.Cr-L	25-Sep-2020	05-Oct-2020	180 days	9 days	✓	06-Oct-2020	170 days	0 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) MW20-02	E421.Cr-L	25-Sep-2020	05-Oct-2020	180 days	9 days	✓	06-Oct-2020	170 days	0 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) MW20-03	E421.Cr-L	25-Sep-2020	05-Oct-2020	180 days	9 days	✓	06-Oct-2020	170 days	0 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) DUP	E509	25-Sep-2020	06-Oct-2020	28 days	10 days	✓	06-Oct-2020	17 days	0 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) FB	E509	25-Sep-2020	06-Oct-2020	28 days	10 days	✓	06-Oct-2020	17 days	0 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) MW20-01	E509	25-Sep-2020	06-Oct-2020	28 days	10 days	✓	06-Oct-2020	17 days	0 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) MW20-02	E509	25-Sep-2020	06-Oct-2020	28 days	10 days	✓	06-Oct-2020	17 days	0 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) MW20-03	E509	25-Sep-2020	06-Oct-2020	28 days	11 days	✓	06-Oct-2020	16 days	0 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) DUP	E421	25-Sep-2020	05-Oct-2020	180 days	9 days	✓	06-Oct-2020	170 days	0 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) FB	E421	25-Sep-2020	05-Oct-2020	180 days	9 days	✓	06-Oct-2020	170 days	0 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) MW20-01	E421	25-Sep-2020	05-Oct-2020	180 days	9 days	✓	06-Oct-2020	170 days	0 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) MW20-02	E421	25-Sep-2020	05-Oct-2020	180 days	9 days	✓	06-Oct-2020	170 days	0 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) MW20-03	E421	25-Sep-2020	05-Oct-2020	180 days	9 days	✓	06-Oct-2020	170 days	0 days	✓
Glycols : Glycols (BC List) by GC-FID										
Glass vial (sodium bisulfate) DUP	E680E	25-Sep-2020	03-Oct-2020	14 days	7 days	✓	05-Oct-2020	40 days	2 days	✓
Glycols : Glycols (BC List) by GC-FID										
Glass vial (sodium bisulfate) FB	E680E	25-Sep-2020	03-Oct-2020	14 days	7 days	✓	05-Oct-2020	40 days	2 days	✓
Glycols : Glycols (BC List) by GC-FID										
Glass vial (sodium bisulfate) MW20-01	E680E	25-Sep-2020	03-Oct-2020	14 days	7 days	✓	05-Oct-2020	40 days	2 days	✓
Glycols : Glycols (BC List) by GC-FID										
Glass vial (sodium bisulfate) MW20-02	E680E	25-Sep-2020	03-Oct-2020	14 days	7 days	✓	05-Oct-2020	40 days	2 days	✓
Glycols : Glycols (BC List) by GC-FID										
Glass vial (sodium bisulfate) MW20-03	E680E	25-Sep-2020	03-Oct-2020	14 days	7 days	✓	05-Oct-2020	40 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	*Method*	*Sampling Date*	*Extraction / Preparation* *Preparation Date*	*Holding Times* *Rec*	*Actual*	*Eval*	*Analysis* *Analysis Date*	*Holding Times* *Rec*	*Actual*	*Eval*
Hydrocarbons : BC PHC - EPH by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) DUP	E601A	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	06-Oct-2020	40 days	1 days	✓
Hydrocarbons : BC PHC - EPH by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) FB	E601A	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	06-Oct-2020	40 days	1 days	✓
Hydrocarbons : BC PHC - EPH by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW20-01	E601A	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	06-Oct-2020	40 days	1 days	✓
Hydrocarbons : BC PHC - EPH by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW20-02	E601A	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	06-Oct-2020	40 days	1 days	✓
Hydrocarbons : BC PHC - EPH by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW20-03	E601A	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	06-Oct-2020	40 days	1 days	✓
Hydrocarbons : BC PHC - EPH(sg) by GC-FID										
Amber glass/Teflon lined cap (sodium bisulfate) MW20-01	E601A.SG	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	16-Oct-2020	40 days	11 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) DUP	E581.VH+F1	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	05-Oct-2020	4 days	0 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) FB	E581.VH+F1	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	05-Oct-2020	4 days	0 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) MW20-01	E581.VH+F1	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	05-Oct-2020	4 days	0 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) MW20-02	E581.VH+F1	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	05-Oct-2020	4 days	0 days	✓
Hydrocarbons : VH and F1 by Headspace GC-FID										
Glass vial (sodium bisulfate) MW20-03	E581.VH+F1	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	05-Oct-2020	4 days	0 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) DUP	E641A	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	08-Oct-2020	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) FB	E641A	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	08-Oct-2020	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) MW20-01	E641A	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	08-Oct-2020	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) MW20-02	E641A	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	08-Oct-2020	40 days	2 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate) MW20-03	E641A	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	08-Oct-2020	40 days	2 days	✓
Volatile Organic Compounds : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) DUP	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) FB	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Volatile Organic Compounds : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW20-01	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW20-02	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW20-03	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds [BTEXS+MTBE] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) DUP	E611C	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	05-Oct-2020	4 days	0 days	✓
Volatile Organic Compounds [BTEXS+MTBE] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) FB	E611C	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	05-Oct-2020	4 days	0 days	✓
Volatile Organic Compounds [BTEXS+MTBE] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW20-01	E611C	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	05-Oct-2020	4 days	0 days	✓
Volatile Organic Compounds [BTEXS+MTBE] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW20-02	E611C	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	05-Oct-2020	4 days	0 days	✓
Volatile Organic Compounds [BTEXS+MTBE] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW20-03	E611C	25-Sep-2020	05-Oct-2020	14 days	9 days	✓	05-Oct-2020	4 days	0 days	✓
Volatile Organic Compounds [Drycleaning] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) DUP	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	*Method*	*Sampling Date*	*Extraction / Preparation*				*Analysis*			
Container / Client Sample ID(s)			*Preparation Date*	*Holding Times*		*Eval*	*Analysis Date*	*Holding Times*		*Eval*
				Rec	*Actual*			*Rec*	*Actual*	
Volatile Organic Compounds [Drycleaning] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) FB	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds [Drycleaning] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW20-01	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds [Drycleaning] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW20-02	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds [Drycleaning] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW20-03	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds [THMs] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) DUP	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds [THMs] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) FB	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds [THMs] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW20-01	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds [THMs] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW20-02	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	
Volatile Organic Compounds [THMs] : VOCs (BC List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW20-03	E611C	25-Sep-2020	05-Oct-2020	----	----		05-Oct-2020	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			*Count*		*Frequency (%)*		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
BC PHC - EPH by GC-FID	E601A	97750	1	9	11.1	5.0	✓
BTEX by Headspace GC-MS	E611A	96996	1	18	5.5	5.0	✓
Glycols (BC List) by GC-FID	E680E	96523	1	4	25.0	5.0	✓
Hexavalent Chromium (Cr VI) by IC	E532	104491	2	7	28.5	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	97746	1	9	11.1	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	97747	3	24	12.5	5.0	✓
Moisture Content by Gravimetry	E144	97753	3	37	8.1	5.0	✓
PAHs by Hex:Ace GC-MS (Low Level CCME)	E641A-L	97749	1	9	11.1	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	97748	1	9	11.1	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	96997	2	38	5.2	5.0	✓
VOCs (BC List) by Headspace GC-MS	E611C	97001	1	6	16.6	5.0	✓
Laboratory Control Samples (LCS)							
BC PHC - EPH by GC-FID	E601A	97750	2	9	22.2	10.0	✓
BTEX by Headspace GC-MS	E611A	96996	1	18	5.5	5.0	✓
Glycols (BC List) by GC-FID	E680E	96523	1	4	25.0	5.0	✓
Hexavalent Chromium (Cr VI) by IC	E532	104491	4	7	57.1	10.0	✓
Mercury in Soil/Solid by CVAAS	E510	97746	2	9	22.2	10.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	97747	6	24	25.0	10.0	✓
Moisture Content by Gravimetry	E144	97753	3	37	8.1	5.0	✓
PAHs by Hex:Ace GC-MS (Low Level CCME)	E641A-L	97749	2	9	22.2	10.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	97748	1	9	11.1	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	96997	2	38	5.2	5.0	✓
VOCs (BC List) by Headspace GC-MS	E611C	97001	1	6	16.6	5.0	✓
Method Blanks (MB)							
BC PHC - EPH by GC-FID	E601A	97750	1	9	11.1	5.0	✓
BTEX by Headspace GC-MS	E611A	96996	1	18	5.5	5.0	✓
Glycols (BC List) by GC-FID	E680E	96523	1	4	25.0	5.0	✓
Hexavalent Chromium (Cr VI) by IC	E532	104491	2	7	28.5	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	97746	1	9	11.1	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	97747	3	24	12.5	5.0	✓
Moisture Content by Gravimetry	E144	97753	3	37	8.1	5.0	✓
PAHs by Hex:Ace GC-MS (Low Level CCME)	E641A-L	97749	1	9	11.1	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	96997	2	38	5.2	5.0	✓
VOCs (BC List) by Headspace GC-MS	E611C	97001	1	6	16.6	5.0	✓
Matrix Spikes (MS)							
BTEX by Headspace GC-MS	E611A	96996	1	18	5.5	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	96997	2	38	5.2	5.0	✓

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS) - Continued							
VOCs (BC List) by Headspace GC-MS	E611C	97001	1	6	16.6	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	97162	1	14	7.1	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	97817	2	29	6.9	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	97161	1	18	5.5	5.0	✓
Glycols (BC List) by GC-FID	E680E	96522	1	6	16.6	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	97143	1	19	5.2	5.0	✓
VOCs (BC List) by Headspace GC-MS	E611C	97142	1	19	5.2	5.0	✓
Laboratory Control Samples (LCS)							
BC PHC - EPH by GC-FID	E601A	97117	1	16	6.2	5.0	✓
BC PHC - EPH(sg) by GC-FID	E601A.SG	103096	1	1	100.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	97162	1	14	7.1	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	97817	2	29	6.9	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	97161	1	18	5.5	5.0	✓
Glycols (BC List) by GC-FID	E680E	96522	1	6	16.6	5.0	✓
PAHs by Hexane LVI GC-MS	E641A	97116	1	19	5.2	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	97143	1	19	5.2	5.0	✓
VOCs (BC List) by Headspace GC-MS	E611C	97142	1	19	5.2	5.0	✓
Method Blanks (MB)							
BC PHC - EPH by GC-FID	E601A	97117	1	16	6.2	5.0	✓
BC PHC - EPH(sg) by GC-FID	E601A.SG	103096	1	1	100.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	97162	1	14	7.1	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	97817	2	29	6.9	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	97161	2	18	11.1	5.0	✓
Glycols (BC List) by GC-FID	E680E	96522	1	6	16.6	5.0	✓
PAHs by Hexane LVI GC-MS	E641A	97116	1	19	5.2	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	97143	1	19	5.2	5.0	✓
VOCs (BC List) by Headspace GC-MS	E611C	97142	1	19	5.2	5.0	✓
Matrix Spikes (MS)							
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	97162	1	14	7.1	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	97817	2	29	6.9	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	97161	1	18	5.5	5.0	✓
VH and F1 by Headspace GC-FID	E581.VH+F1	97143	1	19	5.2	5.0	✓
VOCs (BC List) by Headspace GC-MS	E611C	97142	1	19	5.2	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
pH by Meter (1:2 Soil:Water Extraction)	E108 Vancouver - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Metals in Soil/Solid by CRC ICPMS	E440 Vancouver - Environmental	Soil/Solid	EPA 6020B (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available. Silicate minerals are not solubilized. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. Analysis is by Collision/Reaction Cell ICPMS.
Mercury in Soil/Solid by CVAAS	E510 Vancouver - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
Hexavalent Chromium (Cr VI) by IC	E532 Edmonton - Environmental	Soil/Solid	APHA 3500-CR C	Instrumental analysis is performed by ion chromatography with UV detection.
VH and F1 by Headspace GC-FID	E581.VH+F1 Vancouver - Environmental	Soil/Solid	BC MOE Lab Manual / CCME PHC in Soil - Tier 1 (mod)	Volatile Hydrocarbons (VH and F1) is analyzed by static headspace GC-FID. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
BC PHC - EPH by GC-FID	E601A Vancouver - Environmental	Soil/Solid	BC MOE Lab Manual (EPH in Solids by GC/FID) (mod)	Extractable Petroleum Hydrocarbons (EPH) are analyzed by GC-FID.
BTEX by Headspace GC-MS	E611A Vancouver - Environmental	Soil/Solid	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
VOCs (BC List) by Headspace GC-MS	E611C Vancouver - Environmental	Soil/Solid	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.

Analytical Methods	*Method / Lab*	*Matrix*	*Method Reference*	*Method Descriptions*
PAHs by Hex:Ace GC-MS (Low Level CCME)	E641A-L Vancouver - Environmental	Soil/Solid	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are analyzed by GC-MS.
Glycols (BC List) by GC-FID	E680E Vancouver - Environmental	Soil/Solid	EPA 8015D (mod)	Derivatized glycols are analyzed by GC-FID.
Trivalent Chromium (Cr III) by Calculation	EC535C Edmonton - Environmental	Soil/Solid	BC WLAP LAB MANUAL / EPA 3060A & 7196A	This analysis is carried out using the method "Trivalent Chromium in Solids", as published in the BC WLAP Laboratory Methods Manual (2003). Chromium (III) is determined by subtraction of chromium (VI) from total chromium. Chromium (VI) is determined by the alkaline leach method, and total chromium is determined using CSR Analytical Method 8 "Strong Acid Leachable Metals (SALM) in Soil", BC Ministry of Environment, Lands and Parks, 26 June 2001. All results are reported as milligrams per dry kilogram of sediment/soil. The Limit of Reporting for Chromium (III) varies as a function of the test results.
VPH: VH-BTEX-Styrene	EC580A Vancouver - Environmental	Soil/Solid	BC MOE Lab Manual (VPH in Water and Solids) (mod)	Volatile Petroleum Hydrocarbons (VPH) is calculated as follows: VH-BTEX = Volatile Hydrocarbons (VH6-10) minus benzene, toluene, ethylbenzene, xylenes (BTEX) and styrene.
LEPH and HEPH: EPH-PAH	EC600A Vancouver - Environmental	Soil/Solid	BC MOE Lab Manual (LEPH and HEPH) (mod)	Light Extractable Petroleum Hydrocarbons (LEPH) and Heavy Extractable Petroleum Hydrocarbons (HEPH) are calculated as follows: LEPH = Extractable Petroleum Hydrocarbons (EPH10-19) minus Naphthalene and Phenanthrene; HEPH = Extractable Petroleum Hydrocarbons (EPH19-32) minus Benz(a)anthracene, Benzo(b+j+k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, and Pyrene.
Dissolved Metals in Water by CRC ICPMS	E421 Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Vancouver - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Dissolved Mercury in Water by CVAAS	E509 Vancouver - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
VH and F1 by Headspace GC-FID	E581.VH+F1 Vancouver - Environmental	Water	BC MOE Lab Manual / CCME PHC in Soil - Tier 1 (mod)	Volatile Hydrocarbons (VH and F1) is analyzed by static headspace GC-FID. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
BC PHC - EPH by GC-FID	E601A Calgary - Environmental	Water	BC MOE Lab Manual	Extractable Petroleum Hydrocarbons (EPH) are analyzed by GC-FID.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
BC PHC - EPH(sg) by GC-FID	E601A.SG Vancouver - Environmental	Water	BC MOE Lab Manual (EPH in Water by GC/FID) (mod)	Silica gel cleaned Extractable Petroleum Hydrocarbons (EPHsg) are analyzed by GC-FID.
VOCs (BC List) by Headspace GC-MS	E611C Vancouver - Environmental	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
PAHs by Hexane LVI GC-MS	E641A Calgary - Environmental	Water	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are analyzed by large volume injection (LVI) GC-MS.
Glycols (BC List) by GC-FID	E680E Vancouver - Environmental	Water	EPA 8015D (mod)	Derivatized glycols are analyzed by GC-FID.
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
VPH: VH-BTEX-Styrene	EC580A Vancouver - Environmental	Water	BC MOE Lab Manual (VPH in Water and Solids) (mod)	Volatile Petroleum Hydrocarbons (VPH) is calculated as follows: VPHw = Volatile Hydrocarbons (VH6-10) minus benzene, toluene, ethylbenzene, xylenes (BTEX) and styrene.
LEPH and HEPH: EPH-PAH	EC600A Calgary - Environmental	Water	BC MOE Lab Manual (LEPH and HEPH) (mod)	Light Extractable Petroleum Hydrocarbons (LEPH) and Heavy Extractable Petroleum Hydrocarbons (HEPH) are calculated as follows: LEPH = Extractable Petroleum Hydrocarbons (EPH10-19) minus Acenaphthene, Acridine, Anthracene, Fluorene, Naphthalene and Phenanthrene; HEPH = Extractable Petroleum Hydrocarbons (EPH19-32) minus Benz(a)anthracene, Benzo(a)pyrene, Fluoranthene, and Pyrene.
LEPHsg and HEPHsg: EPHsg-PAH	EC600A.SG Vancouver - Environmental	Water	BC MOE Lab Manual (LEPH and HEPH) (mod)	Silca gel treated Light Extractable Petroleum Hydrocarbons (LEPH-sg) and silica gel treated Heavy Extractable Petroleum Hydrocarbons (HEPH-sg) are calculated as follows: LEPH-sg = Silica gel treated Extractable Petroleum Hydrocarbons (EPH10-19-sg) minus Acenaphthene, Acridine, Anthracene, Fluorene, Naphthalene and Phenanthrene; HEPH-sg = Silica gel treated Extractable Petroleum Hydrocarbons (EPH19-32-sg) minus Benz(a)anthracene, Benzo(a)pyrene, Fluoranthene, and Pyrene.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH	EP108 Vancouver - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Digestion for Metals and Mercury	EP440 Vancouver - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. This method is intended to liberate metals that may be environmentally available.

Preparation Methods	*Method / Lab*	*Matrix*	*Method Reference*	*Method Descriptions*
Preparation of Hexavalent Chromium (Cr VI) for IC	EP532 Edmonton - Environmental	Soil/Solid	EPA 3060A	Field moist samples are digested with a sodium hydroxide/sodium carbonate solution as described in EPA 3060A.
VOCs Methanol Extraction for Headspace Analysis	EP581 Vancouver - Environmental	Soil/Solid	EPA 5035A (mod)	VOCs in samples are extracted with methanol. Extracts are then prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
PHCs and PAHs Hexane-Acetone Tumbler Extraction	EP601 Vancouver - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1 (mod)	Samples are subsampled and Petroleum Hydrocarbons (PHC) and PAHs are extracted with 1:1 hexane:acetone using a rotary extractor.
Glycols Extraction and Derivatization (BC Only)	EP680E Vancouver - Environmental	Soil/Solid	EPA 8015D (mod)	Samples are subsampled and analytes are extracted with aqueous solvent. The extracts are then derivatized.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.
VOCs Preparation for Headspace Analysis	EP581 Vancouver - Environmental	Water	EPA 5021A (mod)	Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler. An aliquot of the headspace is then injected into the GC/MS-FID system.
PHCs and PAHs Hexane Extraction	EP601 Calgary - Environmental	Water	EPA 3511 (mod)	Petroleum Hydrocarbons (PHCs) and Polycyclic Aromatic Hydrocarbons (PAHs) are extracted using a hexane liquid-liquid extraction.
Glycols Extraction and Derivatization (BC Only)	EP680E Vancouver - Environmental	Water	EPA 8015D (mod)	Aqueous sample is derivatized and extracted with orgaic solvent.

QUALITY CONTROL REPORT

Work Order	: **WR2000970**	Page	: 1 of 38
Amendment	: **4**		
Client	: Tetra Tech Canada Inc.	Laboratory	: Whitehorse - Environmental
Contact	: Kristina Schmidt	Account Manager	: Brent Mack
Address	: 61 Wasson Place Whitehorse YT Canada Y1A 0H7	Address	: #12 151 Industrial Road Whitehorse, Yukon Canada Y1A 2V3
Telephone	: ----	Telephone	: +1 867 668 6689
Project	: 704-ENW.PENW03102-01	Date Samples Received	: 29-Sep-2020 16:20
PO	: ----	Date Analysis Commenced	: 03-Oct-2020
C-O-C number	: ----	Issue Date	: 27-Oct-2020 10:26
Sampler	: KS		
Site	: ----		
Quote number	: Standard Client Price List (BC & YK)		
No. of samples received	: 27		
No. of samples analysed	: 20		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits
- Reference Material (RM) Report; Recovery and Acceptance Limits
- Method Blank (MB) Report; Recovery and Acceptance Limits
- Laboratory Control Sample (LCS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Drake	Lab Analyst	Inorganics, Edmonton, Alberta
Ann Ho	Laboratory Analyst	Metals, Burnaby, British Columbia
Brieanna Allen	Department Manager - Organics	Organics, Burnaby, British Columbia
Gloria Chan	Lab Analyst	Metals, Burnaby, British Columbia
Jashan Kaur	Lab Assistant	Metals, Burnaby, British Columbia
Jeanie Mark		Organics, Calgary, Alberta
Kim Jensen	Department Manager - Metals	Metals, Burnaby, British Columbia
Ophelia Chiu	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Ping Yeung	Team Leader - Inorganics	Inorganics, Edmonton, Alberta
Ping Yeung	Team Leader - Inorganics	Metals, Edmonton, Alberta
Robin Weeks	Team Leader - Metals	Metals, Burnaby, British Columbia
Shaneel Dayal	Analyst	Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Services number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percentage Difference
# = Indicates a QC result that did not meet the ALS DQO.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 107142)											
VA20B8747-001	Anonymous	moisture	----	E144	0.25	%	8.05	8.04	0.139%	20%	----
Physical Tests (QC Lot: 97748)											
WR2000970-001	TP20-01-0.5m	pH (1:2 soil:water)	----	E108	0.10	pH units	8.88	8.71	1.93%	5%	----
Physical Tests (QC Lot: 97753)											
VA20B6308-011	Anonymous	moisture	----	E144	0.25	%	7.25	6.37	12.9%	20%	----
Physical Tests (QC Lot: 99712)											
VA20B7211-001	Anonymous	moisture	----	E144	0.25	%	16.7	15.8	5.26%	20%	----
Metals (QC Lot: 103114)											
WR2000970-014	TP20-05-0.75m	aluminum	7429-90-5	E440	50	mg/kg	16400	14900	9.20%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	0.36	0.37	0.02	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.10	mg/kg	3.56	3.04	15.6%	30%	----
		barium	7440-39-3	E440	0.50	mg/kg	150	143	4.81%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.20	0.18	0.02	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.097	0.091	0.006	Diff <2x LOR	----
		calcium	7440-70-2	E440	50	mg/kg	4110	3850	6.59%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	219	202	7.94%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	17.2	16.5	4.26%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	22.6	20.3	11.0%	30%	----
		iron	7439-89-6	E440	50	mg/kg	21000	19700	6.50%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	3.25	3.89	18.0%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	11.9	11.9	0.03	Diff <2x LOR	----
		magnesium	7439-95-4	E440	20	mg/kg	16700	16000	4.55%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	247	225	9.20%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	0.24	0.28	0.04	Diff <2x LOR	----
		nickel	7440-02-0	E440	0.50	mg/kg	188	181	3.62%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	349	383	9.33%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	370	330	40	Diff <2x LOR	----
		selenium	7782-49-2	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	140	128	12	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 103114) - continued											
WR2000970-014	TP20-05-0.75m	strontium	7440-24-6	E440	0.50	mg/kg	22.2	19.7	11.9%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	722	620	15.1%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	0.445	0.372	18.0%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	52.9	48.3	9.21%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	32.0	31.8	0.927%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	4.0	3.4	0.6	Diff <2x LOR	----
Metals (QC Lot: 107135)											
VA20B8747-001	Anonymous	aluminum	7429-90-5	E440	50	mg/kg	13600	17300	23.5%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	2.83	2.02	33.1%	30%	DUP-H
		arsenic	7440-38-2	E440	0.10	mg/kg	7.38	5.24	33.9%	30%	DUP-H
		barium	7440-39-3	E440	0.50	mg/kg	145	119	19.6%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.23	0.29	0.06	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	7.7	5.9	1.8	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.373	0.374	0.178%	30%	----
		calcium	7440-70-2	E440	50	mg/kg	11200	12200	8.80%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	20.1	26.3	27.0%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	8.86	10.4	15.8%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	69.6	52.1	28.8%	30%	----
		iron	7439-89-6	E440	50	mg/kg	24100	27400	12.7%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	102	75.9	29.0%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	7.9	8.9	1.0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	20	mg/kg	6150	7440	19.0%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	440	533	19.0%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	0.71	0.56	23.2%	40%	----
		nickel	7440-02-0	E440	0.50	mg/kg	20.9	23.7	12.8%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	778	751	3.42%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	670	710	5.95%	40%	----
		selenium	7782-49-2	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	0.18	0.21	0.03	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	338	346	2.33%	40%	----
		strontium	7440-24-6	E440	0.50	mg/kg	78.8	75.0	5.00%	40%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 107135) - continued											
VA20B8747-001	Anonymous	sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	5.3	6.5	1.2	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	1020	1100	8.03%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	0.360	0.324	10.4%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	54.6	65.5	18.3%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	193	174	10.5%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	2.0	2.5	0.5	Diff <2x LOR	----
Metals (QC Lot: 97746)											
WR2000970-001	TP20-01-0.5m	mercury	7439-97-6	E510	0.0050	mg/kg	0.0201	0.0164	0.0036	Diff <2x LOR	----
Metals (QC Lot: 97747)											
WR2000970-001	TP20-01-0.5m	aluminum	7429-90-5	E440	50	mg/kg	9530	12200	24.7%	40%	----
		antimony	7440-36-0	E440	0.40	mg/kg	<0.40	<0.40	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.10	mg/kg	4.23	3.44	20.7%	30%	----
		barium	7440-39-3	E440	0.50	mg/kg	78.8	66.5	17.0%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.18	0.15	0.03	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.110	0.092	0.018	Diff <2x LOR	----
		calcium	7440-70-2	E440	50	mg/kg	2020	2560	23.3%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	116	152	26.5%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	9.19	12.0	26.6%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	15.6	16.3	4.64%	30%	----
		iron	7439-89-6	E440	50	mg/kg	14000	15800	12.0%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	4.91	4.44	9.94%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	9.4	11.5	2.1	Diff <2x LOR	----
		magnesium	7439-95-4	E440	20	mg/kg	9650	12400	25.2%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	169	221	26.6%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	0.27	0.28	0.009	Diff <2x LOR	----
		nickel	7440-02-0	E440	0.50	mg/kg	46.0	63.8	32.5%	30%	DUP-H
		phosphorus	7723-14-0	E440	50	mg/kg	339	# 192	147	Diff <2x LOR	DUP-H
		potassium	7440-09-7	E440	100	mg/kg	550	480	13.6%	40%	----
		selenium	7782-49-2	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	<50	<50	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 97747) - continued											
WR2000970-001	TP20-01-0.5m	strontium	7440-24-6	E440	0.50	mg/kg	11.9	11.3	5.36%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	245	440	56.7%	40%	DUP-H
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	0.510	0.442	14.3%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	29.6	33.6	12.7%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	28.0	24.1	15.0%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	2.6	2.2	0.5	Diff <2x LOR	----
Speciated Metals (QC Lot: 104491)											
WR2000970-015	TP20-05-1.25m	chromium, hexavalent [Cr VI]	18540-29-9	E532	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
Speciated Metals (QC Lot: 107728)											
WR2000970-003	TP20-01-1.75m	chromium, hexavalent [Cr VI]	18540-29-9	E532	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 96996)											
WR2000999-001	Anonymous	benzene	71-43-2	E611A	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611A	0.015	mg/kg	<0.015	<0.015	0	Diff <2x LOR	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.200	mg/kg	<0.200	<0.200	0	Diff <2x LOR	----
		styrene	100-42-5	E611A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		toluene	108-88-3	E611A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 97001)											
VA20B6777-003	Anonymous	benzene	71-43-2	E611C	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		bromodichloromethane	75-27-4	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		bromoform	75-25-2	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		carbon tetrachloride	56-23-5	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		chlorobenzene	108-90-7	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		chloroethane	75-00-3	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		chloroform	67-66-3	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		chloromethane	74-87-3	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		dibromochloromethane	124-48-1	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		dichlorobenzene, 1,2-	95-50-1	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		dichlorobenzene, 1,3-	541-73-1	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		dichlorobenzene, 1,4-	106-46-7	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 97001) - continued											
VA20B6777-003	Anonymous	dichloroethane, 1,1-	75-34-3	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		dichloroethane, 1,2-	107-06-2	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		dichloroethylene, 1,1-	75-35-4	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		dichloroethylene, cis-1,2-	156-59-4	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		dichloroethylene, trans-1,2-	156-60-5	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		dichloromethane	75-09-2	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		dichloropropane, 1,2-	78-87-5	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		dichloropropylene, cis-1,3-	10061-01-5	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		dichloropropylene, trans-1,3-	10061-02-6	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611C	0.015	mg/kg	<0.015	<0.015	0	Diff <2x LOR	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		styrene	100-42-5	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tetrachloroethane, 1,1,1,2-	630-20-6	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tetrachloroethane, 1,1,2,2-	79-34-5	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		tetrachloroethylene	127-18-4	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		toluene	108-88-3	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		trichloroethane, 1,1,1-	71-55-6	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		trichloroethane, 1,1,2-	79-00-5	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		trichloroethylene	79-01-6	E611C	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		trichlorofluoromethane	75-69-4	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		vinyl chloride	75-01-4	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611C	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 96997)											
WR2000999-003	Anonymous	VHs (C6-C10)	----	E581.VH+F1	10	mg/kg	<10	<10	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 97000)											
VA20B6777-002	Anonymous	VHs (C6-C10)	----	E581.VH+F1	10	mg/kg	<10	<10	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 97750)											
VA20B6308-011	Anonymous	EPH (C10-C19)	----	E601A	200	mg/kg	470	530	60	Diff <2x LOR	----
		EPH (C19-C32)	----	E601A	200	mg/kg	8420	9590	12.9%	40%	----
Polycyclic Aromatic Hydrocarbons (QC Lot: 97749)											
VA20B6308-011	Anonymous	acenaphthene	83-32-9	E641A-L	0.0090	mg/kg	<0.0090	<0.0200	0.0110	Diff <2x LOR	----
		acenaphthylene	208-96-8	E641A-L	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		acridine	260-94-6	E641A-L	0.060	mg/kg	<0.060	<0.050	0.010	Diff <2x LOR	----
		anthracene	120-12-7	E641A-L	0.0040	mg/kg	<0.0040	<0.0040	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

Laboratory Duplicate (DUP) Report

Polycyclic Aromatic Hydrocarbons (QC Lot: 97749) - continued

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
VA20B6308-011	Anonymous	benz(a)anthracene	56-55-3	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		benzo(a)pyrene	50-32-8	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		benzo(b+j)fluoranthene	----	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		benzo(g,h,i)perylene	191-24-2	E641A-L	0.010	mg/kg	0.082	0.082	0.119%	50%	----
		benzo(k)fluoranthene	207-08-9	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		chrysene	218-01-9	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		dibenz(a,h)anthracene	53-70-3	E641A-L	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		fluoranthene	206-44-0	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		fluorene	86-73-7	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		methylnaphthalene, 1-	90-12-0	E641A-L	0.010	mg/kg	0.039	0.045	13.6%	50%	----
		methylnaphthalene, 2-	91-57-6	E641A-L	0.010	mg/kg	0.036	0.041	0.006	Diff <2x LOR	----
		naphthalene	91-20-3	E641A-L	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		phenanthrene	85-01-8	E641A-L	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		pyrene	129-00-0	E641A-L	0.010	mg/kg	0.062	0.060	3.79%	50%	----
		quinoline	6027-02-7	E641A-L	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----

Glycols (QC Lot: 96523)

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
VA20B6777-006	Anonymous	diethylene glycol	111-46-6	E680E	10	mg/kg	<10	<10	0	Diff <2x LOR	----
		ethylene glycol	107-21-1	E680E	10	mg/kg	<10	<10	0	Diff <2x LOR	----
		propylene glycol, 1,2-	57-55-6	E680E	10	mg/kg	<10	<10	0	Diff <2x LOR	----
		triethylene glycol	112-27-6	E680E	10	mg/kg	<10	<10	0	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory Duplicate (DUP) Report

Dissolved Metals (QC Lot: 97161)

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
VA20B6870-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0019	0.0018	0.0001	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00075	0.00075	0.000007	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0628	0.0621	1.03%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000100	mg/L	<0.000100	<0.000100	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0000077	0.0000098	0.0000021	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	75.9	74.2	2.16%	20%	----
		cesium, dissolved	7440-46-2	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 97161) - continued											
VA20B6870-001	Anonymous	copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00037	0.00036	0.00001	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0046	0.0046	0.000003	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	19.7	20.3	2.99%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00158	0.00156	1.59%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00325	0.00334	2.64%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		phosphorus, dissolved	7723-14-0	E421	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	3.80	3.83	0.820%	20%	----
		rubidium, dissolved	7440-17-7	E421	0.00020	mg/L	0.00075	0.00083	0.00008	Diff <2x LOR	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.00567	0.00556	1.93%	20%	----
		silicon, dissolved	7440-21-3	E421	0.100	mg/L	8.95	8.84	1.19%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	17341-25-2	E421	0.050	mg/L	8.34	8.46	1.49%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.832	0.827	0.672%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	25.0	25.1	0.535%	20%	----
		tellurium, dissolved	13494-80-9	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		thorium, dissolved	7440-29-1	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	0.00098	0.00096	0.00002	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		tungsten, dissolved	7440-33-7	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00190	0.00196	2.58%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	0.00050	0.00051	0.000005	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		zirconium, dissolved	7440-67-7	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 97162)											
VA20B6870-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00015	0.00015	0.0000005	Diff <2x LOR	----
Dissolved Metals (QC Lot: 97817)											
VA20B6963-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 98014)											
VA20B6928-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 97142)											
VA20B6540-003	Anonymous	benzene	71-43-2	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 97142) - continued											
VA20B6540-003	Anonymous	bromodichloromethane	75-27-4	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		bromoform	75-25-2	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		carbon tetrachloride	56-23-5	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		chlorobenzene	108-90-7	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		chloroethane	75-00-3	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		chloroform	67-66-3	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		chloromethane	74-87-3	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dibromochloromethane	124-48-1	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichlorobenzene, 1,2-	95-50-1	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichlorobenzene, 1,3-	541-73-1	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichlorobenzene, 1,4-	106-46-7	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichloroethane, 1,1-	75-34-3	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichloroethane, 1,2-	107-06-2	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichloroethylene, 1,1-	75-35-4	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichloroethylene, cis-1,2-	156-59-4	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichloroethylene, trans-1,2-	156-60-5	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichloromethane	75-09-2	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichloropropane, 1,2-	78-87-5	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichloropropylene, cis-1,3-	10061-01-5	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		dichloropropylene, trans-1,3-	10061-02-6	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		ethylbenzene	100-41-4	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		styrene	100-42-5	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		tetrachloroethane, 1,1,1,2-	630-20-6	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		tetrachloroethane, 1,1,2,2-	79-34-5	E611C	0.20	µg/L	<0.20	<0.20	0	Diff <2x LOR	----
		tetrachloroethylene	127-18-4	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		toluene	108-88-3	E611C	0.40	µg/L	<0.40	<0.40	0	Diff <2x LOR	----
		trichloroethane, 1,1,1-	71-55-6	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		trichloroethane, 1,1,2-	79-00-5	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		trichloroethylene	79-01-6	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		trichlorofluoromethane	75-69-4	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		vinyl chloride	75-01-4	E611C	0.40	µg/L	<0.40	<0.40	0	Diff <2x LOR	----
		xylene, m+p-	179601-23-1	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		xylene, o-	95-47-6	E611C	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 97143)											
VA20B6540-001	Anonymous	VHw (C6-C10)	----	E581.VH+F1	100	µg/L	<100	<100	0.00%	30%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Glycols (QC Lot: 96522)											
KS2001985-003	Anonymous	diethylene glycol	111-46-6	E680E	5.0	mg/L	<5.0	<5.0	0	Diff <2x LOR	----
		ethylene glycol	107-21-1	E680E	5.0	mg/L	<5.0	<5.0	0	Diff <2x LOR	----
		propylene glycol, 1,2-	57-55-6	E680E	5.0	mg/L	<5.0	<5.0	0	Diff <2x LOR	----
		triethylene glycol	112-27-6	E680E	5.0	mg/L	<5.0	<5.0	0	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 107142)						
moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 97753)						
moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 99712)						
moisture	----	E144	0.25	%	<0.25	----
Metals (QCLot: 103114)						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 103114) - continued						
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Metals (QCLot: 107135)						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 107135) - continued						
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Metals (QCLot: 97746)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 97747)						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 97747) - continued						
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Speciated Metals (QCLot: 104491)						
chromium, hexavalent [Cr VI]	18540-29-9	E532	0.1	mg/kg	<0.10	----
Speciated Metals (QCLot: 107728)						
chromium, hexavalent [Cr VI]	18540-29-9	E532	0.1	mg/kg	<0.10	----
Volatile Organic Compounds (QCLot: 96996)						
benzene	71-43-2	E611A	0.005	mg/kg	<0.0050	----
ethylbenzene	100-41-4	E611A	0.015	mg/kg	<0.015	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.05	mg/kg	<0.050	----
styrene	100-42-5	E611A	0.05	mg/kg	<0.050	----
toluene	108-88-3	E611A	0.05	mg/kg	<0.050	----
xylene, m+p-	179601-23-1	E611A	0.05	mg/kg	<0.050	----
xylene, o-	95-47-6	E611A	0.05	mg/kg	<0.050	----
Volatile Organic Compounds (QCLot: 97001)						
benzene	71-43-2	E611C	0.005	mg/kg	<0.0050	----
bromodichloromethane	75-27-4	E611C	0.05	mg/kg	<0.050	----
bromoform	75-25-2	E611C	0.05	mg/kg	<0.050	----
carbon tetrachloride	56-23-5	E611C	0.05	mg/kg	<0.050	----
chlorobenzene	108-90-7	E611C	0.05	mg/kg	<0.050	----
chloroethane	75-00-3	E611C	0.05	mg/kg	<0.050	----
chloroform	67-66-3	E611C	0.05	mg/kg	<0.050	----
chloromethane	74-87-3	E611C	0.05	mg/kg	<0.050	----
dibromochloromethane	124-48-1	E611C	0.05	mg/kg	<0.050	----
dichlorobenzene, 1,2-	95-50-1	E611C	0.05	mg/kg	<0.050	----
dichlorobenzene, 1,3-	541-73-1	E611C	0.05	mg/kg	<0.050	----
dichlorobenzene, 1,4-	106-46-7	E611C	0.05	mg/kg	<0.050	----
dichloroethane, 1,1-	75-34-3	E611C	0.05	mg/kg	<0.050	----
dichloroethane, 1,2-	107-06-2	E611C	0.05	mg/kg	<0.050	----
dichloroethylene, 1,1-	75-35-4	E611C	0.05	mg/kg	<0.050	----
dichloroethylene, cis-1,2-	156-59-4	E611C	0.05	mg/kg	<0.050	----

Sub-Matrix: **Soil/Solid**

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Result*	*Qualifier*
Volatile Organic Compounds (QCLot: 97001) - continued						
dichloroethylene, trans-1,2-	156-60-5	E611C	0.05	mg/kg	<0.050	----
dichloromethane	75-09-2	E611C	0.05	mg/kg	<0.050	----
dichloropropane, 1,2-	78-87-5	E611C	0.05	mg/kg	<0.050	----
dichloropropylene, cis-1,3-	10061-01-5	E611C	0.05	mg/kg	<0.050	----
dichloropropylene, trans-1,3-	10061-02-6	E611C	0.05	mg/kg	<0.050	----
ethylbenzene	100-41-4	E611C	0.015	mg/kg	<0.015	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611C	0.05	mg/kg	<0.050	----
styrene	100-42-5	E611C	0.05	mg/kg	<0.050	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611C	0.05	mg/kg	<0.050	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611C	0.05	mg/kg	<0.050	----
tetrachloroethylene	127-18-4	E611C	0.05	mg/kg	<0.050	----
toluene	108-88-3	E611C	0.05	mg/kg	<0.050	----
trichloroethane, 1,1,1-	71-55-6	E611C	0.05	mg/kg	<0.050	----
trichloroethane, 1,1,2-	79-00-5	E611C	0.05	mg/kg	<0.050	----
trichloroethylene	79-01-6	E611C	0.01	mg/kg	<0.010	----
trichlorofluoromethane	75-69-4	E611C	0.05	mg/kg	<0.050	----
vinyl chloride	75-01-4	E611C	0.05	mg/kg	<0.050	----
xylene, m+p-	179601-23-1	E611C	0.05	mg/kg	<0.050	----
xylene, o-	95-47-6	E611C	0.05	mg/kg	<0.050	----
Hydrocarbons (QCLot: 96997)						
VHs (C6-C10)	----	E581.VH+F1	10	mg/kg	<10	----
Hydrocarbons (QCLot: 97000)						
VHs (C6-C10)	----	E581.VH+F1	10	mg/kg	<10	----
Hydrocarbons (QCLot: 97750)						
EPH (C10-C19)	----	E601A	200	mg/kg	<200 <200	---- ----
EPH (C19-C32)	----	E601A	200	mg/kg	<200 <200	---- ----
Polycyclic Aromatic Hydrocarbons (QCLot: 97749)						
acenaphthene	83-32-9	E641A-L	0.005	mg/kg	<0.0050 <0.0050	---- ----
acenaphthylene	208-96-8	E641A-L	0.005	mg/kg	<0.0050 <0.0050	---- ----
acridine	260-94-6	E641A-L	0.01	mg/kg	<0.010	----
anthracene	120-12-7	E641A-L	0.004	mg/kg	<0.0040 <0.0040	---- ----
benz(a)anthracene	56-55-3	E641A-L	0.01	mg/kg	<0.010 <0.010	---- ----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 97749) - continued						
benzo(a)pyrene	50-32-8	E641A-L	0.01	mg/kg	<0.010	----
benzo(b+j)fluoranthene	----	E641A-L	0.01	mg/kg	<0.010	----
benzo(g,h,i)perylene	191-24-2	E641A-L	0.01	mg/kg	<0.010	----
benzo(k)fluoranthene	207-08-9	E641A-L	0.01	mg/kg	<0.010	----
chrysene	218-01-9	E641A-L	0.01	mg/kg	<0.010	----
dibenz(a,h)anthracene	53-70-3	E641A-L	0.005	mg/kg	<0.0050 <0.0050	---- ----
fluoranthene	206-44-0	E641A-L	0.01	mg/kg	<0.010	----
fluorene	86-73-7	E641A-L	0.01	mg/kg	<0.010	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.01	mg/kg	<0.010 <0.010	---- ----
methylnaphthalene, 1-	90-12-0	E641A-L	0.01	mg/kg	<0.010	----
methylnaphthalene, 2-	91-57-6	E641A-L	0.01	mg/kg	<0.010	----
naphthalene	91-20-3	E641A-L	0.01	mg/kg	<0.010	----
phenanthrene	85-01-8	E641A-L	0.01	mg/kg	<0.010	----
pyrene	129-00-0	E641A-L	0.01	mg/kg	<0.010	----
quinoline	6027-02-7	E641A-L	0.01	mg/kg	<0.010	----
Glycols (QCLot: 96523)						
diethylene glycol	111-46-6	E680E	10	mg/kg	<10	----
ethylene glycol	107-21-1	E680E	10	mg/kg	<10	----
propylene glycol, 1,2-	57-55-6	E680E	10	mg/kg	<10	----
triethylene glycol	112-27-6	E680E	10	mg/kg	<10	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 97161)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cesium, dissolved	7440-46-2	E421	0.00001	mg/L	<0.000010	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----

Sub-Matrix: **Water**

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Result*	*Qualifier*
Dissolved Metals (QCLot: 97161) - continued						
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	<0.050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
rubidium, dissolved	7440-17-7	E421	0.0002	mg/L	<0.00020	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	17341-25-2	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
tellurium, dissolved	13494-80-9	E421	0.0002	mg/L	<0.00020	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
thorium, dissolved	7440-29-1	E421	0.0001	mg/L	<0.00010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
tungsten, dissolved	7440-33-7	E421	0.0001	mg/L	<0.00010	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	<0.00020	----
Dissolved Metals (QCLot: 97162)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 97817)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 98014)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Volatile Organic Compounds (QCLot: 97142)						
benzene	71-43-2	E611C	0.5	µg/L	<0.50	----
bromodichloromethane	75-27-4	E611C	0.5	µg/L	<0.50	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Volatile Organic Compounds (QCLot: 97142) - continued						
bromoform	75-25-2	E611C	0.5	µg/L	<0.50	----
carbon tetrachloride	56-23-5	E611C	0.5	µg/L	<0.50	----
chlorobenzene	108-90-7	E611C	0.5	µg/L	<0.50	----
chloroethane	75-00-3	E611C	0.5	µg/L	<0.50	----
chloroform	67-66-3	E611C	0.5	µg/L	<0.50	----
chloromethane	74-87-3	E611C	0.5	µg/L	<0.50	----
dibromochloromethane	124-48-1	E611C	0.5	µg/L	<0.50	----
dichlorobenzene, 1,2-	95-50-1	E611C	0.5	µg/L	<0.50	----
dichlorobenzene, 1,3-	541-73-1	E611C	0.5	µg/L	<0.50	----
dichlorobenzene, 1,4-	106-46-7	E611C	0.5	µg/L	<0.50	----
dichloroethane, 1,1-	75-34-3	E611C	0.5	µg/L	<0.50	----
dichloroethane, 1,2-	107-06-2	E611C	0.5	µg/L	<0.50	----
dichloroethylene, 1,1-	75-35-4	E611C	0.5	µg/L	<0.50	----
dichloroethylene, cis-1,2-	156-59-4	E611C	0.5	µg/L	<0.50	----
dichloroethylene, trans-1,2-	156-60-5	E611C	0.5	µg/L	<0.50	----
dichloromethane	75-09-2	E611C	0.5	µg/L	<0.50	----
dichloropropane, 1,2-	78-87-5	E611C	0.5	µg/L	<0.50	----
dichloropropylene, cis-1,3-	10061-01-5	E611C	0.5	µg/L	<0.50	----
dichloropropylene, trans-1,3-	10061-02-6	E611C	0.5	µg/L	<0.50	----
ethylbenzene	100-41-4	E611C	0.5	µg/L	<0.50	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611C	0.5	µg/L	<0.50	----
styrene	100-42-5	E611C	0.5	µg/L	<0.50	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611C	0.5	µg/L	<0.50	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611C	0.2	µg/L	<0.20	----
tetrachloroethylene	127-18-4	E611C	0.5	µg/L	<0.50	----
toluene	108-88-3	E611C	0.4	µg/L	<0.40	----
trichloroethane, 1,1,1-	71-55-6	E611C	0.5	µg/L	<0.50	----
trichloroethane, 1,1,2-	79-00-5	E611C	0.5	µg/L	<0.50	----
trichloroethylene	79-01-6	E611C	0.5	µg/L	<0.50	----
trichlorofluoromethane	75-69-4	E611C	0.5	µg/L	<0.50	----
vinyl chloride	75-01-4	E611C	0.4	µg/L	<0.40	----
xylene, m+p-	179601-23-1	E611C	0.5	µg/L	<0.50	----
xylene, o-	95-47-6	E611C	0.5	µg/L	<0.50	----
Hydrocarbons (QCLot: 103096)						
EPH (C10-C19), silica gel treated	----	E601A.SG	250	µg/L	<250	----
EPH (C19-C32), silica gel treated	----	E601A.SG	250	µg/L	<250	----

Sub-Matrix: **Water**

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Result*	*Qualifier*
Hydrocarbons (QCLot: 97117)						
EPH (C10-C19)	----	E601A	250	µg/L	<250	----
EPH (C19-C32)	----	E601A	250	µg/L	<250	----
Hydrocarbons (QCLot: 97143)						
VHw (C6-C10)	----	E581.VH+F1	100	µg/L	<100	----
Polycyclic Aromatic Hydrocarbons (QCLot: 97116)						
acenaphthene	83-32-9	E641A	0.01	µg/L	<0.010	----
acenaphthylene	208-96-8	E641A	0.01	µg/L	<0.010	----
acridine	260-94-6	E641A	0.01	µg/L	<0.010	----
anthracene	120-12-7	E641A	0.01	µg/L	<0.010	----
benz(a)anthracene	56-55-3	E641A	0.01	µg/L	<0.010	----
benzo(a)pyrene	50-32-8	E641A	0.005	µg/L	<0.0050	----
benzo(b+j)fluoranthene	----	E641A	0.01	µg/L	<0.010	----
benzo(g,h,i)perylene	191-24-2	E641A	0.01	µg/L	<0.010	----
benzo(k)fluoranthene	207-08-9	E641A	0.01	µg/L	<0.010	----
chrysene	218-01-9	E641A	0.01	µg/L	<0.010	----
dibenz(a,h)anthracene	53-70-3	E641A	0.005	µg/L	<0.0050	----
fluoranthene	206-44-0	E641A	0.01	µg/L	<0.010	----
fluorene	86-73-7	E641A	0.01	µg/L	<0.010	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.01	µg/L	<0.010	----
methylnaphthalene, 1-	90-12-0	E641A	0.01	µg/L	<0.010	----
methylnaphthalene, 2-	91-57-6	E641A	0.01	µg/L	<0.010	----
naphthalene	91-20-3	E641A	0.05	µg/L	<0.050	----
phenanthrene	85-01-8	E641A	0.02	µg/L	<0.020	----
pyrene	129-00-0	E641A	0.01	µg/L	<0.010	----
quinoline	6027-02-7	E641A	0.05	µg/L	<0.050	----
Glycols (QCLot: 96522)						
diethylene glycol	111-46-6	E680E	5	mg/L	<5.0	----
ethylene glycol	107-21-1	E680E	5	mg/L	<5.0	----
propylene glycol, 1,2-	57-55-6	E680E	5	mg/L	<5.0	----
triethylene glycol	112-27-6	E680E	5	mg/L	<5.0	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

Laboratory Control Sample (LCS) Report

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Spike*	*Recovery (%)*	*Recovery Limits (%)*		*Qualifier*
					Concentration	*LCS*	*Low*	*High*	
Physical Tests (QCLot: 107142)									
moisture	----	E144	0.25	%	50 %	101	90.0	110	----
Physical Tests (QCLot: 97748)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	100	95.0	105	----
Physical Tests (QCLot: 97753)									
moisture	----	E144	0.25	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 99712)									
moisture	----	E144	0.25	%	50 %	102	90.0	110	----
Metals (QCLot: 103114)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	102	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	102	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	101	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	97.6	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	88.8	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	95.7	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	91.7	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	103	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	94.4	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	103	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	101	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	103	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	106	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	92.7	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	86.2	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	102	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	102	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	99.2	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	101	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	92.4	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	104	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	102	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	102	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	104	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	98.2	80.0	120	----

Sub-Matrix: **Soil/Solid**

Laboratory Control Sample (LCS) Report

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Spike*	*Recovery (%)*	*Recovery Limits (%)*		*Qualifier*
					Concentration	*LCS*	*Low*	*High*	
Metals (QCLot: 103114) - continued									
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	98.2	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	93.1	80.0	120	----
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	100	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	98.9	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	94.6	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	104	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	104	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	107	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	93.8	80.0	120	----
Metals (QCLot: 107135)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	104	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	102	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	102	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	106	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	98.8	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	97.8	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	97.8	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	107	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	102	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	104	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	102	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	102	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	101	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	97.0	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	96.5	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	104	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	105	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	98.4	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	103	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	103	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	104	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	103	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	101	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	106	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	102	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	106	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	102	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 107135) - continued									
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	102	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	105	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	96.2	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	102	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	104	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	101	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	99.8	80.0	120	----
Metals (QCLot: 97746)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	99.2	80.0	120	----
Metals (QCLot: 97747)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	102	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	110	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	103	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	106	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	98.5	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	107	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	103	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	104	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	106	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	101	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	105	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	102	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	110	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	107	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	94.0	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	106	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	102	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	104	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	104	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	111	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	104	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	107	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	110	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	102	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	106	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	106	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	106	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 97747) - continued									
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	102	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	100.0	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	108	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	110	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	105	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	109	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	106	80.0	120	----
Speciated Metals (QCLot: 104491)									
chromium, hexavalent [Cr VI]	18540-29-9	E532	0.1	mg/kg	16 mg/kg	94.2	80.0	120	----
Speciated Metals (QCLot: 107728)									
chromium, hexavalent [Cr VI]	18540-29-9	E532	0.1	mg/kg	16 mg/kg	95.7	80.0	120	----
Volatile Organic Compounds (QCLot: 96996)									
benzene	71-43-2	E611A	0.005	mg/kg	2.5 mg/kg	103	70.0	130	----
ethylbenzene	100-41-4	E611A	0.015	mg/kg	2.5 mg/kg	100	70.0	130	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	0.05	mg/kg	2.5 mg/kg	122	70.0	130	----
styrene	100-42-5	E611A	0.05	mg/kg	2.5 mg/kg	97.0	70.0	130	----
toluene	108-88-3	E611A	0.05	mg/kg	2.5 mg/kg	101	70.0	130	----
xylene, m+p-	179601-23-1	E611A	0.05	mg/kg	5 mg/kg	100	70.0	130	----
xylene, o-	95-47-6	E611A	0.05	mg/kg	2.5 mg/kg	104	70.0	130	----
Volatile Organic Compounds (QCLot: 97001)									
benzene	71-43-2	E611C	0.005	mg/kg	2.5 mg/kg	101	70.0	130	----
bromodichloromethane	75-27-4	E611C	0.05	mg/kg	2.5 mg/kg	108	70.0	130	----
bromoform	75-25-2	E611C	0.05	mg/kg	2.5 mg/kg	125	70.0	130	----
carbon tetrachloride	56-23-5	E611C	0.05	mg/kg	2.5 mg/kg	116	70.0	130	----
chlorobenzene	108-90-7	E611C	0.05	mg/kg	2.5 mg/kg	102	70.0	130	----
chloroethane	75-00-3	E611C	0.05	mg/kg	2.5 mg/kg	101	60.0	140	----
chloroform	67-66-3	E611C	0.05	mg/kg	2.5 mg/kg	102	70.0	130	----
chloromethane	74-87-3	E611C	0.05	mg/kg	2.5 mg/kg	103	60.0	140	----
dibromochloromethane	124-48-1	E611C	0.05	mg/kg	2.5 mg/kg	116	70.0	130	----
dichlorobenzene, 1,2-	95-50-1	E611C	0.05	mg/kg	2.5 mg/kg	97.8	70.0	130	----
dichlorobenzene, 1,3-	541-73-1	E611C	0.05	mg/kg	2.5 mg/kg	96.7	70.0	130	----
dichlorobenzene, 1,4-	106-46-7	E611C	0.05	mg/kg	2.5 mg/kg	99.0	70.0	130	----
dichloroethane, 1,1-	75-34-3	E611C	0.05	mg/kg	2.5 mg/kg	96.2	70.0	130	----
dichloroethane, 1,2-	107-06-2	E611C	0.05	mg/kg	2.5 mg/kg	96.6	70.0	130	----
dichloroethylene, 1,1-	75-35-4	E611C	0.05	mg/kg	2.5 mg/kg	100	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Concentration*	*LCS*	*Low*	*High*	*Qualifier*
Volatile Organic Compounds (QCLot: 97001) - continued									
dichloroethylene, cis-1,2-	156-59-4	E611C	0.05	mg/kg	2.5 mg/kg	99.0	70.0	130	----
dichloroethylene, trans-1,2-	156-60-5	E611C	0.05	mg/kg	2.5 mg/kg	101	70.0	130	----
dichloromethane	75-09-2	E611C	0.05	mg/kg	2.5 mg/kg	100.0	60.0	140	----
dichloropropane, 1,2-	78-87-5	E611C	0.05	mg/kg	2.5 mg/kg	102	70.0	130	----
dichloropropylene, cis-1,3-	10061-01-5	E611C	0.05	mg/kg	2.5 mg/kg	114	70.0	130	----
dichloropropylene, trans-1,3-	10061-02-6	E611C	0.05	mg/kg	2.5 mg/kg	120	70.0	130	----
ethylbenzene	100-41-4	E611C	0.015	mg/kg	2.5 mg/kg	108	70.0	130	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611C	0.05	mg/kg	2.5 mg/kg	109	70.0	130	----
styrene	100-42-5	E611C	0.05	mg/kg	2.5 mg/kg	103	70.0	130	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611C	0.05	mg/kg	2.5 mg/kg	118	70.0	130	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611C	0.05	mg/kg	2.5 mg/kg	101	70.0	130	----
tetrachloroethylene	127-18-4	E611C	0.05	mg/kg	2.5 mg/kg	94.9	70.0	130	----
toluene	108-88-3	E611C	0.05	mg/kg	2.5 mg/kg	92.4	70.0	130	----
trichloroethane, 1,1,1-	71-55-6	E611C	0.05	mg/kg	2.5 mg/kg	105	70.0	130	----
trichloroethane, 1,1,2-	79-00-5	E611C	0.05	mg/kg	2.5 mg/kg	96.4	70.0	130	----
trichloroethylene	79-01-6	E611C	0.01	mg/kg	2.5 mg/kg	102	70.0	130	----
trichlorofluoromethane	75-69-4	E611C	0.05	mg/kg	2.5 mg/kg	95.4	60.0	140	----
vinyl chloride	75-01-4	E611C	0.05	mg/kg	2.5 mg/kg	101	60.0	140	----
xylene, m+p-	179601-23-1	E611C	0.05	mg/kg	5 mg/kg	102	70.0	130	----
xylene, o-	95-47-6	E611C	0.05	mg/kg	2.5 mg/kg	100	70.0	130	----
Hydrocarbons (QCLot: 96997)									
VHs (C6-C10)	----	E581.VH+F1	10	mg/kg	85.8 mg/kg	119	70.0	130	----
Hydrocarbons (QCLot: 97000)									
VHs (C6-C10)	----	E581.VH+F1	10	mg/kg	64.8 mg/kg	76.0	70.0	130	----
Hydrocarbons (QCLot: 97750)									
EPH (C10-C19)	----	E601A	200	mg/kg	1134.37 mg/kg	116	70.0	130	----
					7113 mg/kg	111	70.0	130	----
EPH (C19-C32)	----	E601A	200	mg/kg	575.98 mg/kg	114	70.0	130	----
					10183 mg/kg	108	70.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 97749)									
acenaphthene	83-32-9	E641A-L	0.005	mg/kg	0.5 mg/kg	103	60.0	130	----
					0.638 mg/kg	94.7	60.0	130	----
acenaphthylene	208-96-8	E641A-L	0.005	mg/kg	0.5 mg/kg	101	60.0	130	----
					0.2 mg/kg	96.4	60.0	130	----
acridine	260-94-6	E641A-L	0.01	mg/kg	0.5 mg/kg	82.9	60.0	130	----

Sub-Matrix: **Soil/Solid**

Laboratory Control Sample (LCS) Report

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Spike Concentration*	*Recovery (%) LCS*	*Recovery Limits (%) Low*	*Recovery Limits (%) High*	*Qualifier*
Polycyclic Aromatic Hydrocarbons (QCLot: 97749) - continued									
anthracene	120-12-7	E641A-L	0.004	mg/kg	0.5 mg/kg	101	60.0	130	----
					0.32 mg/kg	96.7	60.0	130	----
benz(a)anthracene	56-55-3	E641A-L	0.01	mg/kg	0.5 mg/kg	100	60.0	130	----
					0.545 mg/kg	92.9	60.0	130	----
benzo(a)pyrene	50-32-8	E641A-L	0.01	mg/kg	0.5 mg/kg	97.8	60.0	130	----
benzo(b+j)fluoranthene	----	E641A-L	0.01	mg/kg	0.5 mg/kg	99.5	60.0	130	----
benzo(g,h,i)perylene	191-24-2	E641A-L	0.01	mg/kg	0.5 mg/kg	101	60.0	130	----
benzo(k)fluoranthene	207-08-9	E641A-L	0.01	mg/kg	0.5 mg/kg	104	60.0	130	----
chrysene	218-01-9	E641A-L	0.01	mg/kg	0.5 mg/kg	97.4	60.0	130	----
dibenz(a,h)anthracene	53-70-3	E641A-L	0.005	mg/kg	0.5 mg/kg	96.7	60.0	130	----
					1.196 mg/kg	95.7	60.0	130	----
fluoranthene	206-44-0	E641A-L	0.01	mg/kg	0.5 mg/kg	99.7	60.0	130	----
fluorene	86-73-7	E641A-L	0.01	mg/kg	0.5 mg/kg	101	60.0	130	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.01	mg/kg	0.5 mg/kg	100	60.0	130	----
					0.445 mg/kg	94.1	60.0	130	----
methylnaphthalene, 1-	90-12-0	E641A-L	0.01	mg/kg	0.5 mg/kg	96.2	60.0	130	----
methylnaphthalene, 2-	91-57-6	E641A-L	0.01	mg/kg	0.5 mg/kg	97.3	60.0	130	----
naphthalene	91-20-3	E641A-L	0.01	mg/kg	0.5 mg/kg	97.3	50.0	130	----
phenanthrene	85-01-8	E641A-L	0.01	mg/kg	0.5 mg/kg	103	60.0	130	----
pyrene	129-00-0	E641A-L	0.01	mg/kg	0.5 mg/kg	105	60.0	130	----
quinoline	6027-02-7	E641A-L	0.01	mg/kg	0.5 mg/kg	81.2	60.0	130	----
Glycols (QCLot: 96523)									
diethylene glycol	111-46-6	E680E	10	mg/kg	50 mg/kg	98.0	70.0	130	----
ethylene glycol	107-21-1	E680E	10	mg/kg	50 mg/kg	97.7	70.0	130	----
propylene glycol, 1,2-	57-55-6	E680E	10	mg/kg	50 mg/kg	95.1	70.0	130	----
triethylene glycol	112-27-6	E680E	10	mg/kg	50 mg/kg	96.4	70.0	130	----

Sub-Matrix: **Water**

Laboratory Control Sample (LCS) Report

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Spike Concentration*	*Recovery (%) LCS*	*Recovery Limits (%) Low*	*Recovery Limits (%) High*	*Qualifier*
Dissolved Metals (QCLot: 97161)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	96.9	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	98.8	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	97.2	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	91.4	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 97161) - continued									
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	97.0	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	87.2	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	99.9	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	97.1	80.0	120	----
cesium, dissolved	7440-46-2	E421	0.00001	mg/L	0.05 mg/L	101	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	98.7	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	98.7	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	102	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	99.8	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	87.8	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	96.8	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	98.4	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	103	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	97.2	80.0	120	----
phosphorus, dissolved	7723-14-0	E421	0.05	mg/L	10 mg/L	97.2	70.0	130	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	101	80.0	120	----
rubidium, dissolved	7440-17-7	E421	0.0002	mg/L	0.1 mg/L	97.3	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	99.7	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	104	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	100	80.0	120	----
sodium, dissolved	17341-25-2	E421	0.05	mg/L	50 mg/L	99.6	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	100	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	104	80.0	120	----
tellurium, dissolved	13494-80-9	E421	0.0002	mg/L	0.1 mg/L	103	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	97.3	80.0	120	----
thorium, dissolved	7440-29-1	E421	0.0001	mg/L	0.1 mg/L	94.9	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	99.8	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	87.5	80.0	120	----
tungsten, dissolved	7440-33-7	E421	0.0001	mg/L	0.1 mg/L	96.2	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	98.5	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	101	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	98.2	80.0	120	----
zirconium, dissolved	7440-67-7	E421	0.0002	mg/L	0.1 mg/L	98.0	80.0	120	----
Dissolved Metals (QCLot: 97162)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	99.0	80.0	120	----
Dissolved Metals (QCLot: 97817)									
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	108	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 98014)									
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	98.0	80.0	120	----
Volatile Organic Compounds (QCLot: 97142)									
benzene	71-43-2	E611C	0.5	µg/L	100 µg/L	92.4	70.0	130	----
bromodichloromethane	75-27-4	E611C	0.5	µg/L	100 µg/L	95.7	70.0	130	----
bromoform	75-25-2	E611C	0.5	µg/L	100 µg/L	103	70.0	130	----
carbon tetrachloride	56-23-5	E611C	0.5	µg/L	100 µg/L	93.4	70.0	130	----
chlorobenzene	108-90-7	E611C	0.5	µg/L	100 µg/L	99.0	70.0	130	----
chloroethane	75-00-3	E611C	0.5	µg/L	100 µg/L	108	60.0	140	----
chloroform	67-66-3	E611C	0.5	µg/L	100 µg/L	84.8	70.0	130	----
chloromethane	74-87-3	E611C	0.5	µg/L	100 µg/L	102	60.0	140	----
dibromochloromethane	124-48-1	E611C	0.5	µg/L	100 µg/L	102	70.0	130	----
dichlorobenzene, 1,2-	95-50-1	E611C	0.5	µg/L	100 µg/L	101	70.0	130	----
dichlorobenzene, 1,3-	541-73-1	E611C	0.5	µg/L	100 µg/L	95.0	70.0	130	----
dichlorobenzene, 1,4-	106-46-7	E611C	0.5	µg/L	100 µg/L	97.2	70.0	130	----
dichloroethane, 1,1-	75-34-3	E611C	0.5	µg/L	100 µg/L	92.2	70.0	130	----
dichloroethane, 1,2-	107-06-2	E611C	0.5	µg/L	100 µg/L	95.6	70.0	130	----
dichloroethylene, 1,1-	75-35-4	E611C	0.5	µg/L	100 µg/L	90.5	70.0	130	----
dichloroethylene, cis-1,2-	156-59-4	E611C	0.5	µg/L	100 µg/L	91.9	70.0	130	----
dichloroethylene, trans-1,2-	156-60-5	E611C	0.5	µg/L	100 µg/L	93.6	70.0	130	----
dichloromethane	75-09-2	E611C	0.5	µg/L	100 µg/L	93.2	70.0	130	----
dichloropropane, 1,2-	78-87-5	E611C	0.5	µg/L	100 µg/L	94.0	70.0	130	----
dichloropropylene, cis-1,3-	10061-01-5	E611C	0.5	µg/L	100 µg/L	104	70.0	130	----
dichloropropylene, trans-1,3-	10061-02-6	E611C	0.5	µg/L	100 µg/L	109	70.0	130	----
ethylbenzene	100-41-4	E611C	0.5	µg/L	100 µg/L	104	70.0	130	----
methyl-tert-butyl ether [MTBE]	1634-04-4	E611C	0.5	µg/L	100 µg/L	104	70.0	130	----
styrene	100-42-5	E611C	0.5	µg/L	100 µg/L	97.9	70.0	130	----
tetrachloroethane, 1,1,1,2-	630-20-6	E611C	0.5	µg/L	100 µg/L	107	70.0	130	----
tetrachloroethane, 1,1,2,2-	79-34-5	E611C	0.2	µg/L	100 µg/L	100	70.0	130	----
tetrachloroethylene	127-18-4	E611C	0.5	µg/L	100 µg/L	98.0	70.0	130	----
toluene	108-88-3	E611C	0.4	µg/L	100 µg/L	106	70.0	130	----
trichloroethane, 1,1,1-	71-55-6	E611C	0.5	µg/L	100 µg/L	95.8	70.0	130	----
trichloroethane, 1,1,2-	79-00-5	E611C	0.5	µg/L	100 µg/L	94.3	70.0	130	----
trichloroethylene	79-01-6	E611C	0.5	µg/L	100 µg/L	93.9	70.0	130	----
trichlorofluoromethane	75-69-4	E611C	0.5	µg/L	100 µg/L	77.5	60.0	140	----
vinyl chloride	75-01-4	E611C	0.4	µg/L	100 µg/L	106	60.0	140	----
xylene, m+p-	179601-23-1	E611C	0.5	µg/L	200 µg/L	116	70.0	130	----
xylene, o-	95-47-6	E611C	0.5	µg/L	100 µg/L	106	70.0	130	----

Sub-Matrix: **Water**

Laboratory Control Sample (LCS) Report

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Spike Concentration*	*Recovery (%) LCS*	*Recovery Limits (%) Low*	*Recovery Limits (%) High*	*Qualifier*
Hydrocarbons (QCLot: 103096)									
EPH (C10-C19), silica gel treated	----	E601A.SG	250	µg/L	6491 µg/L	81.4	70.0	130	----
EPH (C19-C32), silica gel treated	----	E601A.SG	250	µg/L	3363 µg/L	# 59.4	70.0	130	LCS-ND
Hydrocarbons (QCLot: 97117)									
EPH (C10-C19)	----	E601A	250	µg/L	8310 µg/L	89.8	70.0	130	----
EPH (C19-C32)	----	E601A	250	µg/L	3570 µg/L	74.0	70.0	130	----
Hydrocarbons (QCLot: 97143)									
VHw (C6-C10)	----	E581.VH+F1	100	µg/L	6310 µg/L	111	70.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 97116)									
acenaphthene	83-32-9	E641A	0.01	µg/L	0.5 µg/L	109	60.0	130	----
acenaphthylene	208-96-8	E641A	0.01	µg/L	0.5 µg/L	99.2	60.0	130	----
acridine	260-94-6	E641A	0.01	µg/L	0.5 µg/L	95.6	60.0	130	----
anthracene	120-12-7	E641A	0.01	µg/L	0.5 µg/L	92.5	60.0	130	----
benz(a)anthracene	56-55-3	E641A	0.01	µg/L	0.5 µg/L	92.5	60.0	130	----
benzo(a)pyrene	50-32-8	E641A	0.005	µg/L	0.5 µg/L	95.7	60.0	130	----
benzo(b+j)fluoranthene	----	E641A	0.01	µg/L	0.5 µg/L	105	60.0	130	----
benzo(g,h,i)perylene	191-24-2	E641A	0.01	µg/L	0.5 µg/L	93.6	60.0	130	----
benzo(k)fluoranthene	207-08-9	E641A	0.01	µg/L	0.5 µg/L	94.6	60.0	130	----
chrysene	218-01-9	E641A	0.01	µg/L	0.5 µg/L	96.2	60.0	130	----
dibenz(a,h)anthracene	53-70-3	E641A	0.005	µg/L	0.5 µg/L	97.3	60.0	130	----
fluoranthene	206-44-0	E641A	0.01	µg/L	0.5 µg/L	99.8	60.0	130	----
fluorene	86-73-7	E641A	0.01	µg/L	0.5 µg/L	100	60.0	130	----
indeno(1,2,3-c,d)pyrene	193-39-5	E641A	0.01	µg/L	0.5 µg/L	91.8	60.0	130	----
methylnaphthalene, 1-	90-12-0	E641A	0.01	µg/L	0.5 µg/L	110	60.0	130	----
methylnaphthalene, 2-	91-57-6	E641A	0.01	µg/L	0.5 µg/L	104	60.0	130	----
naphthalene	91-20-3	E641A	0.05	µg/L	0.5 µg/L	118	60.0	130	----
phenanthrene	85-01-8	E641A	0.02	µg/L	0.5 µg/L	100	60.0	130	----
pyrene	129-00-0	E641A	0.01	µg/L	0.5 µg/L	102	60.0	130	----
quinoline	6027-02-7	E641A	0.05	µg/L	0.5 µg/L	96.7	60.0	130	----
Glycols (QCLot: 96522)									
diethylene glycol	111-46-6	E680E	5	mg/L	25 mg/L	76.5	70.0	130	----
ethylene glycol	107-21-1	E680E	5	mg/L	25 mg/L	76.8	70.0	130	----
propylene glycol, 1,2-	57-55-6	E680E	5	mg/L	25 mg/L	77.1	70.0	130	----
triethylene glycol	112-27-6	E680E	5	mg/L	25 mg/L	75.6	70.0	130	----

Qualifiers

Qualifier	*Description*
LCS-ND	*Lab Control Sample recovery was slightly outside ALS DQO. Reported non-detect results for associated samples were unaffected.*

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		*Recovery (%)*	*Recovery Limits (%)*		
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*Target*	*MS*	*Low*	*High*	*Qualifier*
Volatile Organic Compounds (QCLot: 96996)										
WR2000999-002	Anonymous	benzene	71-43-2	E611A	2.52 mg/kg	3.125 mg/kg	98.8	60.0	140	----
		ethylbenzene	100-41-4	E611A	2.60 mg/kg	3.125 mg/kg	102	60.0	140	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611A	2.85 mg/kg	3.125 mg/kg	111	60.0	140	----
		styrene	100-42-5	E611A	2.35 mg/kg	3.125 mg/kg	91.8	60.0	140	----
		toluene	108-88-3	E611A	2.97 mg/kg	3.125 mg/kg	116	60.0	140	----
		xylene, m+p-	179601-23-1	E611A	4.74 mg/kg	6.25 mg/kg	92.8	60.0	140	----
		xylene, o-	95-47-6	E611A	ND mg/kg	3.125 mg/kg	ND	60.0	140	----
Volatile Organic Compounds (QCLot: 97001)										
VA20B6777-005	Anonymous	benzene	71-43-2	E611C	1.92 mg/kg	3.125 mg/kg	96.9	60.0	140	----
		bromodichloromethane	75-27-4	E611C	2.24 mg/kg	3.125 mg/kg	113	60.0	140	----
		bromoform	75-25-2	E611C	2.47 mg/kg	3.125 mg/kg	125	60.0	140	----
		carbon tetrachloride	56-23-5	E611C	2.12 mg/kg	3.125 mg/kg	107	60.0	140	----
		chlorobenzene	108-90-7	E611C	1.90 mg/kg	3.125 mg/kg	95.9	60.0	140	----
		chloroethane	75-00-3	E611C	1.99 mg/kg	3.125 mg/kg	100	60.0	140	----
		chloroform	67-66-3	E611C	1.90 mg/kg	3.125 mg/kg	96.1	60.0	140	----
		chloromethane	74-87-3	E611C	2.15 mg/kg	3.125 mg/kg	109	60.0	140	----
		dibromochloromethane	124-48-1	E611C	2.26 mg/kg	3.125 mg/kg	114	60.0	140	----
		dichlorobenzene, 1,2-	95-50-1	E611C	1.79 mg/kg	3.125 mg/kg	90.6	60.0	140	----
		dichlorobenzene, 1,3-	541-73-1	E611C	1.73 mg/kg	3.125 mg/kg	87.7	60.0	140	----
		dichlorobenzene, 1,4-	106-46-7	E611C	1.75 mg/kg	3.125 mg/kg	88.6	60.0	140	----
		dichloroethane, 1,1-	75-34-3	E611C	1.82 mg/kg	3.125 mg/kg	92.3	60.0	140	----
		dichloroethane, 1,2-	107-06-2	E611C	1.88 mg/kg	3.125 mg/kg	95.1	60.0	140	----
		dichloroethylene, 1,1-	75-35-4	E611C	1.93 mg/kg	3.125 mg/kg	97.4	60.0	140	----
		dichloroethylene, cis-1,2-	156-59-4	E611C	1.86 mg/kg	3.125 mg/kg	94.1	60.0	140	----
		dichloroethylene, trans-1,2-	156-60-5	E611C	1.89 mg/kg	3.125 mg/kg	95.4	60.0	140	----
		dichloromethane	75-09-2	E611C	1.92 mg/kg	3.125 mg/kg	96.9	60.0	140	----
		dichloropropane, 1,2-	78-87-5	E611C	1.93 mg/kg	3.125 mg/kg	97.5	60.0	140	----
		dichloropropylene, cis-1,3-	10061-01-5	E611C	2.14 mg/kg	3.125 mg/kg	108	60.0	140	----
		dichloropropylene, trans-1,3-	10061-02-6	E611C	2.14 mg/kg	3.125 mg/kg	108	60.0	140	----
		ethylbenzene	100-41-4	E611C	2.02 mg/kg	3.125 mg/kg	102	60.0	140	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611C	2.04 mg/kg	3.125 mg/kg	103	60.0	140	----

Sub-Matrix: **Soil/Solid**

					Matrix Spike (MS) Report					
					Spike		*Recovery (%)*	*Recovery Limits (%)*		
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*Target*	*MS*	*Low*	*High*	*Qualifier*
Volatile Organic Compounds (QCLot: 97001) - continued										
VA20B6777-005	Anonymous	styrene	100-42-5	E611C	1.98 mg/kg	3.125 mg/kg	99.9	60.0	140	----
		tetrachloroethane, 1,1,1,2-	630-20-6	E611C	2.24 mg/kg	3.125 mg/kg	113	60.0	140	----
		tetrachloroethane, 1,1,2,2-	79-34-5	E611C	1.96 mg/kg	3.125 mg/kg	99.1	60.0	140	----
		tetrachloroethylene	127-18-4	E611C	1.76 mg/kg	3.125 mg/kg	88.9	60.0	140	----
		toluene	108-88-3	E611C	1.73 mg/kg	3.125 mg/kg	87.7	60.0	140	----
		trichloroethane, 1,1,1-	71-55-6	E611C	1.94 mg/kg	3.125 mg/kg	98.2	60.0	140	----
		trichloroethane, 1,1,2-	79-00-5	E611C	1.54 mg/kg	3.125 mg/kg	78.1	60.0	140	----
		trichloroethylene	79-01-6	E611C	1.89 mg/kg	3.125 mg/kg	95.5	60.0	140	----
		trichlorofluoromethane	75-69-4	E611C	1.64 mg/kg	3.125 mg/kg	82.9	60.0	140	----
		vinyl chloride	75-01-4	E611C	2.05 mg/kg	3.125 mg/kg	103	60.0	140	----
		xylene, m+p-	179601-23-1	E611C	3.72 mg/kg	6.25 mg/kg	94.1	60.0	140	----
		xylene, o-	95-47-6	E611C	1.86 mg/kg	3.125 mg/kg	94.2	60.0	140	----
Hydrocarbons (QCLot: 96997)										
WR2000999-004	Anonymous	VHs (C6-C10)	----	E581.VH+F1	160 mg/kg	171.9 mg/kg	102	60.0	140	----
Hydrocarbons (QCLot: 97000)										
VA20B6777-003	Anonymous	VHs (C6-C10)	----	E581.VH+F1	118 mg/kg	171.9 mg/kg	93.8	60.0	140	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		*Recovery (%)*	*Recovery Limits (%)*		
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*Target*	*MS*	*Low*	*High*	*Qualifier*
Dissolved Metals (QCLot: 97161)										
VA20B7191-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.194 mg/L	0.2 mg/L	97.0	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0203 mg/L	0.02 mg/L	102	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0202 mg/L	0.02 mg/L	101	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0388 mg/L	0.04 mg/L	97.1	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00947 mg/L	0.01 mg/L	94.7	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.091 mg/L	0.1 mg/L	91.0	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00403 mg/L	0.004 mg/L	101	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		cesium, dissolved	7440-46-2	E421	0.0102 mg/L	0.01 mg/L	102	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0193 mg/L	0.02 mg/L	96.7	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0190 mg/L	0.02 mg/L	94.8	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.98 mg/L	2 mg/L	98.9	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0196 mg/L	0.02 mg/L	98.2	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.0922 mg/L	0.1 mg/L	92.2	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*Target*	*MS*	*Low*	*High*	*Qualifier*
Dissolved Metals (QCLot: 97161) - continued										
VA20B7191-001	Anonymous	magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.0198 mg/L	0.02 mg/L	99.0	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0209 mg/L	0.02 mg/L	104	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0378 mg/L	0.04 mg/L	94.4	70.0	130	----
		phosphorus, dissolved	7723-14-0	E421	10.3 mg/L	10 mg/L	103	70.0	130	----
		potassium, dissolved	7440-09-7	E421	4.10 mg/L	4 mg/L	102	70.0	130	----
		rubidium, dissolved	7440-17-7	E421	0.0200 mg/L	0.02 mg/L	100	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0432 mg/L	0.04 mg/L	108	70.0	130	----
		silicon, dissolved	7440-21-3	E421	9.45 mg/L	10 mg/L	94.5	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00396 mg/L	0.004 mg/L	99.0	70.0	130	----
		sodium, dissolved	17341-25-2	E421	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	22.8 mg/L	20 mg/L	114	70.0	130	----
		tellurium, dissolved	13494-80-9	E421	0.0389 mg/L	0.04 mg/L	97.2	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00383 mg/L	0.004 mg/L	95.7	70.0	130	----
		thorium, dissolved	7440-29-1	E421	0.0202 mg/L	0.02 mg/L	101	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0205 mg/L	0.02 mg/L	102	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0380 mg/L	0.04 mg/L	94.9	70.0	130	----
		tungsten, dissolved	7440-33-7	E421	0.0198 mg/L	0.02 mg/L	99.2	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.00402 mg/L	0.004 mg/L	100	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.104 mg/L	0.1 mg/L	104	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.390 mg/L	0.4 mg/L	97.6	70.0	130	----
		zirconium, dissolved	7440-67-7	E421	0.0412 mg/L	0.04 mg/L	103	70.0	130	----
Dissolved Metals (QCLot: 97162)										
VA20B7191-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.0400 mg/L	0.04 mg/L	100	70.0	130	----
Dissolved Metals (QCLot: 97817)										
VA20B6963-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000965 mg/L	0.0001 mg/L	96.5	70.0	130	----
Dissolved Metals (QCLot: 98014)										
VA20B6928-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.0001000 mg/L	0.0001 mg/L	100.0	70.0	130	----
Volatile Organic Compounds (QCLot: 97142)										
VA20B6540-004	Anonymous	benzene	71-43-2	E611C	97.1 µg/L	100 µg/L	97.1	60.0	140	----
		bromodichloromethane	75-27-4	E611C	106 µg/L	100 µg/L	106	60.0	140	----
		bromoform	75-25-2	E611C	110 µg/L	100 µg/L	110	60.0	140	----
		carbon tetrachloride	56-23-5	E611C	99.6 µg/L	100 µg/L	99.6	60.0	140	----
		chlorobenzene	108-90-7	E611C	99.9 µg/L	100 µg/L	99.9	60.0	140	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*Target*	*MS*	*Low*	*High*	*Qualifier*
Volatile Organic Compounds (QCLot: 97142) - continued										
VA20B6540-004	Anonymous	chloroethane	75-00-3	E611C	103 µg/L	100 µg/L	103	50.0	150	----
		chloroform	67-66-3	E611C	94.4 µg/L	100 µg/L	94.4	60.0	140	----
		chloromethane	74-87-3	E611C	93.7 µg/L	100 µg/L	93.7	50.0	150	----
		dibromochloromethane	124-48-1	E611C	107 µg/L	100 µg/L	107	60.0	140	----
		dichlorobenzene, 1,2-	95-50-1	E611C	99.4 µg/L	100 µg/L	99.4	60.0	140	----
		dichlorobenzene, 1,3-	541-73-1	E611C	91.5 µg/L	100 µg/L	91.5	60.0	140	----
		dichlorobenzene, 1,4-	106-46-7	E611C	93.1 µg/L	100 µg/L	93.1	60.0	140	----
		dichloroethane, 1,1-	75-34-3	E611C	97.6 µg/L	100 µg/L	97.6	60.0	140	----
		dichloroethane, 1,2-	107-06-2	E611C	106 µg/L	100 µg/L	106	60.0	140	----
		dichloroethylene, 1,1-	75-35-4	E611C	90.8 µg/L	100 µg/L	90.8	60.0	140	----
		dichloroethylene, cis-1,2-	156-59-4	E611C	94.4 µg/L	100 µg/L	94.4	60.0	140	----
		dichloroethylene, trans-1,2-	156-60-5	E611C	90.6 µg/L	100 µg/L	90.6	60.0	140	----
		dichloromethane	75-09-2	E611C	99.4 µg/L	100 µg/L	99.4	60.0	140	----
		dichloropropane, 1,2-	78-87-5	E611C	102 µg/L	100 µg/L	102	60.0	140	----
		dichloropropylene, cis-1,3-	10061-01-5	E611C	100 µg/L	100 µg/L	100	60.0	140	----
		dichloropropylene, trans-1,3-	10061-02-6	E611C	97.9 µg/L	100 µg/L	97.9	60.0	140	----
		ethylbenzene	100-41-4	E611C	97.5 µg/L	100 µg/L	97.5	60.0	140	----
		methyl-tert-butyl ether [MTBE]	1634-04-4	E611C	105 µg/L	100 µg/L	105	60.0	140	----
		styrene	100-42-5	E611C	93.1 µg/L	100 µg/L	93.1	60.0	140	----
		tetrachloroethane, 1,1,1,2-	630-20-6	E611C	111 µg/L	100 µg/L	111	60.0	140	----
		tetrachloroethane, 1,1,2,2-	79-34-5	E611C	103 µg/L	100 µg/L	103	60.0	140	----
		tetrachloroethylene	127-18-4	E611C	91.9 µg/L	100 µg/L	91.9	60.0	140	----
		toluene	108-88-3	E611C	89.0 µg/L	100 µg/L	89.0	60.0	140	----
		trichloroethane, 1,1,1-	71-55-6	E611C	101 µg/L	100 µg/L	101	60.0	140	----
		trichloroethane, 1,1,2-	79-00-5	E611C	102 µg/L	100 µg/L	102	60.0	140	----
		trichloroethylene	79-01-6	E611C	95.4 µg/L	100 µg/L	95.4	60.0	140	----
		trichlorofluoromethane	75-69-4	E611C	90.4 µg/L	100 µg/L	90.4	50.0	150	----
		vinyl chloride	75-01-4	E611C	96.5 µg/L	100 µg/L	96.5	50.0	150	----
		xylene, m+p-	179601-23-1	E611C	219 µg/L	200 µg/L	110	60.0	140	----
		xylene, o-	95-47-6	E611C	102 µg/L	100 µg/L	102	60.0	140	----
Hydrocarbons (QCLot: 97143)										
VA20B6540-002	Anonymous	VHw (C6-C10)	----	E581.VH+F1	6110 µg/L	6310 µg/L	96.8	60.0	140	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix: **Soil/Solid**

					Reference Material (RM) Report				
						Recovery (%)	*Recovery Limits (%)*		
Laboratory sample ID	*Reference Material ID*	*Analyte*	*CAS Number*	*Method*	*RM Target Concentration*	*RM*	*Low*	*High*	*Qualifier*
Metals (QCLot: 103114)									
QC-103114-003	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	106	70.0	130	----
QC-103114-003	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	97.6	70.0	130	----
QC-103114-003	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	102	70.0	130	----
QC-103114-003	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	97.6	70.0	130	----
QC-103114-003	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	92.1	70.0	130	----
QC-103114-003	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	114	40.0	160	----
QC-103114-003	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	109	70.0	130	----
QC-103114-003	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	98.1	70.0	130	----
QC-103114-003	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	112	70.0	130	----
QC-103114-003	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	103	70.0	130	----
QC-103114-003	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	108	70.0	130	----
QC-103114-003	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	106	70.0	130	----
QC-103114-003	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	91.7	70.0	130	----
QC-103114-003	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	92.6	70.0	130	----
QC-103114-003	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	105	70.0	130	----
QC-103114-003	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	108	70.0	130	----
QC-103114-003	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	# 135	70.0	130	MES
QC-103114-003	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	111	70.0	130	----
QC-103114-003	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	98.6	70.0	130	----
QC-103114-003	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	111	70.0	130	----
QC-103114-003	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	106	70.0	130	----
QC-103114-003	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	95.2	70.0	130	----
QC-103114-003	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	97.4	40.0	160	----
QC-103114-003	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	92.5	70.0	130	----
QC-103114-003	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	117	70.0	130	----
QC-103114-003	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	99.8	70.0	130	----
QC-103114-003	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	108	70.0	130	----
QC-103114-003	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	107	70.0	130	----
QC-103114-003	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	96.8	70.0	130	----

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%)	Recovery Limits (%)		Qualifier
						RM	Low	High	
Metals (QCLot: 107135)									
QC-107135-003	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	107	70.0	130	----
QC-107135-003	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	106	70.0	130	----
QC-107135-003	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	104	70.0	130	----
QC-107135-003	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	99.3	70.0	130	----
QC-107135-003	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	102	70.0	130	----
QC-107135-003	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	107	40.0	160	----
QC-107135-003	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	99.0	70.0	130	----
QC-107135-003	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	102	70.0	130	----
QC-107135-003	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	109	70.0	130	----
QC-107135-003	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	100	70.0	130	----
QC-107135-003	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	103	70.0	130	----
QC-107135-003	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	101	70.0	130	----
QC-107135-003	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	96.9	70.0	130	----
QC-107135-003	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	97.3	70.0	130	----
QC-107135-003	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	103	70.0	130	----
QC-107135-003	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	108	70.0	130	----
QC-107135-003	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	100	70.0	130	----
QC-107135-003	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	104	70.0	130	----
QC-107135-003	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	92.4	70.0	130	----
QC-107135-003	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	111	70.0	130	----
QC-107135-003	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	102	70.0	130	----
QC-107135-003	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	102	70.0	130	----
QC-107135-003	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	93.4	40.0	160	----
QC-107135-003	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	94.4	70.0	130	----
QC-107135-003	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	117	70.0	130	----
QC-107135-003	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	98.6	70.0	130	----
QC-107135-003	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	106	70.0	130	----
QC-107135-003	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	99.6	70.0	130	----
QC-107135-003	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	94.0	70.0	130	----
Metals (QCLot: 97746)									
QC-97746-003	SCP SS-2	mercury	7439-97-6	E510	0.059 mg/kg	96.3	70.0	130	----
Metals (QCLot: 97747)									

Sub-Matrix: **Soil/Solid**

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	*Reference Material ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*RM*	*Low*	*High*	*Qualifier*
Metals (QCLot: 97747) - continued									
QC-97747-003	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	100	70.0	130	----
QC-97747-003	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	# 158	70.0	130	RM-H
QC-97747-003	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	104	70.0	130	----
QC-97747-003	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	104	70.0	130	----
QC-97747-003	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	103	70.0	130	----
QC-97747-003	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	112	40.0	160	----
QC-97747-003	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	98.6	70.0	130	----
QC-97747-003	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	105	70.0	130	----
QC-97747-003	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	105	70.0	130	----
QC-97747-003	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	103	70.0	130	----
QC-97747-003	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	101	70.0	130	----
QC-97747-003	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	101	70.0	130	----
QC-97747-003	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	120	70.0	130	----
QC-97747-003	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	99.1	70.0	130	----
QC-97747-003	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	103	70.0	130	----
QC-97747-003	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	104	70.0	130	----
QC-97747-003	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	99.6	70.0	130	----
QC-97747-003	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	104	70.0	130	----
QC-97747-003	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	107	70.0	130	----
QC-97747-003	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	109	70.0	130	----
QC-97747-003	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	103	70.0	130	----
QC-97747-003	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	102	70.0	130	----
QC-97747-003	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	106	40.0	160	----
QC-97747-003	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	92.0	70.0	130	----
QC-97747-003	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	110	70.0	130	----
QC-97747-003	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	104	70.0	130	----
QC-97747-003	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	104	70.0	130	----
QC-97747-003	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	104	70.0	130	----
QC-97747-003	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	96.6	70.0	130	----
Speciated Metals (QCLot: 104491)									
QC-104491-003	RM	chromium, hexavalent [Cr VI]	18540-29-9	E532	220 mg/kg	98.9	80.0	120	----
Speciated Metals (QCLot: 107728)									

Sub-Matrix: **Soil/Solid**

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	 High	 Qualifier
Speciated Metals (QCLot: 107728) - continued									
QC-107728-003	RM	chromium, hexavalent [Cr VI]	18540-29-9	E532	220 mg/kg	110	80.0	120	----
Polycyclic Aromatic Hydrocarbons (QCLot: 97749)									
QC-97749-003	RM	benzo(a)pyrene	50-32-8	E641A-L	0.135 mg/kg	102	60.0	130	----
QC-97749-003	RM	benzo(b+j)fluoranthene	----	E641A-L	0.793 mg/kg	95.1	60.0	130	----
QC-97749-003	RM	benzo(g,h,i)perylene	191-24-2	E641A-L	0.377 mg/kg	99.0	60.0	130	----
QC-97749-003	RM	benzo(k)fluoranthene	207-08-9	E641A-L	0.34 mg/kg	87.5	60.0	130	----
QC-97749-003	RM	chrysene	218-01-9	E641A-L	0.666 mg/kg	94.3	60.0	130	----
QC-97749-003	RM	fluoranthene	206-44-0	E641A-L	1.757 mg/kg	92.4	60.0	130	----
QC-97749-003	RM	fluorene	86-73-7	E641A-L	0.989 mg/kg	94.0	60.0	130	----
QC-97749-003	RM	methylnaphthalene, 1-	90-12-0	E641A-L	1.256 mg/kg	90.8	60.0	130	----
QC-97749-003	RM	methylnaphthalene, 2-	91-57-6	E641A-L	1.088 mg/kg	91.0	60.0	130	----
QC-97749-003	RM	naphthalene	91-20-3	E641A-L	1.03 mg/kg	94.4	50.0	130	----
QC-97749-003	RM	phenanthrene	85-01-8	E641A-L	1.13 mg/kg	96.7	60.0	130	----
QC-97749-003	RM	pyrene	129-00-0	E641A-L	1.325 mg/kg	96.2	60.0	130	----

Qualifiers

Qualifier	*Description*
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*
RM-H	*Reference Material recovery was above ALS DQO. Non-detected sample results are considered reliable. Other results, if reported, have been qualified.*

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 20 -

Page 1 of 3

Report To	Contact and company name below will appear on the final report
Company:	Tetra Tech
Contact:	Kristina Schmidt, Erin O'Brien
Phone:	867-689-5104
	Company address below will appear on the final report
Street:	61 Wasson Place
City/Province:	Whitehorse, YT
Postal Code:	Y1A0H7
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	Tetra Tech
Contact:	EBA.Accounts.Payable@tetratech.com

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax Kristina.Schmidt@tetratech.com

Email 2 Erin.Obrien@tetratech.com

Email 3 EBA.labdata@tetratech.com

Invoice Distribution

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax EBA.Accounts.Payable@tetratech.com

Email 2

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)
- **4 day [P4-20%]** ☐
- **3 day [P3-25%]** ☐
- **2 day [P2-50%]** ☐

EMERGENCY
- **1 Busines**
- **Same Day,**
- **200% (Lab**

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level s

Analysis

Indicate Filtered (F), Preserved (P) or Filtered a

Environmental Division
Whitehorse
Work Order Reference
WR2000970

Telephone : +1 867 668 6689

Project Information

ALS Account # / Quote #:

Job #: 704-ENVW.PENW03102-01

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center:

PO#

Major/Minor Code:

Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only):

ALS Contact: Jesse

Sampler: KS

ALS Sample # (lab use only)	**Sample Identification and/or Coordinates** (This description will appear on the report)	**Date** (dd-mmm-yy)	**Time** (hh:mm)	**Sample Type**	LEPH/HEP/PAH	BTEX/VPH	VOC	Metals (dissolved)	Glycols	SAMPLES ON HOLD	Sample is hazardous (pl	NUMBER OF CONTAINERS
	TP20-01-0.5m	23-Sep-20		Soil	R			R				
	TP20-01-1.0m	23-Sep-20		Soil		R						
	TP20-01-1.75m	23-Sep-20		Soil								
	TP20-04-0.5m	23-Sep-20		Soil								
	TP20-04-1.25m	23-Sep-20		Soil	R	R		R				
	TP20-04-2.0m	23-Sep-20		Soil								
	TP20-09-0.5m	23-Sep-20		Soil	R			R				
	TP20-09-1.25m	23-Sep-20		Soil		R						
	TP20-09-1.6m	23-Sep-20		Soil								
	TP20-07-0.3m	23-Sep-20		Soil	R	R	R	R				
	TP20-07-1.0m	23-Sep-20		Soil								
	TP20-07-1.75m	23-Sep-20		Soil								

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ ☑

Are samples for human consumption/ use?
☐ ☑

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INIITIAL COOLER TEMPERATURES °C: 12 | 15 | 3

FINAL COOLER TEMPERATURES °C

SHIPMENT RELEASE (client use)

Released by: Kristina Schmidt | Date: 23 September 2020 | Time:

INITIAL SHIPMENT RECEPTION (lab use only)

Received by: d | Date: Sept 28/20 | Time: 16:20

FINAL SHIPMENT RECEPTION (lab use only)

Received by: | Date: | Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

SEPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

---

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 20 -

Page 2 of 3

Report To Contact and company name below will appear on the final report

Company:	Tetra Tech
Contact:	Kristina Schmidt, Erin O'Brien
Phone:	867-689-5104
	Company address below will appear on the final report
Street:	61 Wasson Place
City/Province:	Whitehorse, YT
Postal Code:	Y1A0H7

Invoice To Same as Report To ☑ YES ☐ NO

Copy of Invoice with Report ☑ YES ☐ NO

Company: Tetra Tech
Contact: EBA.Accounts.Payable@tetratech.com

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax Kristina.Schmidt@tetratech.com
Email 2 Erin.Obrien@tetratech.com
Email 3 EBA.labdata@tetratech.com

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax EBA.Accounts.Payable@tetratech.com
Email 2

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)
4 day [P4-20%] ☐
3 day [P3-25%] ☐
2 day [P2-50%] ☐

EMERGENCY
1 Business day [E1 - 100%] ☐
Same Day, Weekend or Statutory holiday [E2 - 200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:
Job #: 704-ENW.PENW03102-01
PO / AFE:
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center:
PO#
Major/Minor Code:
Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only):

ALS Contact:

Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	LEPH/HEP/PAH	BTEX/VPH	VOC	Metals (dissolved)	Glycols											SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	TP20-05-0.2m	23-Sep-20		Soil																		
	TP20-05-0.75m	23-Sep-20		Soil																		
	TP20-05-1.25m	23-Sep-20		Soil	R			R														
	TP20-03-0.5m	23-Sep-20		Soil				R														
	TP20-03-1.3m	23-Sep-20		Soil	R	R	R	R	R													
	TP20-03-1.6m	23-Sep-20		Soil																		
	TP20-08-0.5m	23-Sep-20		Soil	R			R														
	TP20-08-1.5m	23-Sep-20		Soil																		
	TP20-08-1.7m	23-Sep-20		Soil		R	R															
	TP00-03-1.3m	23-Sep-20		Soil	R			R														

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ ☐

Are samples for human consumption/ use?
☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INIITIAL COOLER TEMPERATURES °C
FINAL COOLER TEMPERATURES °C

SHIPMENT RELEASE (client use)

Released by: Kristina Schmidt
Date: 23 September 2020
Time:

INITIAL SHIPMENT RECEPTION (lab use only)

Received by:
Date:
Time:

FINAL SHIPMENT RECEPTION (lab use only)

Received by:
Date:
Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

SEPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

[1] If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 20 -

Page 3 of 3

Report To	Contact and company name below will appear on the final report
Company:	Tetra Tech
Contact:	Kristina Schmidt, Erin O'Brien
Phone:	867-689-5104
	Company address below will appear on the final report
Street:	61 Wasson Place
City/Province:	Whitehorse, YT
Postal Code:	Y1A0H7
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	Tetra Tech
Contact:	EBA.Accounts.Payable@tetratech.com

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax Kristina.Schmidt@tetratech.com

Email 2 Erin.Obrien@tetratech.com

Email 3 EBA.labdata@tetratech.com

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax EBA.Accounts.Payable@tetratech.com

Email 2

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY		
	4 day [P4-20%] ☐		1 Business day [E1 - 100%]	☐
	3 day [P3-25%] ☐		Same Day, Weekend or Statutory holiday [E2 - 200% (Laboratory opening fees may apply)]	☐
	2 day [P2-50%] ☐			

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:

Job #: 704-ENW.PENW03102-01

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact:

Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	LEPH/HEP/PAH	BTEX/VPH	VOC	Metals (dissolved)	Glycols											SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	MW20-01	25-Sep-20		Water	R	R	R	R	R													
	MW20-02	25-Sep-20		Water	R	R	R	R	R													
	MW20-03	25-Sep-20		Water	R	R	R	R	R													
	DUP	25-Sep-20		Water	R	R	R	R	R													
	FB	25-Sep-20		Water																		

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?

☐ ☐

Are samples for human consumption/ use?

☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INIITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Kristina Schmidt	Date: 23 September 2020	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

SEPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

[1] If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 20 -

Page 1 of 3

Environmental Division
Whitehorse
Work Order Reference
WR2000970

Telephone : + 1 867 668 6689

Report To	Contact and company name below will appear on the final report	
Company:	Tetra Tech	
Contact:	Kristina Schmidt, Erin O'Brien	
Phone:	867-689-5104	
	Company address below will appear on the final report	
Street:	61 Wasson Place	
City/Province:	Whitehorse, YT	
Postal Code:	Y1A0H7	
Invoice To	Same as Report To	☑ YES ☐ NO
	Copy of Invoice with Report	☑ YES ☐ NO
Company:	Tetra Tech	
Contact:	EBA.Accounts.Payable@tetratech.com	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)
Quality Control (QC) Report with Report ☑ ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax Kristina.Schmidt@tetratech.com
Email 2 Erin.Obrien@tetratech.com
Email 3 EBA.labdata@tetratech.com

Invoice Distribution

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax EBA.Accounts.Payable@tetratech.com
Email 2

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)
4 day [P4-20%] ☐
3 day [P3-25%] ☐
2 day [P2-50%] ☐

EMERGENCY
1 Busines
Same Day,
200% (Lab

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level s

Analysis

Indicate Filtered (F), Preserved (P) or Filtered

Project Information

ALS Account # / Quote #:	
Job #:	704-ENW.PENW03102-01
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Jesse **Sampler:** KS

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	LEPH/HEP/PAH	BTEX/VPH	VOC	Metals (dissolved)	Glycols	SAMPLES ON HOLD	Sample is hazardous (pl	NUMBER OF CONTAINERS
	TP20-01-0.5m	23-Sep-20		Soil	R			R				
	TP20-01-1.0m	23-Sep-20		Soil		R						
	TP20-01-1.75m	23-Sep-20		Soil								
	TP20-04-0.5m	23-Sep-20		Soil								
	TP20-04-1.25m	23-Sep-20		Soil	R	R		R				
	TP20-04-2.0m	23-Sep-20		Soil								
	TP20-09-0.5m	23-Sep-20		Soil	R			R				
	TP20-09-1.25m	23-Sep-20		Soil		R						
	TP20-09-1.6m	23-Sep-20		Soil								
	TP20-07-0.3m	23-Sep-20		Soil	R	R	R	R				
	TP20-07-1.0m	23-Sep-20		Soil								
	TP20-07-1.75m	23-Sep-20		Soil								

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ ☑

Are samples for human consumption/ use?
☐ ☑

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
12	15	3		10			

SHIPMENT RELEASE (client use)

Released by: Kristina Schmidt Date: 23 September 2020 Time:

INITIAL SHIPMENT RECEPTION (lab use only)

Received by: Date: Sept 28/20 Time: 16:20

FINAL SHIPMENT RECEPTION (lab use only)

Received by: Date: SEP 30 2020 Time: 3:15

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

[1] If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

SEPT 2017 FRONT

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 20 -

Page 2 of 3

Report To	Contact and company name below will appear on the final report	**Report Format / Distribution**	
Company:	Tetra Tech	Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)	
Contact:	Kristina Schmidt, Erin O'Brien	Quality Control (QC) Report with Report ☑ ☐ NO	
Phone:	867-689-5104	☐ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Street:	61 Wasson Place	Email 1 or Fax	Kristina.Schmidt@tetratech.com
City/Province:	Whitehorse, YT	Email 2	Erin.Obrien@tetratech.com
Postal Code:	Y1A0H7	Email 3	EBA.labdata@tetratech.com
Invoice To	Same as Report To ☑ YES ☐ NO	**Invoice Distribution**	
	Copy of Invoice with Report ☑ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Company:	Tetra Tech	Email 1 or Fax	EBA.Accounts.Payable@tetratech.com
Contact:	EBA.Accounts.Payable@tetratech.com	Email 2	
Project Information		**Oil and Gas Required Fields (client use)**	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	704-ENW.PENW03102-01	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		**ALS Contact:**	**Sampler:**

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)
- **4 day [P4-20%]** ☐
- **3 day [P3-25%]** ☐
- **2 day [P2-50%]** ☐

EMERGENCY
- **1 Business day [E1 - 100%]** ☐
- **Same Day, Weekend or Statutory holiday [E2 - 200% (Laboratory opening fees may apply)]** ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	LEPH/HEP/PAH	BTEX/VPH	VOC	Metals (dissolved)	Glycols	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	TP20-05-0.2m	23-Sep-20		Soil								
	TP20-05-0.75m	23-Sep-20		Soil								
	TP20-05-1.25m	23-Sep-20		Soil	R			R				
	TP20-03-0.5m	23-Sep-20		Soil				R				
	TP20-03-1.3m	23-Sep-20		Soil	R	R	R	R	R			
	TP20-03-1.6m	23-Sep-20		Soil								
	TP20-08-0.5m	23-Sep-20		Soil	R			R				
	TP20-08-1.5m	23-Sep-20		Soil								
	TP20-08-1.7m	23-Sep-20		Soil		R	R					
	TP00-03-1.3m	23-Sep-20		Soil	R			R				

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ ☐

Are samples for human consumption/ use?
☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				10			

SHIPMENT RELEASE (client use)			**INITIAL SHIPMENT RECEPTION (lab use only)**			**FINAL SHIPMENT RECEPTION (lab use only)**		
Released by: Kristina Schmidt	Date: 23 September 2020	Time:	Received by:	Date:	Time:	Received by:	Date: SEP 2 0 2020	Time: 3:10

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION   WHITE - LABORATORY COPY   YELLOW - CLIENT COPY

SEPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here
(lab use only)

COC Number: 20 -

Page 3 of 3

Report To	Contact and company name below will appear on the final report	**Report Format / Distribution**	
Company:	Tetra Tech	Select Report Format: ☑ PDF ☑ EXCEL ☑ EDD (DIGITAL)	
Contact:	Kristina Schmidt, Erin O'Brien	Quality Control (QC) Report with Report ☑ ☐ NO	
Phone:	867-689-5104	☐ Compare Results to Criteria on Report - provide details below if box checked	
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Street:	61 Wasson Place	Email 1 or Fax	Kristina.Schmidt@tetratech.com
City/Province:	Whitehorse, YT	Email 2	Erin.Obrien@tetratech.com
Postal Code:	Y1A0H7	Email 3	EBA.labdata@tetratech.com
Invoice To	Same as Report To ☑ YES ☐ NO	**Invoice Distribution**	
	Copy of Invoice with Report ☑ YES ☐ NO	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Company:	Tetra Tech	Email 1 or Fax	EBA.Accounts.Payable@tetratech.com
Contact:	EBA.Accounts.Payable@tetratech.com	Email 2	
Project Information		**Oil and Gas Required Fields (client use)**	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	704-ENW.PENW03102-01	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		**ALS Contact:**	**Sampler:**

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)
- **4 day [P4-20%]** ☐
- **3 day [P3-25%]** ☐
- **2 day [P2-50%]** ☐

EMERGENCY
- **1 Business day [E1 - 100%]** ☐
- **Same Day, Weekend or Statutory holiday [E2 - 200% (Laboratory opening fees may apply)]** ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	LEPH/HEP/PAH	BTEX/VPH	VOC	Metals (dissolved)	Glycols											SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	MW20-01	25-Sep-20		Water	R	R	R	R	R													
	MW20-02	25-Sep-20		Water	R	R	R	R	R													
	MW20-03	25-Sep-20		Water	R	R	R	R	R													
	DUP	25-Sep-20		Water	R	R	R	R	R													
	FB	25-Sep-20		Water																		

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System?
☐ ☐

Are samples for human consumption/ use?
☐ ☐

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				10			

SHIPMENT RELEASE (client use)			**INITIAL SHIPMENT RECEPTION (lab use only)**			**FINAL SHIPMENT RECEPTION (lab use only)**		
Released by: Kristina Schmidt	Date: 23 September 2020	Time:	Received by:	Date:	Time:	Received by:	Date: SEP 30 2020	Time: 3 40

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

SEPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

---

[1] If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Report to Council

☒ For Council Decision ☐ For Council Direction ☐ For Council Information

☐ In Camera

AGENDA ITEM: **CBC Project update**

PREPARED BY: Brodie Klemm, Project Manager

DATE: January 28, 2021

RELEVANT BYLAWS / POLICY / LEGISLATION:

ATTACHMENTS:
Colliers Project Leaders – Project Plan Draft
Colliers Project Leaders – Risk Register
Colliers Project Leaders – Master Schedule
Keay Architecture – Project Memo Nov 24
Keay Architecture – Project Memo Jan 25
RDH Building Science – Building Enclosure Review

RECOMMENDATION

That committee of the Whole

- review and provide comments on the Draft Project Plan
- forward to council to direct administration to prepare an RFP for foundation drainage and insulation
- forward to council to direct administration to update the scope and prepare a new RFP for the Wall cladding and roof repair
- forward to council to direct administration to prepare an RFP for design, build and installation of windows and doors
- forward to council to approve administration to enter into a contract with Imperial Production for the restoration/replacement of 21 corbels and 8 roof finials for $36,000 plus gst and shipping.
- provide direction to administration on what is required to determine end use of the building

ISSUE / PURPOSE

Administration has been working on the structural elements of the CBC building and is requesting direction on moving forward.

BACKGOUND SUMMARY

Council approved a 5 year plan for the Canadian Bank of Commerce building in 2018. This plan included the stabilization phase and the Rehabilitation/Restoration Phase. There are still some aspect of both of these phases ongoing. The project plan created with Colliers Project Leaders is a more detailed plan of how to continue to move this project forward.

Subsequently a tender was released and approved for the Wall Cladding & Roof Repair in 2019. The successful contractor started restoration of the finials and procurement of tin to replace missing wall cladding. The project was stalled at the beginning of 2020 due to COVID travel restrictions. The company filed for bankruptcy in the fall of 2020.

During 2020, administration continued working on planning and other work required to get the building ready for occupancy. The following work was undertaken in 2020:

- Colliers Project Leaders: assisted the Asset and Project Manager in moving this project forward and determining and carrying out the necessary steps

- RDH – Building Science Specialists: reviewed the condition of the building enclosure and recommended improvements that can be made for the building enclosure
- Keay Architecture – review of wall cladding drawings as well as assistance in ensuring the steps and decisions made maintain the historic value of the building. Keay Architecture was the company the City of Dawson had retained in 2013 to produce a Condition Survey and Stabilization Plan for the building

ANALYSIS / DISCUSSION

The project team has concluded the following is necessary to continue to move this project forward:

1. Foundation and Drainage
The foundation and drainage preservation was not contemplated prior to the issuance of the first Wall Cladding and Roof Repair contracts. This work is necessary to ensure the building is fully protected ~~as well~~. This involves the installation of weeping/drainage tile and exterior insulation for the basement.

2. Wall Cladding and Roof Repair
As the current Wall Cladding and Roof Repair Contracts are no longer viable due to the bankruptcy of the company awarded, the work ~~this~~ will need to be re-tendered. The following are recommended scope changes for the tender:

- Update the tender drawings to include the changes required to cover the foundation installation work with input from Keay Architecture
- Include the installation of Corbels and Finials

3. The Windows and Doors

These elements were discussed as part of the building envelope. It would be much more sustainable to install high efficiency triple pane windows; however, this would be difficult to do along with keeping the historical aspects of the building. It is recommended to prepare a tender package to include design, build and installation of the windows and doors with re-use and replicas of historic wood framed windows.

4. Restoration/Replacement of Window Corbels and Roof Finials.

The restoration and replacement of the roof finials was originally a part of the Roof Repair contract. Through many conversations, we have managed to re-locate the original finials that were shipped to the company for restoration and subsequently mis-placed during the company bankruptcy.

Prior to the original contract being awarded, the replica corbels were removed from the contract as it was felt that the quote for this work was too high ($13,000/corbel at 21 corbels required). A quote has now been received from another company (Imperial Productions) for the replication of the corbels for a total cost of $26,000. This would reproduce the corbels in the original zinc material. Administration has also requested a response from Imperial Productions to take over the restoration of the finials too, as this would eliminate the need to ship these items back to Dawson City and then back out to another restoration company.

Administration would like to pursue this option with Imperial Productions for a total cost of $36,000 plus taxes and shipping.

5. End Use

Any discussion and work going forward will be dependent on the decision regarding end use of the building. The building envelope work, potential of second floor for access (interior or exterior), and heating and hvac planning is all dependent on what usage this building will have. Seasonal vs. year-round usage as well as public access requirements to the second floor will drive ongoing planning and design of this building. Administration would like to commence these discussions prior to tendering work involving insulation and interior design/fit up.

APPROVAL			
NAME:	C Bellmore	**SIGNATURE:** C L Bellmore	
DATE:	Jan 28, 2021		

Colliers International

Colliers Project Leaders

Project Plan - DRAFT
CBC Building Restoration

November 27, 2020
821160-0009(2.0)

1.0 Purpose

This Project Plan describes:

- The objectives of the Project (the WHY) and;
- The process by which the project will be managed (the HOW).

It will be revised and updated as required throughout the project phases. It will be controlled by the Project Manager.

2.0 Objectives

2.1 Background

The City of Dawson (City) purchased the historic Canadian Bank of Commerce (CBC) building in 2013 and intends to restore it to its original appearance and repurpose its interior. The building was constructed in a prime location in Dawson in 1898 using a wood frame with pressed tin siding, painted to imitate stone. In 1988 the CBC building was designated a national historic site of Canada because of the important services that were performed by the bank during the Gold Rush of 1898 until 1989, and because this Renaissance Revival building is one of Canada's finest surviving structures clad in decorative pressed metal.

In recent years, the building has undergone major renovations to rehabilitate its foundation and remove hazardous materials. The restoration of the building's exterior cladding was supposed to take place in 2019, but due to the COVID-19 pandemic, the work has been postponed to 2020.

The end use of the building has yet to be determined, but the City intends find a use that best suits the Dawson City community and businesses. Work to determine this use will begin in late 2020.

The project will ensure that the *Standards and Guidelines for the Conservation of Historic Places in Canada* is followed, and that the *National Building Code of Canada* and the *Yukon Occupational Health and Safety Regulations* are adhered to.

2.2 Project Objectives

The objectives of the Project are to:

- Enhance the look of Front Street by restoring the CBC building to its former glory;
- Reinstate the integrity of the building by ensuring the following:
  - The building's structure is sound;
  - The building's envelope is watertight and well insulated;
  - The renovation uses as much of the original building elements as possible; and,
  - The building meets current building code requirements.
- Provide useable space for the community rather than another abandoned building in Dawson.

2.3 Project Success Metrics

- The chosen end-use of the building provides socio-economic benefit to the community.
- The restoration meets the Design Guidelines for Historic Dawson and is accepted by the local Heritage Society.
- The exterior restoration is as historically accurate as possible.
- The community is proud of the end result.

3.0 Scope Management

3.1 Completed to Date

The existing building has a long, but recent history of renovation work that has been completed with the goal of stabilizing the building, safely removing pre-existing hazardous materials, and commencing the repairs to the building's exterior elements that are in poor condition. Below is a list of the work completed to date, prior to the current Project Team's involvement:

- 2000 – Previous owner completed basement reconstruction.
- 2013 – City of Dawson purchase building for $170,000. Keay and Associates Architecture Ltd developed condition survey, structural review and stabilization plan.
- 2014 - Completed hazardous materials assessment. Completed storm window reconstruction
- 2015 - Completed hazardous materials abatement of non-encapsulated materials
- 2016 – Completed structural foundations of roof truss repairs. Installed fall arrest anchors on roof in advance of roof repair project
- 2018 – Completed hazardous materials abatement of interior encapsulated materials. Completed roof repair.

Work that was outlined in the Stabilization Plan (Keay Architecture, 2013) has been completed. The exterior stairs of the building have been removed, and the interior wall finishes have been covered temporarily with plywood sheets. Some of the original windows and furniture are stored inside the building on the main floor. The original vault still exists as is within the basement of the building.

3.2 In Scope

Building Exterior

The current focus of the project is to complete the restoration of the exterior of the building as detailed on the cladding restoration plans that were completed by Keay Architecture Ltd. A contractor that is experienced with the restoration of these types of heritage buildings will complete the roof and cladding repairs, saving as much of the original tin façade as possible, and replacing what cannot be salvaged with similar looking materials. A separate contract will be completed to reinstate the windows and doors of the building. Some of the original frames still exist and will be reused if possible. Broken glass panes can be replaced, but window frames that are in too poor of a condition to be used may be replaced with custom windows that replicate the original style of window frame. Should it be considered important that energy efficient building practices be employed on this project, the City may consider refurbish the existing windows with modern copper draft seals, and if not feasible, then replace the windows with new wood-sash windows with sealed thermal panes having true divided panes. The new windows should reproduce exactly the sash width and the arrangement of panes of the original windows, per the *Dawson City Heritage Management Plan, 2008.*

To ensure the quality of the exterior cladding restoration work, and to provide advice on building code related issues associated with the end use of the building, an architect with heritage building project experience will be retained to review the contractor’s sheet metal shop drawings, comment on material selection, comment on items that might be impacted by the selected end use of the building, and potentially visit site to review the quality of the contractor’s work.

Once the exterior cladding work is complete, the building will be painted a colour that matches what is believed to be the original colour of the building, confirmed by the analysis of paint chip samples taken from the building’s exterior.

Because this building is expected to be used year-round, a building envelope specialist, experienced with heritage buildings, will review the existing building envelope to provide the City with options for how the building envelope can be improved to suit its new end use. If possible, increasing the thermal performance of the building’s exterior walls will benefit the City and potential tenants by reducing operating costs. Because the exterior side of the walls is covered with asbestos containing materials, any insulation of the exterior walls will have to be done from the inside. This may reduce the usable floor space within the building’s interior.

Note: The exterior cladding restoration work has been delayed to 2021 because of schedule impacts due to the COVID-19 pandemic.

Building Interior

The interior of the building is to be renovated to suit a new end use that has yet to be defined. It is understood that the interior of the building can be modern in style and does not need to confirm with the *Design Guidelines for Historic Dawson*. This gives the City lots of flexibility when defining the end use and/or determining end users. That said, elements of the original building finishes, such as the original ornate tin ceiling, may be considered for reinstatement. The original bank vault still remains within the building. It is intended that this will remain, and creative ways to incorporate it into the building’s new use will be explored.

The method for selecting the building’s new end use has not yet been determined. The end use decision will be made by Council. The method for determining the end use will be based on what information/data, if any, that Council feels they need to rely upon to make the decision. Information that Council may want to consider could be consultation with key stakeholders, expression of interest from local businesses and organizations, public engagement, analysis of the socio-economic benefits/impacts of certain end uses, etc. Some of these items can be completed informally by the Project Manager/Project Team, or a consultant can be engaged to complete a formal study, depending on what is desired.

Once an end use has been identified, an architect with heritage experience, or support, will be retained to complete preliminary and detailed designs of the interior fit-up of the building. Any required exterior landscaping could be added to their scope, if desired. This would be followed by tendering the work to trades or a general contractor.

Depending on the end use, it is possible that the end user will be required to fund all, or part of the interior renovations. This could be the case if a commercial or government tenant were to occupy the space.

3.3 Not in Scope

No further investigation into the building's current condition, outside of the building envelope review, is currently within scope.

Tenant driven fit-ups of the interior space may be outside of the City's scope for this project.

3.4 Approval of Scope Changes

Any scope change identified before or during construction, which involves a Project Schedule extension and/or an increase in cost above the Project Budget allocations, must be approved in writing by the Sponsor prior to commencement of the work.

4.0 Time Management

4.1 Project Schedule

The Project Schedule milestones are listed below:

Milestone	Scheduled Completion Date
Finalize Planning Documents	November 2020
RDH Building Envelope Review and Report Complete	December 2020
Revise Cladding Restoration Tender Drawings	March 2020
Issue Cladding Tender	March/April 2020
Determine Building End Use	June 2021
Exterior Restoration Work Complete	October 2021
Confirm Tenant	December 2021
Procure Architect (Interior Renovation)	March 2022
Interior Renovation Design Complete	December 2022
Interior Renovation Construction Start	April 2023
Building Occupancy	November 2023

4.2 Schedule Monitoring

The Project Advisor has created a Master Project Schedule, document # 821160-0016. The Project Team will progressively elaborate the Master Project Schedule throughout the project and the Project Manager will prepare monthly updates of the Master Project Schedule.

During construction, the various contractors will create construction schedules that will be updated monthly. Optional: The Project Advisor or Project Manager can carry out a monthly Earned Value Management analysis of the construction schedule and prepare a monthly report on these findings.

The Project Manager will report any deviations from the Master Project Schedule, as required, and will provide a recommended response.

4.3 Approval of Schedule Changes

Any changes to the Project Schedule must be approved in writing by the by the Sponsor.

5.0 Cost Management

5.1 Project Budget

The Project Budget is **$2,388,000** allocated as follows:

Capital Budget (Not including expenditures prior to 2020)	$2,388,000
Project Management Support	$ 50,000
Building Envelope Review	$ 8,500
Architectural Review of Exterior Cladding	$ 3,000
Exterior Cladding Restoration	$ 300,000
Painting of Exterior Walls and Roof	$ 60,000
Windows and Doors Replacement	$ 80,000
Best Use Feasibility Study	$ 50,000
Procurement of Architectural Consultant	$ 10,000
Architectural Services (Interior Renovations)	$ 250,000
Interior Renovations (Construction)*	**$ 1,500,000**

**The interior renovations budget will require validation once the intended use of the building is confirmed and potential tenant requirements are defined.*

5.2 Approved Funding Sources

The current sources of funding are currently available for use on this project:

- Gas Tax
- City of Dawson Reserves

5.3 Potential Funding Sources

The Project Manager will look into the following sources of funding:

- Parks Canada National Cost-Sharing Program for Heritage Places
- YG Historic Properties Assistance Program

- YG Historic Resources Fund
- YG Community Development Fund Program
- FCM Green Municipal Fund
- This Place Matters (Crowdfunding platform of National Trust for Canada)

5.4 Approval of Project Budget Changes

Any increase in cost above the approved budget allocations must be approved by Council.

All Construction Change Directives and Change Orders must be approved in writing by the Sponsor before authorization of the work.

5.5 Approval of Payments

The Project Manager will receive all project related invoice and will approve for payment with the City's Finance Department.

5.6 Cost Tracking

Construction costs will be tracked by the City of Dawson Project Manager (document CBC 2019-2021 – Canadian Bank of Commerce: Stabilization 2019-2021).

6.0 Human Resources Management

6.1 Roles and Responsibilities

The following people and positions are assigned to the roles and responsibilities for this Project:

Person/Position	Role	Responsibilities
Cory Bellmore, Chief Administrative Officer	Sponsor	- Provides direction to all team members - Communicates the City's goals, objectives, values - Oversees all City staff - Provide approval on budget, scope and schedule - Allocate internal resources as required -
Brodie Klemm, Project Manager	Project Manager	- Main point of contact for the City - Manages the day to day of all project activities - Responsible for budget, schedule, cost, scope and risks - Oversees procurements
Council	Represent the citizens of Dawson City	- Responsible for all major project decisions and direction

Person/Position	Role	Responsibilities
Heritage Advisory Committee		Provides advice and approval on renovation and construction within Dawson's designated heritage districts.
Kyle Humphreys, Senior Project Manager (Colliers Project Leaders)	Project Advisor	Provides project management and procurement support as requested. Review of all deliverables and provide advice and direction Prepares project planning documents such as Project Plan, Schedule and Risk Register Prepares complex procurement documents and can assist with procurement evaluations
Jan Rawling, Assistant Project Manager (Colliers Project Leaders)	Assistant to the Project Advisor	Assists the Project Team as required
Ultimate Construction	Contractor	Exterior cladding and roof restoration
Keay Architecture	Heritage Architect	Exterior cladding restoration design and quality control
RDH Building Science	Building Envelope Specialist	Review building envelope and provide advice for improvement.
TBD	Feasibility Study Consultant	Completes a feasibility study of the end use of the building (if required)
TBD	Architect (Interior)	Prepares the design of the base building renovations May complete the tenant fit-up (TBD)
TBD	Interior Renovation Contractor	Completes the base building renovations that the City is responsible for.
TBD	Tenant Fit-up Contractor	Completes the interior fit-up within the building based on tenant requirements. This may be out of the City's scope (TBD)

7.0 Communications & Stakeholders

7.1 Stakeholder Management

The table below provides a summary of stakeholders whose interests need to be addressed during the project and the communications that will be necessary to manage their expectations:

Stakeholder	Required Communications
Mayor and Council	
City of Dawson	
Heritage Advisory Committee	
Parks Canada	
Government of Yukon	
CIBC	
Front Street Businesses	
The Dawson Public	

7.2 Meetings

The Project Team will attend weekly meetings during project development, bi-weekly meetings during design and by-weekly meetings during construction. The Project Team meetings will be scheduled, chaired, and minuted by the Project Manager, or his/her designate.

The Project Manager will meet with the City of Dawson CAO, Council, Heritage Advisory Committee and project funders as required throughout the project.

7.3 Status Reports

The Project Manager, or his/her designate, will prepare monthly Project Status Reports communicating the status of the project performance with respect to scope, schedule, cost, and risk issues. Each status report will include the most current version of the Master Project Schedule, Cost Tracking Log, Risk Register, and Earned Value Management report (if in construction). The Status Report will be issued to the CAO and may be provided to Council as deemed necessary.

7.4 Email Correspondence

All project correspondence will be issued by email. All contractual or legal based direction is to be provided by formal letter or report by the authoring party that is issued as an attachment with the email. All email correspondence related to the Project should have the acronym “**DCCBC**” at the beginning of every subject line. In addition, all email correspondence should contain and maintain one relevant subject for each email chain.

8.0 Risk Management

An active focus on risk management greatly increases the probability that the Project Team will successfully achieve our objectives. Identifying risk at the onset of the project and reviewing/ monitoring them regularly is an important part of the risk management process.

8.1 Risk Management

Colliers has developed an initial Risk Register, document # 821160-0010, based on a discussion with the City of Dawson Project Manager. The highest priority risks from this initial identification are listed below and the Project Team will progressively elaborate the Risk Register throughout the project.

8.2 Currently Identified Risks

- **Lack of available Heritage Contractors.** This may cause a non-competitive environment that could see higher prices than anticipated if the work is retendered. *Potentially mitigate this by leveraging our existing heritage consultant contacts who can recommend suitable contractors to invite to bid on the revised tender documents. This would be beneficial even if this has to be tendered nationally.*
- **Prices for restoration work come in higher than current contract.** Considerable time has passed since Ultimate Construction was awarded their contract. If this job is retendered, bid prices may come in higher due to escalation of construction costs and COVID-19 safety requirements and travel restrictions. *Potentially mitigate this by seeking out a contractor to take over Ultimate Construction's contract for the same or similar price to avoid potential cost increases in the work.*
- **Not receiving all materials from Ultimate Construction's yard.** Ultimate Construction, based on Ontario, has gone into receivership and no longer has control over their inventory. They were in possession of original finials that belonged to the CBC building. It is imperative that the City of Dawson get those back. They were also in possession of some cladding materials that were bought and paid for, but not shipped to Dawson. *Potentially mitigate this by retaining the services of the local Project Manager that was employed by Ultimate Construction to work with the local Receiver to retrieve these materials. These materials can be stored in Ontario temporarily and then shipped back to Dawson or to the contractor who wins the retender of the project.*
- **Design of future work does not meet the heritage requirements or objectives of this project.** As this building has heritage status and the culture of Dawson is rooted in its deep heritage to the gold rush era, it is important that the design meets the requirements and objectives that have been set for this project. *Mitigate this by ensuring that any Architect that is retained for this project must also carry an architect on their team that has significant experience with heritage buildings and/or belongs to a heritage building association.*
- **Cannot determine the end use of the building in a timely manner.** It is believed that Council will a decision on the end use of the building, but it is unclear if this process has started and how long it will take. Without a clear understanding of these timelines and the status of this activity, it is possible that determining the end use of the facility could take longer than expected which may delay the timelines stated in the current project plan. *Potentially mitigate this by informing Council of where we are at with the project and expressing the urgency of getting started with the work and having it completed in a timely manner. Ensuring the right stakeholders and advisors are at*

the table as early as possible in the process to contribute to the discussion and supporting a decision. If Council needs more technical information to make a decision, a Feasibility Study could be commissioned.

- **Quality of work doesn't meet standards.** Because of the remoteness of Dawson City, and current COVID-19 protocols, it may be difficult or expensive for the Architect to travel to site and review the work that is completed by the contractor(s). *Potential mitigations are to retain a local architect and/or the Project Manager can visit site on a regular basis and provide photos and observations to the consultants who are responsible for project sign-off.*
- **Lack of funding effects the completion of the project:** The budget for this project was established years ago and may no longer be enough to complete the project given the costs of escalation in construction costs. *To mitigate this, the Project Manager and the Project Advisor will work to update the budget and identify any additional budget needs early, for Council's consideration, and for funding approval. Also, they will identify any sources of external funding that could be applied for to supplement the budget. Additional cost savings measures may be that the future tenant of the building cost share the cost of the interior fit-up of the building, reducing the City's capital spend.*
- **COVID-19 crisis.** The social distancing and travel restriction measures will have some minor impacts on schedule because of the loss of productivity from people working from home and the lack of face to face meetings. Decisions requiring senior management or Council may become slower. Public gatherings will not be possible for the time being. *Mitigate this by switching most meetings to video conferencing. Make room in the schedule for decisions. The Project Manager can be more involved in quality control inspection process.*

9.0 Quality Management

9.1 Project Management Documents

9.2 Design Documents

All Design Consultants will be responsible for defining and delivering the appropriate quality assurance and quality control efforts to prepare the design documents (e.g. working drawings and specifications) so that the intended Project Objectives and specified standards are achieved.

The quality assurance requirements for this project are expected to be consistent with current standards of practice. The Project Team have reviewed the quality objectives for this Project and have specified that the following quality assurance procedures be included in the design documents for this Project:

- The design and construction shall adhere to the following standards:
    - Standards and Guidelines for the Conservation of Historic Places in Canada
    - Dawson City Heritage Management Plan
    - Design Guidelines for Historic Dawson
    - National Building Code of Canada

    - Yukon Occupational Health and Safety Regulations.
- Design Consultants will be expected to review the Project Objectives and Success Metrics.
- Design Consultants will be expected to document all functional program and scope requirements within a clear and concise document for review by the Project Team, and other stakeholders as deemed necessary. This document will be updated as changes are made.
- The Project Team will review design deliverables at intervals that are standard industry practice (I.e. 33% design complete, 66% design complete, etc.) Council will approve all final designs prior to tendering for construction.

9.3 Construction

During all construction phases, the General Contractors, Consultants, and third-party testing and inspection agencies will be responsible for the day to day quality control inspection and testing of the work to ensure compliance to the contract documents. The Project Manager will carry out sufficient inspection of the work and will share photos and comments with the Consultant(s) to verify that the work has been carried out in accordance with the contract documents. The Project Manager will also create deficiency lists and document site observations.

Requirements for third party testing and inspection will be defined by the Consultants. The Project Manager and Consultants will review all inspection reports, provide direction to resolve any deficiencies, and assemble and file all reports.

For small trade contracts, such as painting, the Project Manager may opt to take on reviews for quality control, if deemed appropriate and based on the simplicity of the work.

10.0 Procurement Management

All procurement shall follow City of Dawson’s applicable purchasing policies.

- Exterior cladding and roofing contractor will be retained via public tender.
- Colliers Project Leaders, RDH and Keay Architecture have been sole-sourced because the cost of their scope of work is within the City’s sole-source limit.
- Small trade contracts will be considered to public tender locally within Dawson City.
- Large trade contracts will be considered for public tender in the Yukon.
- Specialized work may be sourced from outside the territory.
- Design Consultants will be procured using a public Request for Proposal.
- The Project Advisor will assist the Project Manager in developing any complex procurement documents.
- The CAO will review all procurement documents prior to them being issued.
- Council will approve award of major contracts.

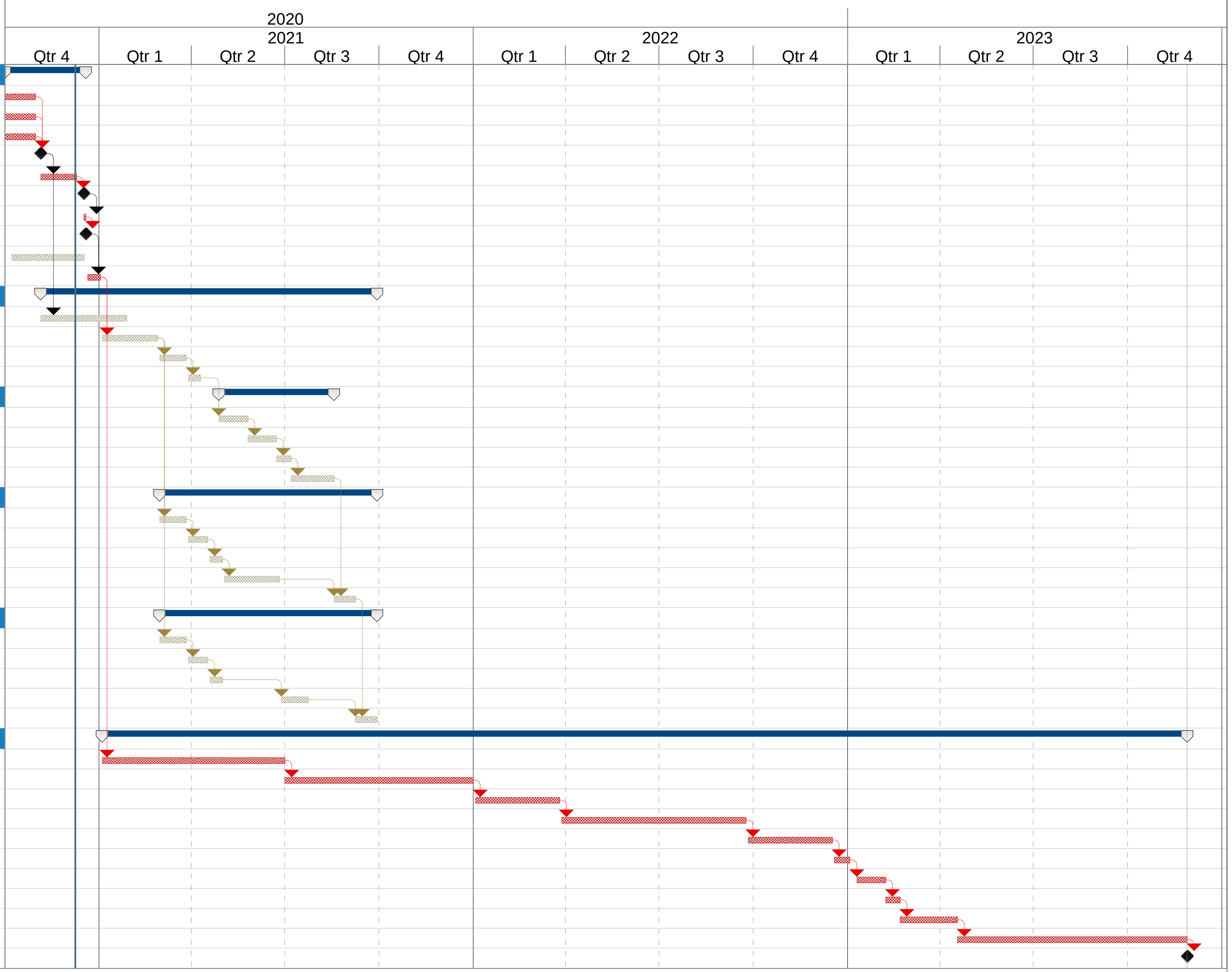
City of Dawson
CBC Building Restoration
Risk Register

Identification					Qualitative Analysis				Response Planning			Monitoring and Control		
ID Number	Risk	Identified Risk Description	Impact Description	Project Phase	Probability	Impact	Rating	Estimated Date of Impact	Risk Management Strategy	Response	Responsibility	Responsibility	Last Update (Date)	Next Update (Date)
1	2	3	4	5	6	7	8	9	10	11	12	20	21	22
1.1	Lack of available Heritage Contractors	This may cause a non-competitive environment that could see higher prices than anticipated if the work is retendered.	**Scope:** n/a **Time:** n/a **Cost:** Costs come in over budget. **Quality:** n/a **Other:** n/a	Exterior Cladding Restoration Tender	3	3	9	Mar-21	Mitigate	Potentially mitigate this by leveraging our existing heritage consultant contacts who can recommend suitable contractors to invite to bid on the revised tender documents. This would be beneficial even if this has to be tendered nationally	Brodie Klemm	Colliers Project Leaders	December 9, 2020	January 8, 2021
1.2	Not receiving all materials from Ultimate Construction's yard	Ultimate Construction, based on Ontario, has gone into receivership and no longer has control over their inventory. They were in possession of original finials that belonged to the CBC building. It is imperative that the City of Dawson get those back. They were also in possession of some cladding materials that were bought and paid for, but not shipped to Dawson.	**Scope:** original building elements have to be reproduced from new. **Time:** The re-tender could be delayed, but not a great concern at this time. **Cost:** Repaying for pre-purchased metal cladding, but a priceless loss of existing builing elements. **Quality:** Original building elements, such as the finials are lost and need to be reproduced.	Exterior Cladding Restoration Construction	3	3	9	Mar-21	Mitigate	Potentially mitigate this by retaining the services of the local Project Manager that was employed by Ultimate Construction to work with the local Receiver to retrieve these materials. These materials can be stored in Ontario temporarily and then shipped back to Dawson or to the contractor who wins the retender of the project	Brodie Klemm	Colliers Project Leaders	December 9, 2020	January 8, 2021
1.3	Prices for restoration work come in higher than current contract	Considerable time has passed since Ultimate Construction was awarded their contract. If this job is retendered, bid prices may come in higher due to escalation of construction costs and COVID-19 safety requirements and travel restrictions.	**Scope:** n/a **Time:** n/a **Cost:** Costs come in over budget. **Quality:** n/a **Other:** n/a	Exterior Cladding Restoration Tender	2	3	6	Mar-21	Mitigate	Potentially mitigate this by seeking out a contractor to take over Ultimate Construction's contract for the same or similar price to avoid potential cost increases in the work	Brodie Klemm	Colliers Project Leaders	December 9, 2020	January 8, 2021
1.4	Cannot determine the end use of the building in a timely manner	It is believed that Council will a decision on the end use of the building, but it is unclear if this process has started and how long it will take. Without a clear understanding of these timelines and the status of this activity, it is possible that determining the end use of the facility could take longer than expected which may delay the timelines stated in the current project plan.	**Scope:** Unknown **Time:** Schedule delays. **Cost:** Unknown **Quality:** n/a **Other:** n/a	Interior Design	2	3	6	Jun-21	Mitigate	Potentially mitigate this by informing Council of where we are at with the project and expressing the urgency of getting started with the work and having it completed in a timely manner. Ensuring the right stakeholders and advisors are at the table as early as possible in the process to contribute to the discussion and supporting a decision. If Council needs more technical information to make a decision, a Feasibility Study could be commissioned	Council	Colliers Project Leaders	December 9, 2020	January 8, 2021
1.5	Lack of funding effects the completion of the project	The budget for this project was established years ago and may no longer be enough to complete the project given the costs of escalation in construction costs.	**Scope:** scope may need to be reduced if a budget increase is not available. **Time:** n/a **Cost:** increase to budget required **Quality:** if an increase to the budget is not feasible, it could affect the quality of the project.	All	2	3	6	Dec-22	Mitigate	To mitigate this, the Project Manager and the Project Advisor will work to update the budget and identify any additional budget needs early, for Council's consideration, and for funding approval. Also, they will identify any sources of external funding that could be applied for to supplement the budget. Additional cost savings measures may be that the future tenant of the building cost share the cost of the interior fit-up of the building, reducing the City's capital spend	Council	Colliers Project Leaders	December 9, 2020	January 8, 2021
1.6	Design of future work does not meet the heritage requirements or objectives of this project	As this building has heritage status and the culture of Dawson is rooted in its deep heritage to the gold rush era, it is important that the design meets the requirements and objectives that have been set for this project.	**Scope:** Rework may be required if new building elements don't meet the heritage requirements. **Time:** Schedule delayed to deal with rework. **Cost:** Additional costs for the rework. **Quality:** Does not meet heritage requirements. **Others:** Stakeholders don't accept the	Exterior Cladding Restoration and Interior Design	1	3	3	Feb-21	Mitigate	Mitigate this by ensuring that any Architect that is retained for this project must also carry an architect on their team that has significant experience with heritage buildings and/or belongs to a heritage building association	Brodie Klemm	Colliers Project Leaders	December 9, 2020	January 8, 2021
1.7	COVID-19 crisis	The social distancing and travel restriction measures will have some minor impacts on schedule because of the loss of productivity from people working from home and the lack of face to face meetings. Decisions requiring senior management or Council may become slower. Public gatherings will not be possible for the time being.	**Scope:** No impact expected. **Time:** No impact expected. **Cost:** Additional general conditions may be required to accommodate social distancing procedures. **Quality:** **Other:** n/a	Exterior Cladding Restoration Construction	3	1	3	Apr-21	Mitigate	Mitigate this by switching most meetings to video conferencing. Make room in the schedule for decisions. The Project Manager can be more involved in quality control inspection process	All	Colliers Project Leaders	December 9, 2020	January 8, 2021
1.8	Quality of work doesn't meet standards	Because of the remoteness of Dawson City, and current COVID-19 protocols, it may be difficult or expensive for the Architect to travel to site and review the work that is completed by the contractor(s).	**Scope:** rework to correct quality issues. **Time:** additional time required for any rework **Cost:** additional cost for any rework **Quality:** quality does not match what was paid for. **Other:** n/a	Exterior Cladding Restoration Construction	1	2	2	Aug-21	Mitigate	Potential mitigations are to retain a local architect and/or the Project Manager can visit site on a regular basis and provide photos and observations to the consultants who are responsible for project sign-off.	Brodie Klemm	Colliers Project Leaders	December 9, 2020	January 8, 2021

CBC Building Restoration Project

City of Dawson
Master Project Schedule

ID	ⓘ	Name	Duration	Start	Finish
1		**Project Planning**	**57 days**	**Thu 20-10-01**	**Fri 20-12-18**
2	▦	Develop Project Plan	22 days	Thu 20-10-01	Fri 20-10-30
3	▦	Develop Master Project Schedule	22 days	Thu 20-10-01	Fri 20-10-30
4	▦	Develop Risk Register	22 days	Thu 20-10-01	Fri 20-10-30
5		***City Review***	***0 days***	***Wed 20-11-04***	***Wed 20-11-04***
6		Revise Planning Documents	25 days	Thu 20-11-05	Wed 20-12-09
7		***Council Review***	***0 days***	***Wed 20-12-16***	***Wed 20-12-16***
8		Finalize Planning Documents	2 days	Thu 20-12-17	Fri 20-12-18
9		***Acceptance of Planning Documents***	***0 days***	***Fri 20-12-18***	***Fri 20-12-18***
10	▦	RDH Building Envelope Review and Report	50 days	Thu 20-10-08	Wed 20-12-16
11		Holidays	10 days	Mon 20-12-21	Fri 21-01-01
12		**Exterior Cladding Restoration**	**234 days**	**Thu 20-11-05**	**Tue 21-09-28**
13		Recover finials from Ultimate Construction	60 days	Thu 20-11-05	Wed 21-01-27
14		Revise Cladding Restoration Tender Drawings	40 days	Mon 21-01-04	Fri 21-02-26
15		Tender Period	20 days	Mon 21-03-01	Fri 21-03-26
16		Award Contract	10 days	Mon 21-03-29	Fri 21-04-09
17		**Restore Pressed Tin Exterior**	**80 days**	**Wed 21-04-28**	**Tue 21-08-17**
18		Shop Drawing Review (Keay Architecture)	20 days	Wed 21-04-28	Tue 21-05-25
19		Metal Fabrications	20 days	Wed 21-05-26	Tue 21-06-22
20		Mobilization	10 days	Wed 21-06-23	Tue 21-07-06
21		Construction	30 days	Wed 21-07-07	Tue 21-08-17
22		**Replace Windows and Doors**	**152 days**	**Mon 21-03-01**	**Tue 21-09-28**
23	▦	Develop Tender Documents	20 days	Mon 21-03-01	Fri 21-03-26
24		Tender Period	15 days	Mon 21-03-29	Fri 21-04-16
25		Contract Award	10 days	Mon 21-04-19	Fri 21-04-30
26		Material Ordering	40 days	Mon 21-05-03	Fri 21-06-25
27		Construction	15 days	Wed 21-08-18	Tue 21-09-07
28		**Paint Building Exterior**	**152 days**	**Mon 21-03-01**	**Tue 21-09-28**
29	▦	Develop Tender Documents	20 days	Mon 21-03-01	Fri 21-03-26
30		Tender Period	15 days	Mon 21-03-29	Fri 21-04-16
31		Contract Award	10 days	Mon 21-04-19	Fri 21-04-30
32		Material Ordering	20 days	Mon 21-06-28	Fri 21-07-23
33		Construction	15 days	Wed 21-09-08	Tue 21-09-28
34		**Interior Renovations**	**756 days**	**Mon 21-01-04**	**Mon 23-11-27**
35		Determine Building End Use	128 days	Mon 21-01-04	Wed 21-06-30
36		Confirm tenant and their requirements	132 days	Thu 21-07-01	Fri 21-12-31
37		Procure Architect	60 days	Mon 22-01-03	Fri 22-03-25
38		Interior Design	130 days	Mon 22-03-28	Fri 22-09-23
39		Approvals	60 days	Mon 22-09-26	Fri 22-12-16
40		Holidays	11 days	Mon 22-12-19	Mon 23-01-02
41		Tender Period	20 days	Tue 23-01-10	Mon 23-02-06
42		Contract Award	10 days	Tue 23-02-07	Mon 23-02-20
43		Shop Drawing / Material Ordering	40 days	Tue 23-02-21	Mon 23-04-17
44		Construction	160 days	Tue 23-04-18	Mon 23-11-27
45		***Occupancy***	***0 days***	***Mon 23-11-27***	***Mon 23-11-27***



Project: CBC Restoration Project
Date: Wed 20-12-09
File: 821160-0016(2.0)

Normal Task	▨	Critical Task Progress	▬	Task Split	┆┆┆┆┆┆	Inactive Summary	▽▽
Normal Task Progress	▬	Milestone	◆	Inactive Split	┆┆┆┆┆┆	Deadline	⬇
Critical Task	▨	Summary Task	▽▬▽	Inactive Milestone	◇	Baseline Plan	▨

MEMO

TO: BRODIE KLEMM
PROJECT: BANK OF COMMERCE, DAWSON CITY
DATE: NOVEMBER 24, 2020
COPY: CAO DAWSON, SARAH GRAY, KYLE HUMPHREYS, ROBIN URQUHART, TREVOR VILAC

Nicole and I appreciated the meeting last week, and the opportunity to hear from the consultants and City. As I mentioned during the phone call I think there are issues that should be discussed in further detail as they have significant impacts on the building, as well as the cost of doing the work. These impacts are augmented by the small size and open plan of the building, which make it difficult to incorporate changes without major impacts on the space and finishes.

Before committing to work on the building the following need to be addressed:

1. Any discussion of a building of national heritage significance such as the Bank of Commerce must begin with the incorporation of the "Standards and Guidelines for the Restoration of Historic Buildings." There are 12 of these standards, they are pretty clear, and pertain to the retention of original materials, function, reversibility, and so on. I have attached them to this document
2. The proposed purpose of the building: is there a defined use, is there a demand for space of this configuration in this part of town, is it necessary to operate the building year round? Year round use, with requirements for thermal performance, heating, moisture control, and so on incorporates a large expense financially, and begins to dictate significant impacts on the building. As an example, seasonal use could be accommodated without insulation and with minor heating by means of baseboard heaters.
3. Associated with this is the question of how much of the building is likely to be used, on either a seasonal or full time basis. There was discussion of using all floors, as well as the attic, and this has repercussions around access and code requirements. For instance, year round use of the main floor only completely alters the thermal performance expectations of the upper floor and attic
4. Access and accessibility: the main floor is pretty straightforward, access to other floors quickly gets complicated. Access to the attic and

basement doesn't seem necessary for other than inspections. A major consideration would be the location of the stair to the upper floor, it is really only appropriate, from the point of view of heritage integrity, to reinstate the exterior stair (or stairs.) Accessibility to the second floor would require a lift or elevator, the expense and impact on the building would, in our view, require a compelling argument for the use of the space.

5. Exterior finishes: there was discussion on the conference call about glazing, the replacement of sheet metal decorative elements, and the replication of metal siding materials, these are discussed below
6. Interior finishes: much of the character and heritage significance of the building results on the remaining interior finishes, in particular the pressed metal ceiling

There was discussion regarding work that could start on the building:

i. exterior cladding: missing in several areas, but can be matched through archival photographs and a review of remaining elements. For various reasons existing cladding should not be relocated to match up to existing, this will only expose more of the asbestos backing that will have to be remediated, and in terms of the Standards and Guidelines the change in materials, including where it was cut to allow the foundation work to take place, should remain as part of the history and evolution of the building fabric

ii. windows: there is sufficient information to accurately replicate the windows, which should be single glazed with storm windows as appropriate. Multiple glazing systems, particularly with false muntin bars, will significantly affect appearance, reflective qualities, and transparency

iii. roof: the roof should be repaired as required, with every effort to maintain existing finishes and appearance. A proposed course of repair is outlined in Appendix 4, roof repair, of our report

iv. exterior decorative elements: the pressed metal finishes should be retained and repaired as much as possible, with resoldering and regalvanizing as appropriate. Where elements have deteriorated beyond repair fibreglass replicas, using original parts as patterns, are acceptable. Return of the missing finials should be expedited

v. basement: it makes sense to waterproof the basement walls, and add drain tile and insulation in the process. As discussed, the insulation would be on the exterior, protected with metal cladding.

In closing, I would refer to the study which we did on the building in 2013, along with the follow up document regarding roof repair, and suggest these be incorporated into the decision process.

Yours truly,

John Keay, Architect

KEAY ARCHITECTURE LTD
1124 FORT STREET, VICTORIA, V8V 3K8
250 382 3823
john@keayarchitecture.com

MEMO

TO: BRODIE KLEMM
PROJECT: BANK OF COMMERCE, DAWSON CITY
DATE: JANUARY 25, 2021
COPY: CAO DAWSON, SARAH GRAY, KYLE HUMPHREYS, ROBIN URQUHART, TREVOR VILAC, GRAHAM FINCH

Hi Brodie,

Further to the conference call of January 21 and your follow up, our comments are as follows:

i. use of the building still remains an issue. Seasonal and/or year round occupancy remains a significant design determinant, currently the intent is to stabilize the exterior of the building and insulate as appropriate so that decisions regarding use can be deferred while incorporating the upgraded and stabilized exterior finishes.

ii. use of the attic should not be considered, and therefore access provided only to meet servicing and maintenance requirements. The original exterior finishes should be retained to the maximum extent possible, via Option 2. Insulation options are to insulate the underside of the roof, or to insulate the upper floor ceiling, the latter would appear to provide better ventilation and reduced condensation

iii. the basement should be upgraded in accordance with Option 1, excavation around the perimeter to permit the installation of exterior insulation with protective metal cladding, and a waterproofing system. Perimeter drainage should be installed. The installation of a sump and pumping system should be reviewed to confirm if this is required to mitigate spring flooding. Access should be for maintenance only, the construction of any sort of public access would be very intrusive and is, apart from the vault, unlikely to provide any sort of cultural experience

iv. The main floor could be considered for year round use depending on perceived need by the community. Exterior walls would be insulated in accordance with Option 1, the existing 2x10 framing would provide enough insulation depth. Floor and ceiling could be insulated as well, heating would be determined at a later date. Appropriate window restoration requires further analysis. Details of the original windows can be accurately replicated through photographs and remnants available on site. Per the discussion, the appearance of high performance windows can affect the heritage qualities of the building, and this needs to be weighed against the heat loss through the windows and the extent of off season use. Normal wood storm windows will provide significantly improved thermal performance, and could be thermal glazed and then removed for the summer season.

v. the upper floor would seem suitable for seasonal use as an apartment, for example as student or tourist oriented housing. The exterior stair provides code compliant access, and no interior changes are required to the main floor. At the same time, thermal upgrading of the walls would be relatively simple, and new single glazed windows would be acceptable.   As noted above, the ceiling would be insulated

vi. accessibility: the adjacent boardwalk could be modified to suit requirements for the main floor. Access to any other floors would require a lift/elevator, with resulting major impacts on what is a small floor plate.

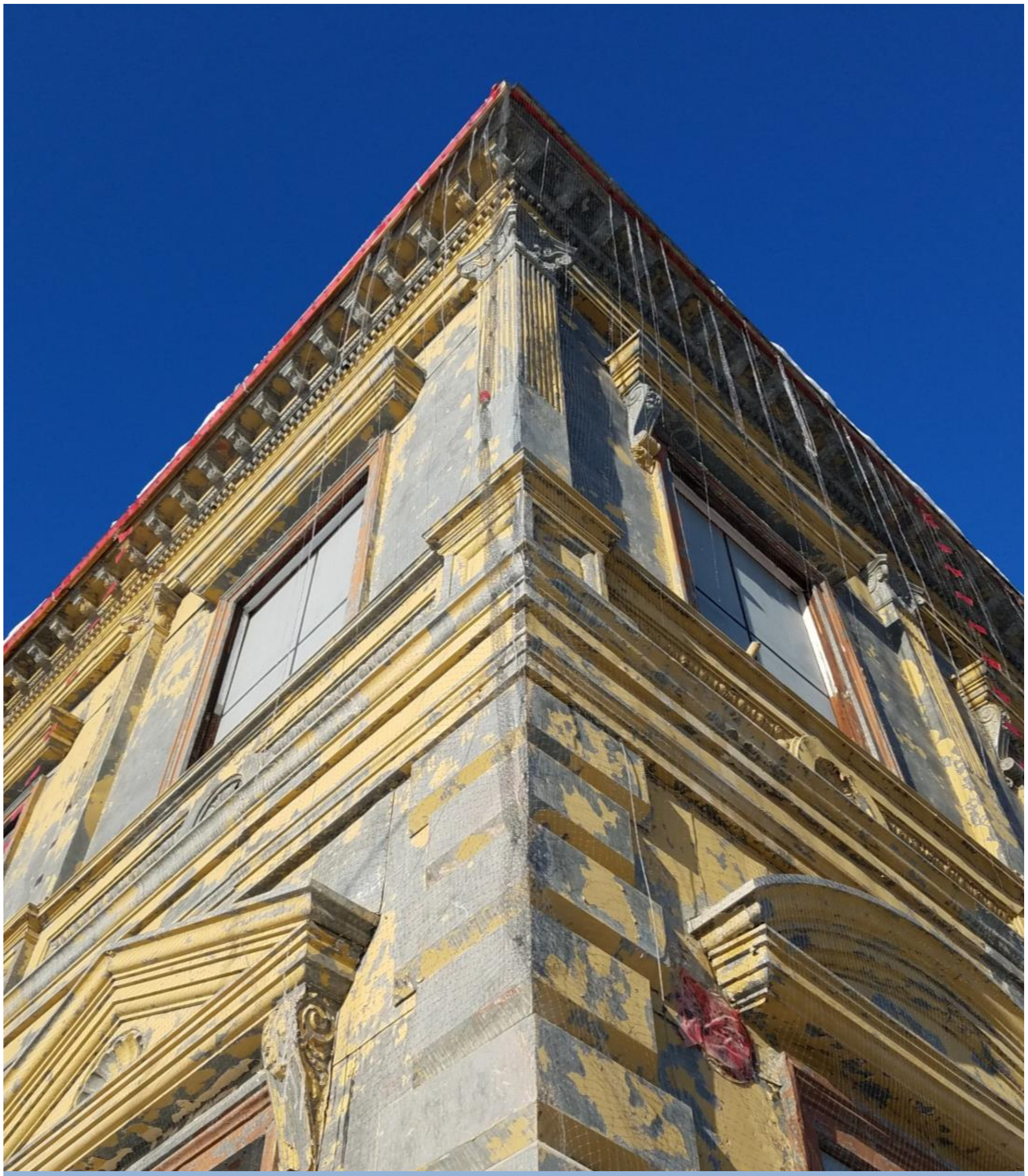
Thanks for the opportunity for comment, we look forward to continuing the discussion of the restoration and use of this significant building. In the meantime, let us know if you have any questions.

Yours truly,

John Keay, Architect

Building Enclosure Review Report | Project R-23944.000

Canadian Bank of Commerce NHS, 978 Second Avenue, Dawson City, YT



To Brodie Klemm
City of Dawson
1336 Front Street, 2nd Floor
Dawson City YT Y0B 1G0

Submitted December 23, 2020 by
RDH Building Science Inc.
4333 Still Creek Drive #400
Burnaby BC V5C 6S6

Contents

1 Executive Summary

RDH Building Science Inc. (RDH) was retained to review the condition of the building enclosure and provide recommendations regarding improvements that can be made to the building enclosure for a future retrofit project at the Canadian Bank of Commerce National Historic Site (NHS) in Dawson City, YT.

In order to obtain additional information, verify findings from earlier investigations by others, and to assess the viability of repair or renewal strategies, RDH conducted a field investigation of the building enclosure on October 16, 2020.

An online "roundtable" meeting with key project stakeholders was hosted on November 18, 2020. We discussed the city's drivers and objectives for the project, design challenges, construction challenges, etc. Discussion and outcomes from this session helped inform our work.

Section 5 of this report describes the different Enclosure Options to be considered for a future retrofit project. The design options presented throughout are collated in Section 6 and a recommendation is provided by RDH for each enclosure assembly.

Assembly	Options	RDH Recommendation
Exterior Walls	→ Exterior Walls Option 1, Maintain Cladding in Place: Exterior Vented Interior Insulation + Interior Air/Vapour Barrier → Exterior Walls Option 2, Remove and Reinstall All Cladding: Split Interior/Exterior Insulation + Exterior Air Barrier	→ Exterior Walls Option 1, Maintain Cladding in Place: Exterior Vented Interior Insulation + Interior Air/Vapour Barrier
Windows	→ Windows Option 1, Double sash: Heritage-replica wood window at exterior with a second high-performance interior window → Windows Option 2, High-Performance Window with Heritage Aesthetic: install a single new high-performance window	→ Windows Option 2, Double sash: Heritage-replica wood window at exterior with a second high-performance interior window
Roofs	→ Roof Option 1, Exterior Insulated Roof → Roof Option 2, Interior Insulated Roof → Roof Option 3, Cathedral Roof	→ Roof Option 1, Exterior Insulated Roof
At- and Below- Grade Walls	→ At- and Below- Grade Option 1, Exterior Insulated Below Grade Wall → At- and Below- Grade Option 2, Insulated Floor Assembly at Ground Floor	→ At- and Below- Grade Option 1, Exterior Insulated Below Grade Wall

2 Introduction

2.1 Terms of Reference

RDH Building Science Inc. (RDH) was retained by City of Dawson (The City) to undertake a building enclosure review of the Canadian Bank of Commerce National Historic Site, located at the corner of Front Street and Queen Street, Dawson City, YT.

This report has been undertaken for The City and is not to be relied on by others.

2.2 Scope of Services

The scope of services for this review were defined in our proposal, dated September 4, 2020, and are summarized as follows:

1) Reviewed documents made available to us by the City; see Section 3.2 for the list of documents.

2) Hosted an online “roundtable” meeting with key project stakeholders: City staff, Colliers, RDH, and Keay Architects on November 18, 2020. We discussed the city’s drivers and objectives for the project, design challenges, construction challenges, etc. Discussion and outcomes from this session helped inform our work.

3) Field investigation services: RDH conducted one (1) work day of on-site field investigation services which included:

   a) A visual review of the interior of the building in spaces that are safely accessible from interior stairs or use of a ladder.
   b) A visual review of the exterior of the building from the ground and ladders.

2.3 Organization of Report

Background information relevant to the initiation, scope, and structure of the review and this report is discussed in section 2 of this report.

Section 3 provides a description of the building and history relevant to the performance of the building enclosure and summary of the document review.

Section 4 of this report summarizes our field investigation. A description of the building enclosure assemblies and a discussion of our on-site observations

Section 5 of this report describes potential Enclosure Options – We provide a discussion of the proposed building enclosure assemblies including heritage conservation considerations and constructability considerations.

Section 6 provides a high-level summary of the field investigation and analysis of the proposed building enclosure assemblies that we evaluated, based on the design options discussed in Section 5. We also include a discussion of the next steps required to implement the proposed building enclosure renewal program.

2.4 Limitations

This report documents the current condition of the building enclosure elements. It may also provide information related to the specific sources of moisture or other physical factors which have resulted in the observed conditions. This report is not intended to provide our opinions regarding the actions or services provided by individuals or organizations that may have contributed to, or caused, the observed conditions.

This report, and the scope of services provided by RDH, does not address mechanical ventilation systems, indoor air quality, mould, or the potential health concerns related to the presence of mould.

Our assessment has been based on a review of a representative sample of the building enclosure. Observations regarding specific maintenance items may be made if they relate to a proposed rehabilitation or renewals recommendation; however, this report does not constitute an overall maintenance and renewals plan.

3 Background

3.1 Description of Building

The Canadian Bank of Commerce NHS is a two-storey wood framed building constructed above a below-grade wood framed basement on concrete foundation. The building has undergone a number of renovations since original construction, including raising the building and installing a basement below the main floors. The building has recently undergone a series of structural stabilization repairs. The building is currently unoccupied.

Original construction was completed in 1901. All exterior cladding and decorative elements (including pediments, window trim and stools, entablature, columns and capitals, quoins and corbels) on the building are stamped tin. The pastiche neo-classical style of the stamped tin is typical for the era.

Figure 3.1

Aerial view of Canadian Bank of Commerce NHS.

Site is shaded red.

(Imagery: © Google 2020)

A description of the building is provided in Table 3.1. Photographs of the principal elevations of the building are provided in Figure 3.2 to Figure 3.5.

TABLE 3.1 DESCRIPTION OF BUILDING

Name	Canadian Bank of Commerce National Historic Site
Address	1025 Front St, Dawson City, YT
Approximate year of construction	1901
Number of floor levels	2
Building code classification	Part 3
Building enclosure requirements	Part 5 (assumed)
Type of construction	Combustible
Sprinklered	No
Principal occupancy	Currently unoccupied; commercial use is being contemplated after renovation
Structural system	Balloon framed light wood structure with below-grade wood framed walls bearing on a concrete curb. Slab-on-grade in basement.

Figure 3.2

South Elevation.

Figure 3.3

West Elevation.

Figure 3.4

North Elevation.

Figure 3.5

East Elevation.

3.2 Document Review

The documents listed in Table 3.2 were provided to RDH and relevant portions were reviewed.

TABLE 3.2 DOCUMENTS PROVIDED

DOCUMENT	PREPARED BY	DATE	PAGES
Dawson City Heritage Management Plan	Commonwealth Historic Resource Management Limited	March 2008	144 pages
Condition Survey and Stabilization Plan	Keay & Associates, Architecture Ltd.	March 2013	136 pages (report, drawings and statement of significance)
Bank of Commerce National Historic Site – Rehabilitation for Community Economic Development Concept Discussion Paper	Regional Economic Development Advisory Board	January 2017	11 pages
City of Dawson Canadian Bank of Commerce NHS Five Year Plan	City of Dawson	February 20, 2019	9 pages
Canadian Bank of Commerce NHS: Hip Roof Cladding Stabilization Terms of Reference and Addendum 01	City of Dawson	April 16, 2019	12 pages
Canadian Bank of Commerce NHS: Wall Cladding Restoration Contemplated Change Orders 2-4	City of Dawson	July 2019 to September 2019	8 pages
Ultimate Construction Metal Cladding Shop Drawings	Ultimate Construction	March 10, 2020	10 pages

The key findings from the document review are listed below:

→ The building is currently vacant, there are no major interior finishes or systems currently installed. The City has not yet confirmed the future use or tenant for the building.

- → The City of Dawson has completed a series of targeted building enclosure repairs, primarily on the roof and some cladding areas, to stop bulk water leakage into the structure and subsequent deterioration.
- → The City reports that there is likely asbestos in the building paper behind the existing metal cladding.
- → Ultimate Construction (based out of Barrie, Ontario) was awarded a contract for exterior sheet metal cladding repairs. This work has been on hold from 2019 and has been further delayed due to COVID-19. Ultimate Construction went into receivership in Fall 2020.

3.1 History

A brief history of activities and events relating to the building enclosure assemblies as reported to us, or as described in the documents reviewed, is listed in Table 3.3.

TABLE 3.3 BUILDING ACTIVITIES RELATED TO ENCLOSURE PERFORMANCE

DATE	DESCRIPTION
1901	Original construction of the building
2000s	Raising of building and installation of basement slab on grade.
2000s	Structural rehabilitation
2013	Building was purchased by the City of Dawson

- → Raising and basement: The building was raised in 2000 and a basement was installed beneath it. The basement is constructed of permanent wood foundation (PWF) framing materials and sits on a concrete footing. A poured concrete slab is installed to a height 2” above the top of the footings to provide lateral support to the basement wall framing. Metal ties provide lateral support to the top of the basement wall framing.
- → Structural rehabilitation: Niels Jacobsen, P.Eng., designed the structural rehabilitation for the building, which was completed around the same time as the basement. Generally, load paths were strengthened. Floor and roof structural framing were strengthened with metal gussets, metal saddles and metal rods. All deteriorated structural members were removed and replaced. All interior finishes and framing materials were removed. All insulation was removed. Floors joists were replaced where necessary and original floor decking was covered with ½” plywood.

4 Field Investigation Observations

To obtain additional information, verify findings from earlier investigations by others, and to assess the viability of repair or renewal strategies, RDH conducted a field investigation of the building enclosure on October 16, 2020. Our review included an interior and exterior review of the building, carried out from the ground and from boom lift.

4.1 Exterior Walls

Description

Conditions and performance of the wall assemblies at interfaces that occur between the walls and other major elements of the building enclosure are discussed in later sections of this report. This section therefore focuses on the wall assembly itself, as well as penetrations and other features within the wall areas.

Figure 4.1

Southwest corner of the building.

The typical existing wall assembly at the Canadian Bank of Commerce NHS consists of (Figure 4.2):

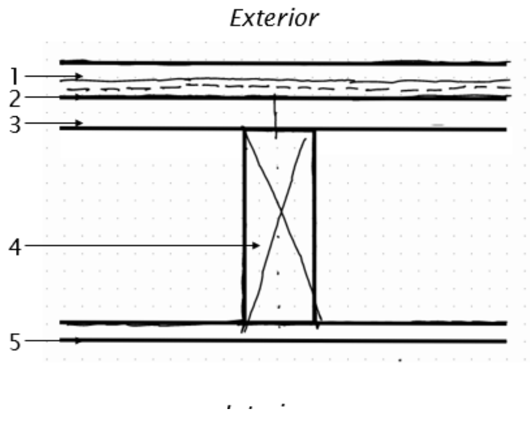


Figure 4.2

Exterior

1. Historic metal cladding
2. Building paper (asbestos containing)
3. 1x6 horizontal wood shiplap sheathing
4. 2x6 rough cut wood framing at 16" O.C.
5. 1/2" plywood (temporary)

Interior

Additionally, there are several architectural elements installed at the corners and field areas of the exterior walls, such as decorative columns, capitals, consoles, quoins, trims, entablatures, cornices.

Figure 4.3

Stamped metal architectural elements at the roof line of the building.

Figure 4.4

Stamped metal architectural elements between the first and second floors.

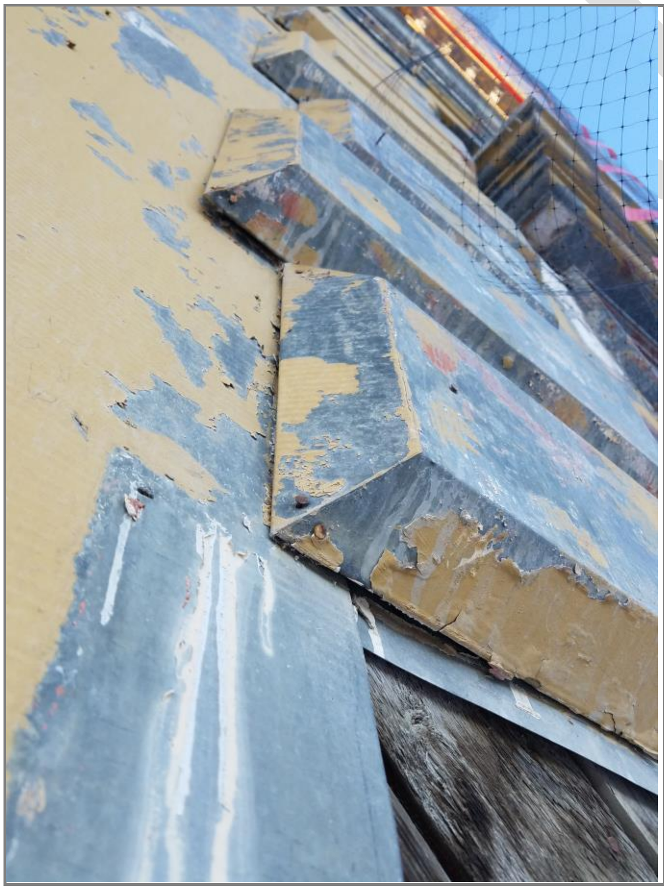


Figure 4.5

Quoin at field of wall.

Corner quoins are composed of two pieces of stamped metal with a joint at the corner. They are individually attached to the building. Corner quoins lap approximately 22" and 18" beyond the corner point onto the decorative façade and 8" on the non-decorative façade.

Window trims are entirely composed of stamped metal. There is no observable blocking in the trim voids.

Attachment of other architectural elements such as consoles, entablatures, cornices could not be confirmed at the time of the review.

Observations

The following was noted during our visual review:

General:

- All visible framing and sheathing materials were generally in sound condition at the time of our review (with exception to a small section of decayed sheathing). This area was intentionally retained during the earlier structural rehabilitation project due to the presence of asbestos in the building paper.
- Architectural features such as decorative columns, capitals, lower entablature and upper entablature corners were generally noted to be sound.
- The stud framing incorporates built-up stud packs that transmit load from the roof to foundation running behind the decorative columns.
- Window trims on all 1st floor windows are damaged/deformed in most locations. Seams generally have open gaps. Window trim is missing in various locations, primarily the non-decorative west façade (Figure 4.8).

East Elevation:

- First floor: Localized areas of deteriorated sheathing at the transition to exterior plywood at-grade (Figure 4.9).
- Second floor: There are a number of projecting architectural elements (consoles, quoins, window trim, entablature, cornice, etc.) where joints in the material are not installed tightly. There are no jointing compounds present and the installation appears to be a friction fit assembly.
- There is a significant number of missing quoins and consoles (Figure 4.13).

North Elevation:

- Cladding is missing from approximately 40% of the façade (Figure 4.10).
- There is evidence a staircase was installed to access `the second floor. Original corrugated metal cladding was removed to accommodate the staircase and appears to have never been replaced.
- Cladding overlaps but is generally not tight. Additionally, cladding attachment nails have loosed and/or are proud in a number of locations.

West Elevation:

- There is cladding missing from approximately 10% of the first floor façade.
- Southwest corner and northwest corner: There are scupper drains adjacent to decorative elements at the roof line (Figure 4.11). The scuppers project out from the façade approximately 14".

- → There are several projecting architectural elements (consoles, quoins, window trim, entablature, cornice, etc.) where joints in the material are not installed tightly. There are no jointing compounds present and the installation appears to be a friction fit assembly.

<u>South Elevation:</u>

- → There is a significant number of missing quoins and consoles (Figure 4.12).

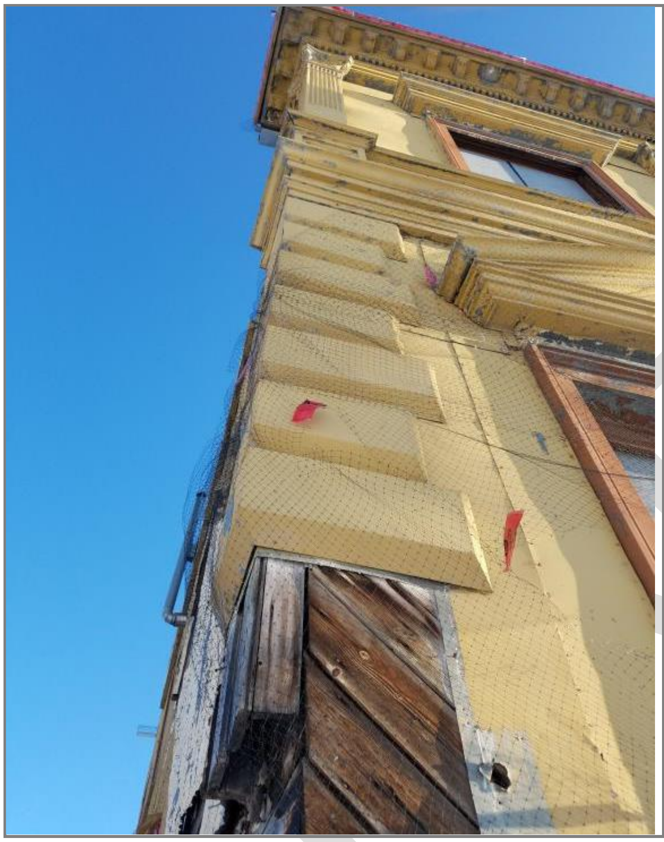


Figure 4.6

Southwest corner quoin genrally intact (where not missing).

Figure 4.7

Pressed metal elements at southeast corner were generally sound.

Figure 4.8

Typical window trim with open joints.

Figure 4.9

East elevation at grade transition to plywood sheathing.

Figure 4.10

Approximately 40% of the cladding is missing at the north elevation.

Figure 4.11

Southwest corner, roof: there is a scupper adjacent to decorative elements at the roof line of the building.

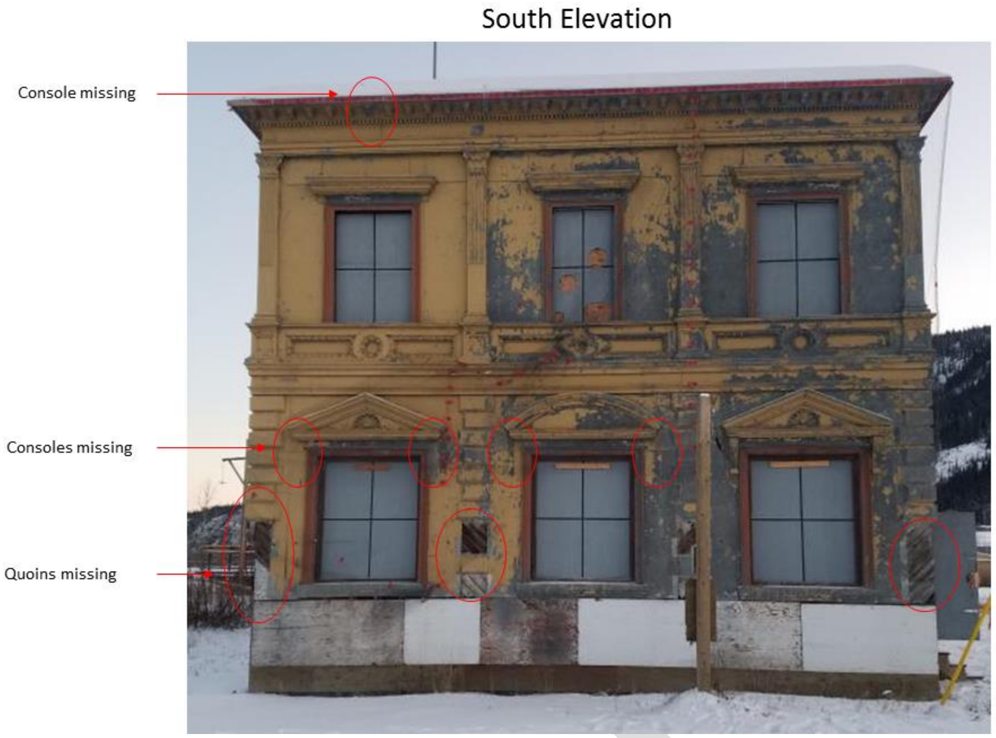


Figure 4.12 South elevation with damaged/missing cladding locations identified.

Figure 4.13 East elevation with damaged/missing cladding locations identified.

4.2 Windows and Doors

The windows and doors at Canadian Bank of Commerce NHS were traditionally wood framed. Unfortunately, the majority of the original wood framed windows have been lost since the original construction of the building.

Figure 4.14

Second floor windows with rough openings protected by plywood at the southeast corner of the building.

Figure 4.15

A collection of previously installed wood storm windows at the Canadian Bank of Commerce NHS.

Description

The original configuration of the wood framed windows and doors at the Canadian Bank of Commerce National Historic Site is generally evidenced through historic drawings available for the building. The original wood framed windows appear to have been one-over-one hung sash, with each sash having a vertical wood muntin to create a subdivided grid of glass within each sash.

The rough openings for the windows are currently protected with sheets of plywood.

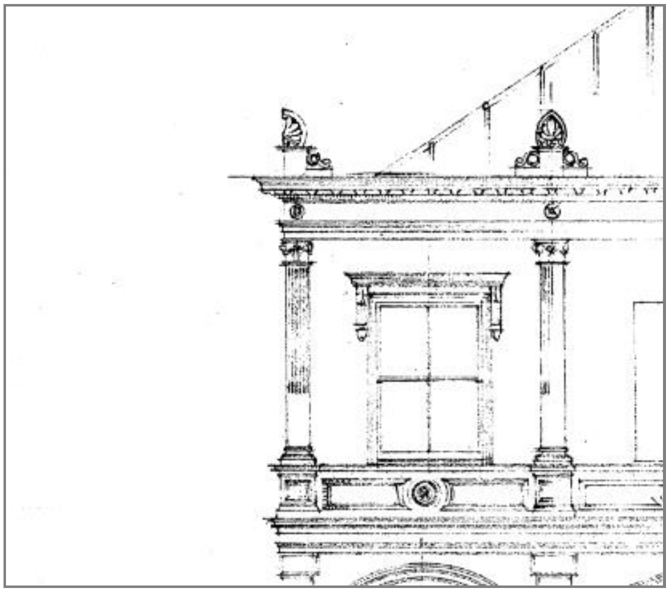


Figure 4.16

Partial view of an original elevation drawing for the Canadian Bank of Commerce NHS showing the original window design.

Figure 4.17

Window openings at the west elevation.

4.3 Roofs

The Canadian Bank of Commerce NHS has two types of roof assemblies: a sloped roof assembly and low-slope (flat) roof assembly. Access to the roof areas was limited at the time of the review due to snow.

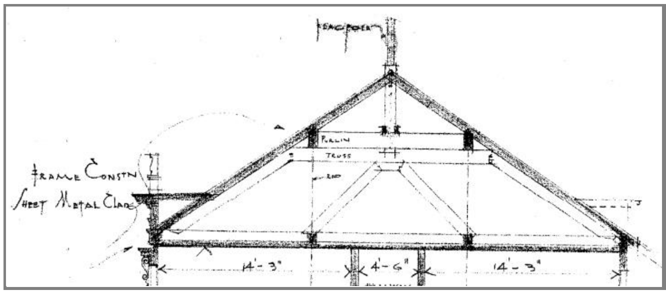


Figure 4.18

Section drawing at roof from original architectural drawings.

Figure 4.19

Metal roof assembly with gasketed roofing screws installed at seams.

Description

The sloped roof assembly is a peaked assembly formed by 4 hips. The flat roof assembly interfaces with the bottom perimeter of the sloped roof assembly and the exterior walls of the building. The sloped roof assembly sheds water onto the flat roof. The flat roof drains toward scuppers at the west elevation (Figure 4.20).

The sloped roof assembly is protected by the original standing seam metal roof assembly and consists of:

Exterior

- → Original standing seam metal roofing
- → Wood truss system
- → Ceiling joists

Interior

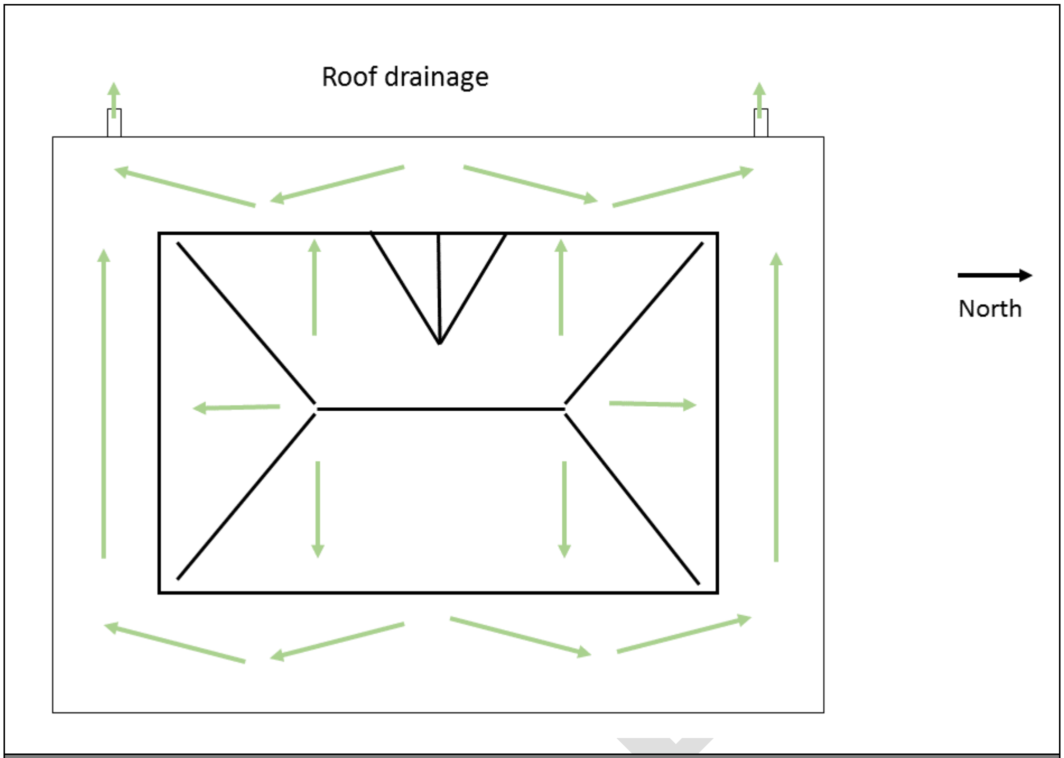


Figure 4.20 Roof plan diagram wih indication of roof drainage direction marked with green arrows.

The attic framing consists of full dimension 2x6 rough cut lumber. Large structural timbers 8"x10" heavy timber members create trusses that support the roof framing and the attic floor and 2nd floor. There was no insulation present in the attic at the time of the review. The attic has a dormer facing west to access the roof exterior.

The attic conforms to the interior of the sloped roof. The perimeter of the roof creates a 32" high cavity in the attic. The hipped portion of the roof extends from 32" at the perimeter to 12' at the apex. Structural truss elements are approximately 6' from the top of the attic floor framing.

Figure 4.21

Attic framing, looking south. Structural trusses form the structural elements of the sloped roof assembly.

Figure 4.22

There is evidence of moisture staining from roof leaks within the attic space/at the second floor ceiling.

4.4 At- and Below-Grade Assemblies

The term at-grade assembly refers to the interface between the base of the exterior walls and the adjacent landscaping. The term below-grade refers to the portions of the building that are constructed below-grade, such as the basement.

Description

The basement wall framing is 2x8 permanent wood foundation (PWF) with horizontal blocking and exterior 5/8” pressure treated (PT) plywood sheathing. The exterior sheathing was treated with a paint-on coating for moisture protection. The basement ceiling/first floor structure is formed by 12” deep wood I-joists spaced 16” O.C. Metal strapping provides lateral resistance at the top of the basement wall.

A concrete perimeter foundation wall supports the exterior walls of the building. A concrete foundation curb extends 2” above the perimeter of the slab-on-grade. The basement wall is fixed to the concrete perimeter with threaded rod connections and nuts.

Observations

During our field investigation we noted there was poor drainage and sloping at-grade and around the building perimeter

There is evidence of water damage and deterioration to one wood I-joist near the east elevation. Water appears to have entered the building prior to the stabilization repairs to stop bulk water leakage into the building. We understand that the structural engineer involved with the structural rehabilitation project recommended sistering in another wood I-joist rather than replacing it completely.

The basement experiences yearly flooding and a pump must be running everyday during the spring melt. It is common for standing water to be present in the basement in the spring/summer months. Connection rods and sill plates show signs of excessive moisture.

The basement ceiling height is 7’8”. The old bank vault is located in the northeast corner of the basement and projects up through the first floor an additional 3 feet. A polyethylene sheet covers the vault.

Figure 4.23

Basement looking northwest (vault visible left, sewer water hookup visible centre)

Figure 4.24

Basement framing (typ.) also showing water damage at sheathing north elevation

Figure 4.25

TJI showing deterioration at east elevation.

Figure 4.26

Second floor ceiling water damage/deterioration.

5 Enclosure Options

The proposed building enclosure renewal strategies are intended to repair existing conditions resulting from assemblies reaching the end of their service life, to mitigate future moisture ingress, and improve building enclosure performance.

The benefits and drawbacks of the design options for each assembly are considered against the following criteria:

→ Constructability and detailing;

→ Sensitivity to heritage fabric of the historic place; and

→ Building enclosure performance.

5.1 Exterior Walls

→ Exterior Walls Option 1, Maintain Cladding in Place: Vented Interior Insulation + Interior Air/Vapour Barrier

→ Exterior Walls Option 2, Remove and Reinstall All Cladding: Split Interior/Exterior Insulation + Exterior Air Barrier

Option 1 - Maintain Cladding in Place: *Vented Exterior Wall with Interior Air and Vapour Barrier*

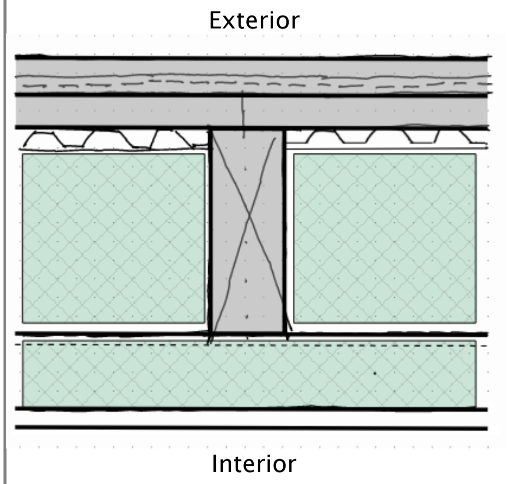


Figure 5.1

Exterior

- → Existing historic metal cladding
- → Existing building paper (suspected asbestos containing)
- → Existing 1x6 horizontal wood shiplap sheathing
- → Existing 2x5.5 rough cut wood framing at 16” O.C.
- → **New insulation baffle (ventilation layer)**
- → **New mineral fibre insulation within stud cavity**
- → **New interior 2x2 furring (not shown)**
- → **New polyethylene vapour and air barrier**
- → **New mineral fibre insulation within furring cavity**
- → **New interior finish**

Interior

Note: existing components to be retained are shaded grey

TABLE 5.1 VENTED EXTERIOR WALL WITH INTERIOR AVB

Benefits:	Drawbacks:
→ Relatively straightforward construction and interior detailing → Allows for installing interior services within 2x2 furring cavity, to avoid puncturing the polyethylene vapour and air barrier → Utilizes a preservation/stabilization approach for the historic façade; historic metal elements and existing building paper can typically remain in place → Improved air-tightness and good thermal performance, approximately R23 nominal exterior wall, effective R-value to be calculated and depends on furring space, insulation type and thickness	→ Placement of interior vapour barrier and additional insulation need to be modeled to confirm hygrothermal performance to assess the risk for condensation and seasonal moisture accumulation → Damaged/deteriorated exterior sheathing is not replaced, nor protected by a new weather-resistant barrier

<u>Option 2 - Remove and Reinstall All Cladding:</u> Split Insulation Exterior Wall with Exterior Air Barrier

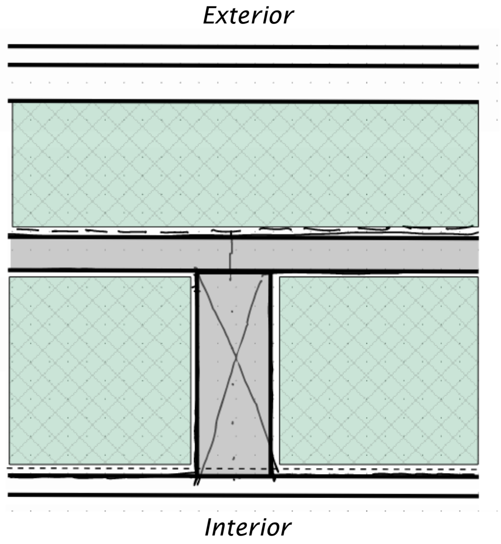


Figure 5.2

Exterior

- → *Reinstalled historic metal cladding and air space*
- → ***New mineral fibre exterior insulation***
- → ***New exterior air barrier and moisture barrier (vapour permeable)***
- → *Existing 1x6 horizontal wood shiplap sheathing*
- → *Existing 2x5.5 rough cut wood framing at 16" O.C.*
- → **New mineral fibre insulation within stud cavity**
- → **New polyethylene vapour barrier**
- → **New interior finish**

Interior

Note: existing components to be retained are shaded grey

TABLE 5.2 SPLIT INSULATION EXTERIOR WALL WITH EXTERIOR VAB	
<u>Benefits:</u>	<u>Drawbacks:</u>
→ Simplified interior finishing → Air barrier and moisture barrier are located on the plane of exterior sheathing, keeps exterior walls warm up to the plane of the sheathing → Improved air-tightness and excellent thermal performance with continuous insulation, capable of reaching R20 effective and above	→ Requires hazardous materials abatement (removal of asbestos containing building paper) to install exterior vapour and air barrier → Requires removal and reinstallation of historic metal cladding, and associated risk of damaging metal components → Increases overall thickness of exterior wall assemblies, requiring the installation of infill pieces of metal for architectural elements at the historic facade → Not so sensitive to the heritage fabric of the building

Exterior Wall Option 1 (*Maintain Cladding in Place: Vented Interior Insulation + Interior Air/Vapour Barrier*) balances the criteria of constructability, maintaining the heritage fabric, and improving building enclosure performance. However, the thermal and moisture balance of this wall would require further development during the design development stage. The placement of the air and vapour barrier and the balance of insulation are critical details in this wall assembly. The hygrothermal performance of this wall assembly would need to be verified through computer modeling to confirm the properties and placement of the vapour barrier and thermal insulation in the wall so that seasonal moisture accumulation does not occur. Additionally, the balance of the ventilation at the plane of the exterior sheathing would need to be confirmed.

There are also clear benefits with Exterior Wall Option 2 (*Remove and Reinstall All Cladding: Split Interior/Exterior Insulation + Exterior Air Barrier*), however the risk of damaging the historic metal cladding is quite high with this approach, and additional metal would be need to build out the added exterior wall depth, which is a highly visible intervention. As such, it is not as sensitive to the heritage fabric of the building.

An additional consideration with the exterior walls that should be taken into account is how to preserve the existing wood sheathing:

- With Exterior Wall Option 2, new preservative treated wood sheathing could be installed at the time of the wall renewal work.
- With Exterior Wall Option 1, there is limited access to the exterior sheathing to review for deterioration at the exterior side of the sheathing.

A stabilization approach can be utilized with the installation of wood preservative applied from the interior of the building; however, the installation of wood preservative from the interior side of the wall assembly will have varying impact on the exterior side of the sheathing. Additionally, without removal of the existing cladding and building paper to review areas of the sheathing at the exterior of the building, potential deterioration at the exterior side of the sheathing will not be visible for review or treatment. The wood preservative may improve the service life of the sheathing; however, this approach will not be as effective as a comprehensive review carried out from the exterior side of the sheathing. Additionally, the type of wood preservative utilized would need to be considered as part of the hygrothermal analysis of the exterior walls.

5.2 Windows

Since most of the original wood windows have been lost, new historically appropriate replacement windows will therefore be necessary as part of any construction work. Improving the window performance will greatly improve the thermal comfort within the space, regardless of the future occupancy of the building. Improvements to the windows will be the single best standalone improvement that can be made to the overall performance of the building enclosure.

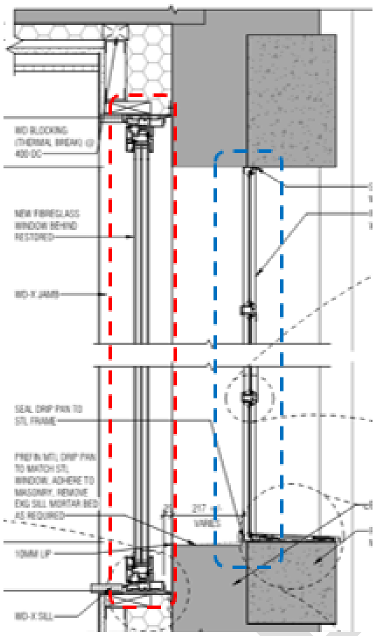
The historic architectural drawings and historic photographs provide sufficient physical evidence to construct replica windows.

Figure 5.3 Examples of evidence available to create replica windows for the Canadian Bank of Commerce NHS.

→ Windows Option 1, Double Sash: Heritage-replica wood window at exterior with a second high-performance interior window

→ Windows Option 2, High-Performance Window with Heritage Aesthetic: install a single new high-performance window

Option 1 - Double Sash

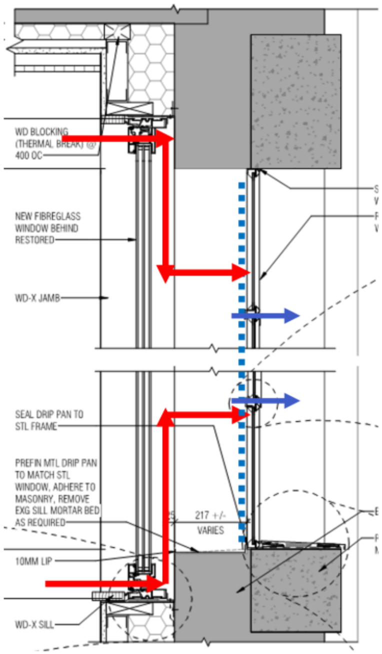


Interior
New high-performance window
- **Open-in for cleaning**
- **Air-sealed**
- **Set within new interior insulation**
- **Frames not visible from exterior**

Exterior
Original Wood Windows or New Replica Windows

The outer windows are mostly aesthetic, not providing much thermal or air control benefit

Figure 5.4 Example of an double sash approach witn an interior storm sash window (drawing underlay source: Diamond Schmitt Architects and NumberTen Architectural Group). Note, the interior window for the Canadian Bank of Commerce would be a high performance window.



CAUTION!

If **warm air leaks** through new interior window into the space between new+old windows – **condensation can occur in winter.**

Vent the space between new+old windows to help **clear condensation**

Figure 5.5 Careful consideration needs to be given to warm air leakage through the interior sash window into the interstitial space between the interior storm sash and exterior replica window (drawing underlay source: Diamond Schmitt Architects and NumberTen Architectural Group).

TABLE 5.3 DOUBLE SASH APPROACH

Benefits:	Drawbacks:
→ Wood window at the exterior is potentially a more sensitive approach to the heritage fabric of the original façade → Potentially higher performance solution	→ Careful detailing and venting of the air space between the outer sash and the interior higher performance window to prevent moisture accumulation. → Constrained detailing due to limited space within the existing window rough opening

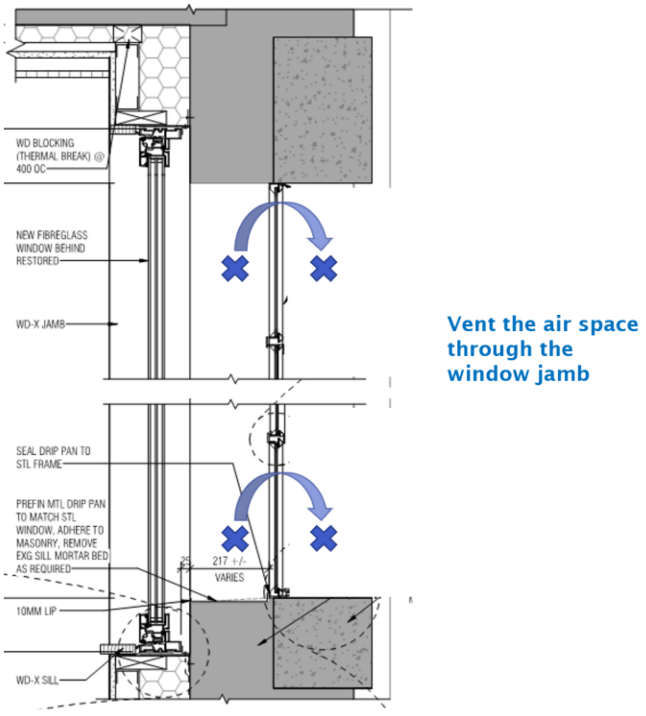


Figure 5.6 Venting within the interstitial space between the inenr sash and the exterior replica window is required (drawing underlay source: Diamond Schmitt Architects and NumberTen Architectural Group).

Option 2 - High-Performance Window with Heritage Aesthetic

The high-performance window with a heritage aesthetic is a viable option, given the evidence available to replicate the original windows. A customized muntin placement to match the historic condition can be achieved based on photographic evidence and original building drawings. Customized muntins can be installed within the IGUs, or as supplemental snap on pieces applied to the exterior side of the glass. Additionally, low-conductance window frames (such as a wood, fiberglass, high-performance aluminum or vinyl) can be used in combination with triple glazed insulating glazing units (IGUs) to improve the overall thermal performance of the assembly.

TABLE 5.4 HIGH-PERFORMANCE WINDOW WITH HERITAGE AESTHETIC	
Benefits:	Drawbacks:
→ Simplified detailing when compared to double sash approach → Less risk of condensation on the glass → One of the best single improvements to make to overall building enclosure performance	→ Potentially not as sensitive to the heritage fabric of the original façade

Figure 5.7

Example of a high-performance window with heritage aesthetic.

Window on left side of image is a high-performance aluminum-framed window with heritage aesthetic. Right side of image is an original historic window.

Example photo is 515 West Hastings Street, Vancouver (The Spencer Building).

The window detailing strategy needs to be considered in unison with the wall renewal strategy. The choice of the wall assembly will impact the window detailing to be used on this project. There is more control over the placement of the window within the rough opening when a single high-performance window is used.

Both window approaches will provide acceptable levels of thermal performance.

5.3 Roofs

- → <u>Roof Option 1</u>, Exterior Insulated Roof
- → <u>Roof Option 2</u>, Interior Insulated Roof
- → <u>Roof Option 3,</u> Cathedral Roof

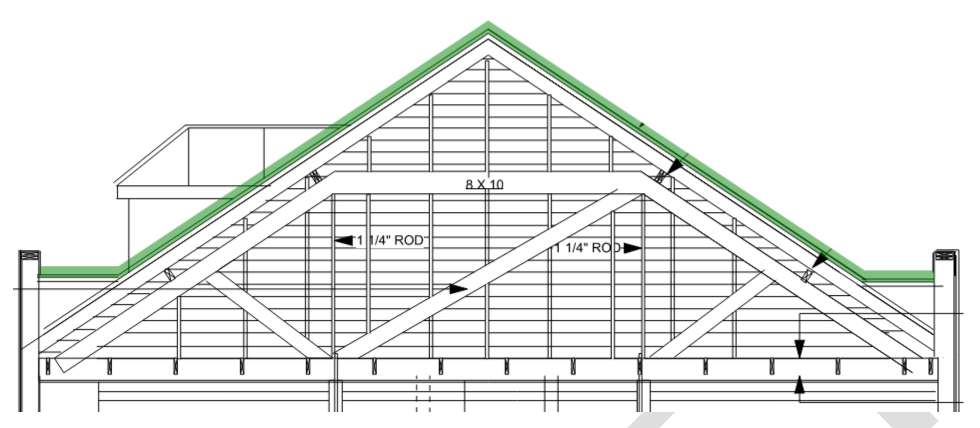


Figure 5.8 Example of an exterior insulated roof approach, with the plane of the insulation shaded green on a partial section drawnig of the roof (drawing underlay source: Keay Architecture Ltd.).

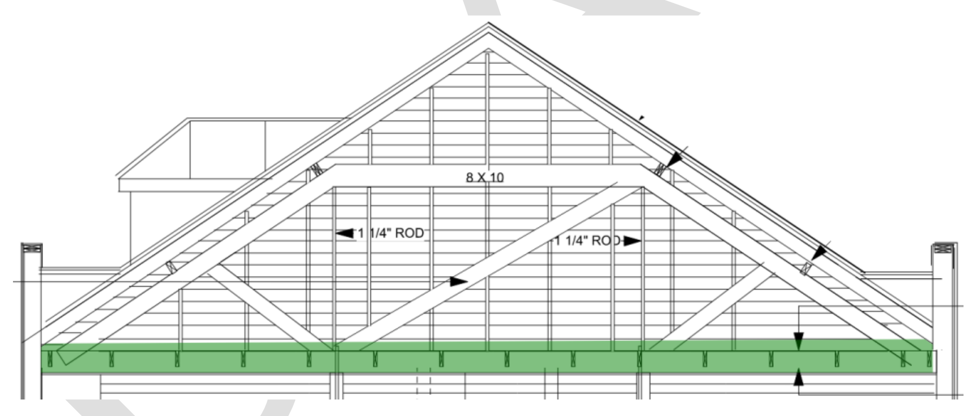


Figure 5.9 Example of an interior insulated roof approach, with the plane of the insulation shaded green on a partial section drawnig of the roof (drawing underlay source: Keay Architecture Ltd.).

Option 1 - Exterior Insulated Roof

An exterior insulated roof approach would involve the installation of a new standing seam metal roof assembly with exterior insulation, and a new conventional flat roof assembly at the perimeter. The vapour, air and moisture barriers would all generally be installed over the roof sheathing.

TABLE 5.5 EXTERIOR INSULATED ROOF

Benefits:	Drawbacks:
→ Creates a potentially useable attic space (e.g. for storage) → Removing existing roof allows for repair of deteriorated roof sheathing boards → High performance roof assembly from the standpoint of thermal performance, control of air leakage, and reduced condensation risk	→ Requires full renewal existing roof assemblies (i.e. remove and dispose of existing metal roof)

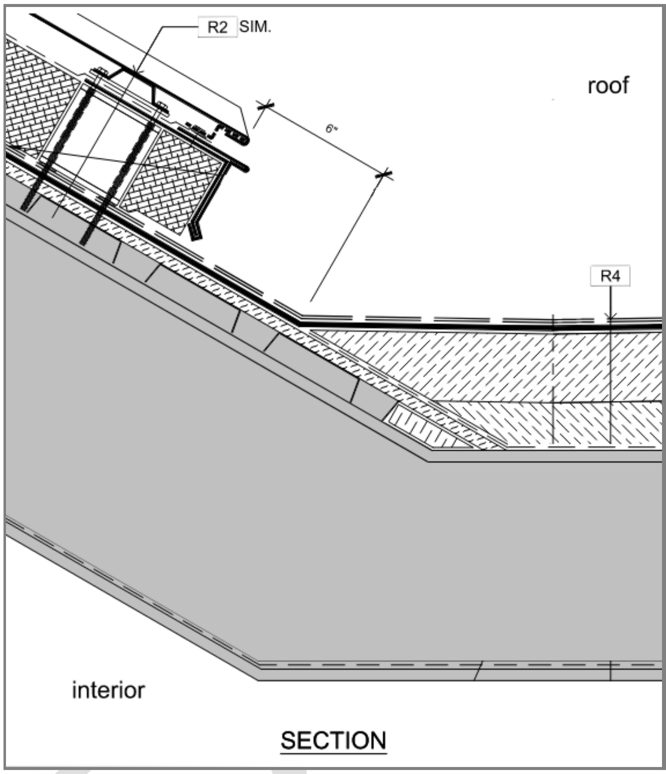


Figure 5.10

Example of an exterior insulated standing seam metal roof interface with a conventional low-slope roof assembly.

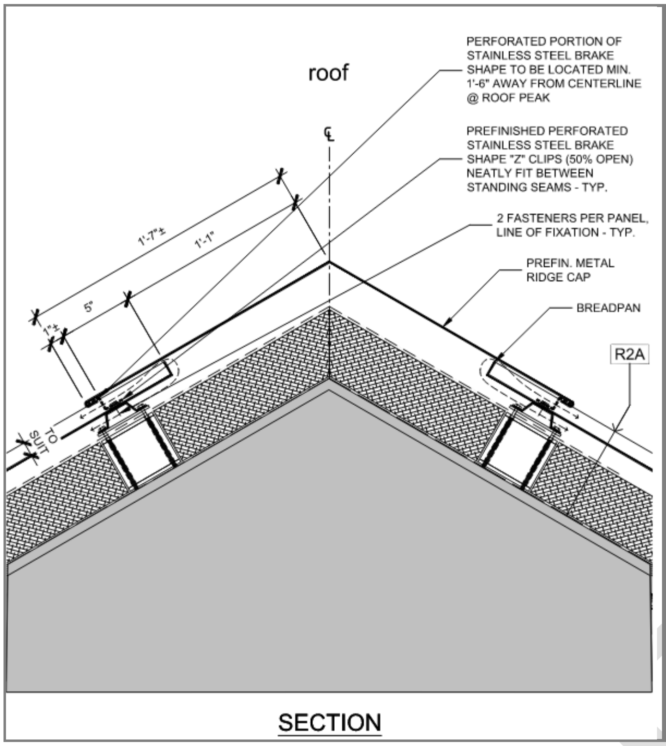


Figure 5.11

Example of an exterior insulated standing seam metal roof peak detail. This system would incorporate venting of the metal roof assembly. A similar approach would be necessary for a vented attic with retained metal roofing.

Option 2 - Interior Insulated Roof

An interior insulated roof assembly would allow for the existing original metal roof assembly to be retained. Insulation would be installed within the attic space, between ceiling joists. Fibreglass batt insulation or a blown-in cellulose type insulation would be installed within the attic space. The air and vapour barrier approach for this assembly would be at the plane of the 2nd floor ceiling and would need to be carefully considered with the selected wall assembly to ensure continuity of the critical barriers.

TABLE 5.6 INTERIOR INSULATED ROOF

Benefits:	Drawbacks:
→ Less invasive approach compared to new exterior insulated roof	→ Usability of attic is limited → Difficult to repair existing damage to roof sheathing boards → Very high risk of condensation at the underside of the roof sheathing, even with ventilation best practices → Need to introduce space heating within attic to keep temperature above the dew point, or accept there will be condensation within the attic → Must introduce ventilation intake somewhere within the historic façade near the roof eave

Interior insulated vented attics are difficult to implement successfully in cold climates. With this particular roof assembly, control of moisture within the attic space is traditionally problematic. Even if this assembly is constructed to code standards and in accordance with roofing best practices, there is still a very high risk of condensation within the attic space. Condensation within the attic can be managed; however, with this approach there needs to be an acknowledgement that condensation within the attic will occur.

Option 3 - Cathedral Roof Assembly

A third approach to roofing is a cathedral roof assembly, where insulation is installed between the roof truss members/roof joists. There is a large temperature gradient across the assembly within a small depth, paired with thermal bridges at the wood framing members. Additionally, the temperature of the roof sheathing can decrease further than the air temperature due to the night-sky cooling effect.

While a cathedral roof assembly may initially appear to be a good balance between an exterior insulated and interior insulated roof assembly, there is a high risk of condensation within this assembly. Furthermore, condensation within this roof assembly will not be immediately visible, as it will likely be concealed between the insulation and the roof sheathing. Additionally, ventilation of this type of roof assembly is difficult to implement. RDH **does not** recommend proceeding with a cathedral roof assembly.

Figure 5.12 and Figure 5.13 illustrate examples of failed cathedral roof assemblies where condensation and subsequent mould growth on wood framing has occurred.

Figure 5.12

Example of a cathedral roof assembly with spray foam insulation installed between roof joists and sheathing.

There is visible moisture staining and mould within the assembly when the spray foam insulation was cut and removed.

***Note**: This photo is from another building and is **NOT** from the Canadian Bank of Commerce NHS.*

Figure 5.13

Example of a cathedral roof assembly with spray foam insulation installed between roof joists and sheathing.

There is visible moisture staining and mould within the assembly when the spray foam insulation was cut and removed.

***Note**: This photo is from another building and is **NOT** from the Canadian Bank of Commerce NHS.*

5.4 At- and Below-Grade Assemblies

During our field investigation we noted there was poor drainage and sloping at-grade and around the building perimeter. At a minimum, the adjacent landscape sloping is to be re-graded to slope away from the building to limit the exposure to wetting of at-grade and below-grade assemblies.

When considering the approach to renewal of the at- and below- grade assemblies, flooding in the basement needs to be considered. Flooding in the basement will impact the insulation strategy that is to be used for the building. If insulation is installed within the stud cavities at the basement, such as a batt insulation, flooding will damage the insulation. Fastening and finishing of interior surfaces should also be considered with flood repairs in mind. For instance, the City may wish to consider a cement board type finish at the interior with exposed fasteners at the lower portion of the below-grade wall at the interior to allow for temporary removal of finishes when drying of the interior is required.

Additionally, given the proximity of the building to the river, the installation of a waterproof membrane at the exterior side of the foundation walls should be considered. Given the PWF foundation, if the below grade assembly is to be insulated then exterior insulation should be considered.

The following options are presented for consideration for the renewal of at- and below-grade assemblies at the Canadian Bank of Commerce NHS:

- → At- and Below-Grade Option 1, Exterior Insulated Below-Grade Wall
- → At- and Below-Grade Option 2, Insulated Floor Assembly at Ground Floor

Option 1 – Exterior Insulated Below-Grade Wall

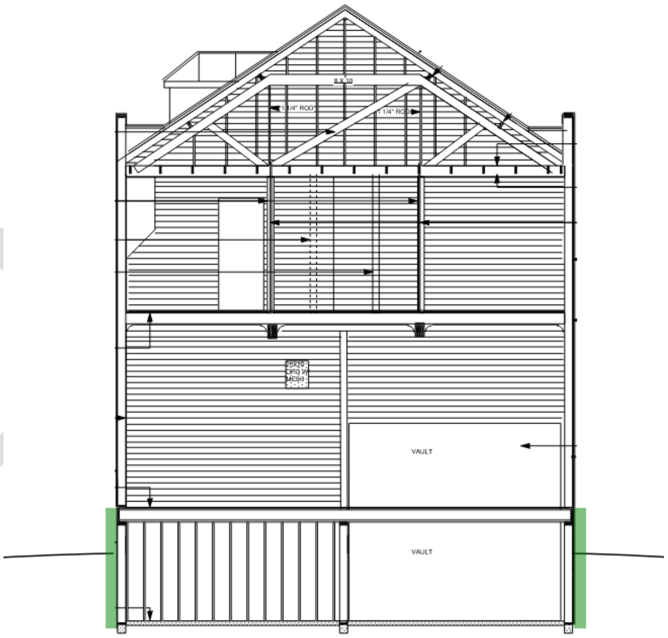


Figure 5.14 Exterior insulated below grade wall: insulation is installed at the plane of the exterior sheathing. Placement of the plane of the insulation is shaded green (drawing underlay source: Keay Architecture Ltd.).

TABLE 5.7 EXTERIOR INSULATED BELOW GRADE WALL

Benefits:	Drawbacks:
→ Creates a potentially useable basement space → Work overlaps well with waterproofing membrane installation at the exterior side of the below-grade walls → Enough visual evidence available from the original architectural drawings and photos of the building to produce a visually compatible metal cladding to protect exterior insulation	→ Currently unable to insulate under the slab-on-grade → Need to install a visually compatible material (metal cladding) to conceal exterior insulation near the at-grade interface

Option 2 – Insulated Ground Floor Assembly

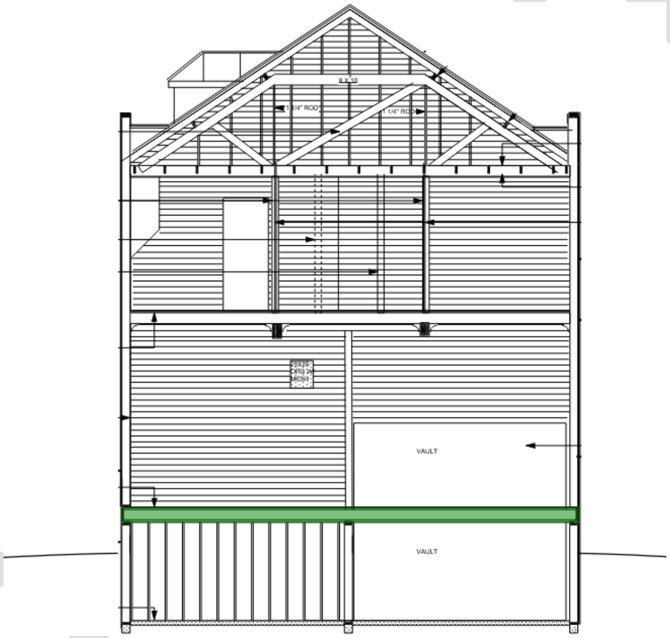


Figure 5.15 Insulated floor assembly at ground floor, insulation is installed between the floor joists and a ceiling finish at the basement. Below grade walls would remain uninsulated with this approach. Placement of the plane of the insulation is shaded green (drawing underlay source: Keay Architecture Ltd.).

TABLE 5.8 INSULATED FLOOR ASSEMBLY AT GROUND FLOOR

Benefits:	Drawbacks:
→ More opportunity to install insulation at ground floor plane	→ Vault at ground floor/basement interferes with insulation at floor structure → Limited usability of basement

Conversely, the benefit of installing insulation at the plane of the ground floor would offset the concern about not being able to insulate under the slab-on-grade. With this strategy however, the vault at the ground floor/basement level will interfere with the plane of new floor insulation. Furthermore, the vault would be a significant thermal bridge through this assembly. Additionally, providing insulation at the plane of the ground floor (instead of exterior insulating) would result in an unheated basement space with limited usability. If the basement is going to become a heated space, implications of frost heaving or soil adfreezing need to be investigated during design development.

6 Summary, Recommendations and Next Steps

6.1 Summary and Recommendations

Table 6.1 summarizes the design options from Section 5 of this report, along with our recommendations.

TABLE 6.1 SUMMARY OF DESIGN OPTIONS AND RECOMMENDATIONS

Assembly	Options	RDH Recommendation
Exterior Walls	→ Exterior Walls Option 1, Maintain Cladding in Place: Exterior Vented Interior Insulation + Interior Air/Vapour Barrier → Exterior Walls Option 2, Remove and Reinstall All Cladding: Split Interior/Exterior Insulation + Exterior Air Barrier	→ Exterior Walls Option 1, Maintain Cladding in Place: Exterior Vented Interior Insulation + Interior Air/Vapour Barrier
Windows	→ Windows Option 1, Double sash: Heritage-replica wood window at exterior with a second high-performance interior window → Windows Option 2, High-Performance Window with Heritage Aesthetic: install a single new high-performance window	→ Windows Option 2, Double sash: Heritage-replica wood window at exterior with a second high-performance interior window
Roofs	→ Roof Option 1, Exterior Insulated Roof → Roof Option 2, Interior Insulated Roof → Roof Option 3, Cathedral Roof	→ Roof Option 1, Exterior Insulated Roof
At- and Below- Grade Walls	→ At- and Below- Grade Option 1, Exterior Insulated Below Grade Wall → At- and Below- Grade Option 2, Insulated Floor Assembly at Ground Floor	→ At- and Below- Grade Option 1, Exterior Insulated Below Grade Wall

6.2 Next Steps

This building enclosure review report presents conceptual-level recommendations with respect to rehabilitation and renewal activities. It is important to understand that these recommendations do not provide a basis for implementing remedial work. Conceptual recommendations need to be developed, refined, and documented in detail, and cost estimates prepared, before the construction work can be tendered to contractors or a building permit obtained.

Given the issue with Ultimate Construction's receivership, we understand that the City is contemplating options for moving forward with the metal cladding work. We recommend that the City considers, and selects, the preferred building enclosure solutions so that any changes to the cladding project can be made to accommodate expected detailing for the walls, roofs, and windows. Even in the additional wall, window, and/or roof repairs are not conducted with the metal cladding repairs, there may be some elements of the metal cladding repairs that need to anticipate or accommodate future work, such as how the metal cladding will interface with below-grade waterproofing and insulation

The next step typically begins with the design development process where the consultant considers alternative ways of design considerations and assists you in making decisions with respect to specifics of the renewals program.

Additionally, during the design development phase, hygrothermal analysis needs to be carried out where discussed to confirm specifics of the proposed building enclosure assemblies. This is of particular importance with the proposed approach to exterior walls, where the balance of heat, air and moisture is critical to the long-term performance of the wall.

6.3 Closure

We trust this report meets The City's requirements at this time. Please do not hesitate to contact the undersigned to discuss this report, or if we can be of any further assistance. After we discuss any questions you may have, we will finalize the report to close-out our deliverable.

Yours truly,

Trevor Vilac | Intern Architect AIBC
Intern Architect (IA)
tvilac@rdh.com
T 604-873-1181
RDH Building Science Inc.

Reviewed by
Sarah Gray | MSc, P.Eng., CAHP
Principal, Senior Building Science Specialist
sgray@rdh.com
T 416-314-2328
RDH Building Science Inc.

Reviewed by
Graham Finch | Dipl.T, MASc, P.Eng
Principal, Senior Building Science Specialist
gfinch@rdh.com
T 250-479-1110
RDH Building Science Inc.

Report to Council

☒ For Council Decision ☐ For Council Direction ☐ For Council Information

☐ In Camera

AGENDA ITEM:	**Parks and Recreation Master Plan**	
PREPARED BY:	Cory Bellmore, CAO	**ATTACHMENTS:** **Parks and Recreation Master Plan**
DATE:	January 28, 2021	
RELEVANT BYLAWS / POLICY / LEGISLATION:		

RECOMMENDATION

That committee forward to council final approval the Parks and Recreation Master Plan

ISSUE / PURPOSE

Administration has been working towards finalizing the Parks and Recreation Master Plan titled “Play Dawson”. This plan will provide strategic direction for the delivery of parks and recreation programs and infrastructure.

BACKGOUND SUMMARY

Phase 1 of this plan began in 2019. This final plan was forwarded in fall 2020 for approval, council requested final edits. The following changes have been made to the plan:

Added: under 9.0 Goals, Programming Goal #9 Action 9.4

- *Endeavour to ensure available spaces meet demand*

Edited: under 9.0 Goals, Partnership & Community Development Goal #14 Action 14.3

- *Advocate for an increase to the Comprehensive Municipal Grant to reflect the City’s actual service population for recreation services (municipal and peripheral resident users)*

Added: under 9.0 Goals, Partnership & Community Development Goal #14 Action 14.4

- *Investigate additional opportunities to recuperate costs for recreational services related to peripheral users*

ANALYSIS / DISCUSSION

The Recreation department looks forward to using this plan to guide decisions and planning for programming and recreation and parks infrastructure in Dawson City.

APPROVAL			
NAME:	C Bellmore	**SIGNATURE:** CLBellmore	
DATE:	Jan 28, 2021		

playdawson

CITY OF DAWSON PARKS & RECREATION MASTER PLAN

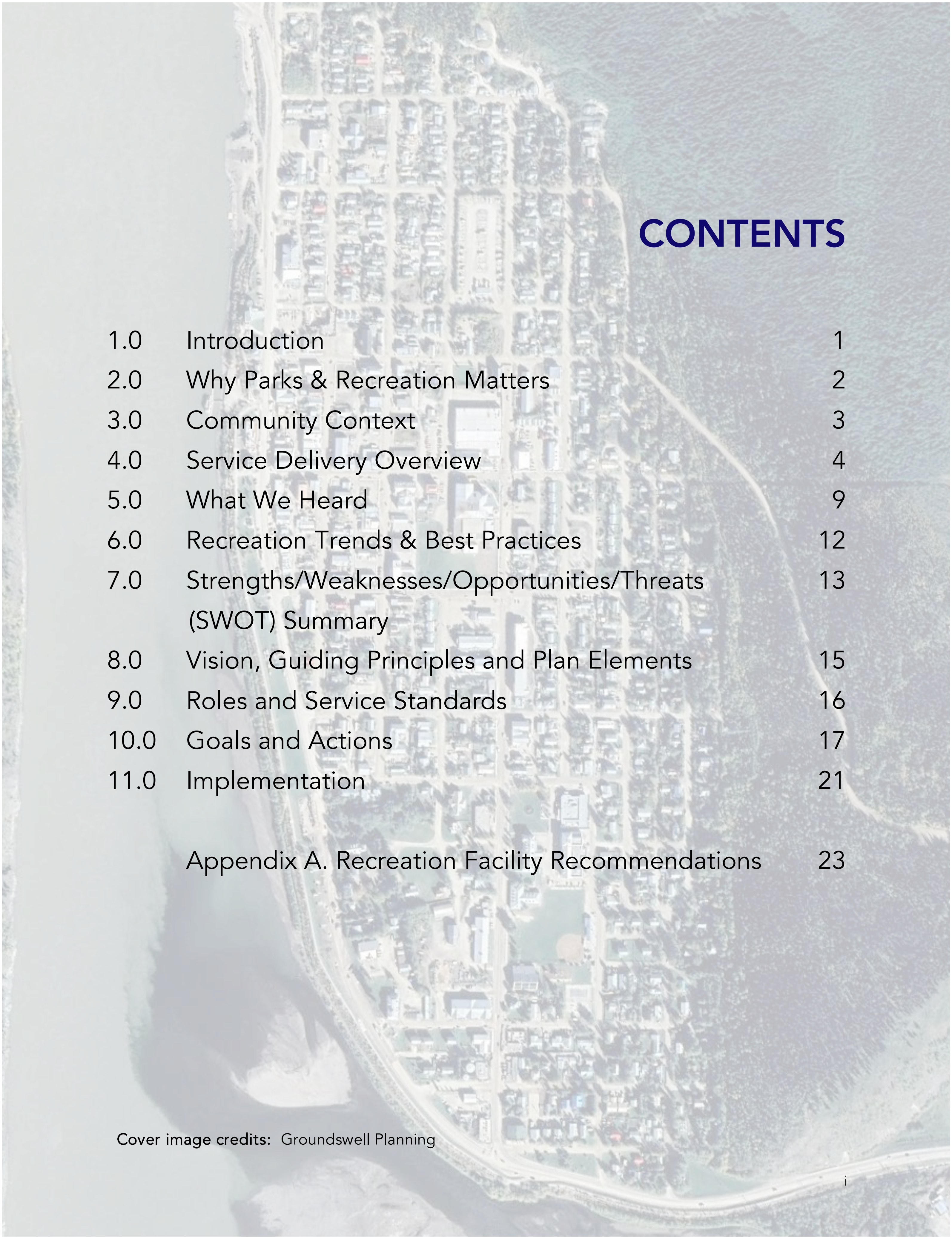





Groundswell
PLANNING

Across the River Consulting
Monarda Communications

JUNE 2020



CONTENTS

Cover image credits: Groundswell Planning

1.0 Introduction

A Parks and Recreation Master Plan (PRMP) sets the high-level, strategic direction for how a municipality delivers parks and recreation programs and infrastructure. The City of Dawson undertook an internal master planning exercise in 2007. The community has grown and changed considerably since that time, and the City determined that 2019 was the ideal time to re-examine and confirm its approach to parks and recreation in order to prepare for the next decade.

The PRMP creates a 10-year blueprint for the City of Dawson that:

- Sets out a **vision** and **guiding principles** for parks and recreation consistent with community needs and Council priorities;
- Establishes key **goals** and **objectives** for municipal recreation services, programs, facilities and events;
- Considers City capacity and budget implications; and,
- Sets out a course for **implementation** and **performance evaluation**.

The Plan was developed over a yearlong timeframe and was developed in partnership with the City by a team led by Groundswell Planning of Whitehorse. The team's planning process included compiling background research, engaging the community and stakeholders, working with staff and Council to chart direction and strategy, and drafting the plan document. The project was organized into three phases as follows:

Council adopted the final plan in July 2020.

Please note that the background and analysis sections of this document are a summary of the planning team's comprehensive report, entitled "State of Play", which is available from the City of Dawson.

2.0 Why Parks and Recreation Matters

Recreation is defined as "the experience that results from freely chosen participation in physical, social, intellectual, creative and spiritual pursuits that enhance individual and community well-being."[1] Governments have a long history of providing parks and recreation to citizens, stemming from a guiding philosophy that views recreation as a "public good" – available to all - akin to schools, roads, drinking water, and law enforcement. This ongoing public investment into recreation has tangible benefits both at an individual and societal level. The graphic below depicts a summary of recreation benefits as compiled by The National Benefits Hub[2].

BENEFITS OF PARKS & RECREATION

PERSONAL BENEFITS

- Extends life expectancy
- Prolongs independent living
- Reduces heart disease, stroke and obesity
- Combats and/or prevents osteoporosis, arthritis, cancer
- Contributes to mental health
- Promotes holistic development of children, youth, and adults
- Supports lifelong learning and academic success
- Builds self-esteem and positive self-image
- Enhances life satisfaction

SOCIAL BENEFITS

- Leisure activities and parks enhance perceived/actual quality of life and place/infrastructure
- Independent living for the disabled is nurtured
- Reduces self-destructive behaviour and crime
- Reduces isolation and loneliness
- Keeps families together
- Provides safe programs and children and youth
- Produces leaders
- Builds social skills
- Builds strong communities
- Builds pride and sense of place in community
- Help people understand cultural differences and different family forms

ECONOMIC BENEFITS

- Reduce illness and disability
- Reduce social service and health care costs
- Reduce crime and social dysfunction
- Improve work performance and productivity
- Attract business and residents to the community
- Generate or enhance tourism
- Generate employment
- Large returns on small investments
- Increase in property values
- Improve storm water retention
- Increase tax revenues

ENVIRONMENTAL BENEFITS

- Protect habitat and biodiversity
- Improve air quality
- Facilitate environmental and personal health education
- Mitigate against environmental disaster
- Reduction of fossil fuel usage through active transportation
- Encourage stewardship of the land
- Green spaces promote overall good health and quality of life
- Connects people to land-based spirituality

---

[1] Interprovincial Sports and Recreation Council and the Canadian Parks and Recreation Association, 2015. Framework for Recreation in Canada: Pathways to Wellbeing.

[2] National Benefits Hub. www.benefitshub.ca

2.0 Community Context

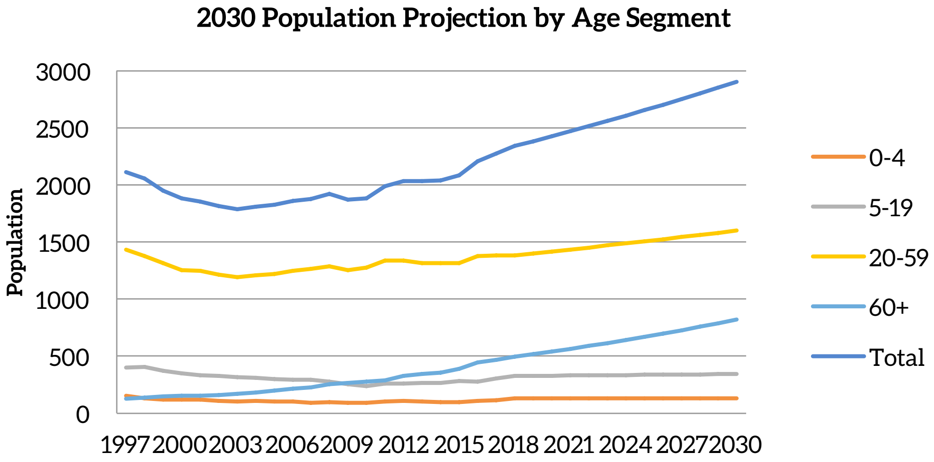
Dawson City is situated in the Traditional Territory of the Tr’ondëk Hwëch’in (TH), at the culturally, historically, and ecologically rich setting of the confluence of the Klondike and Yukon rivers in central Yukon. The main economic drivers of Dawson are public administration, mining (primarily placer) and tourism. The economy can be characterized as stable and resilient, with the greatest uncertainty currently being the unknown course and impacts (economic, population, and otherwise) of Goldcorp’s nearby Coffee Creek mine development.

The built heritage of the Klondike Gold Rush, and indeed the Gold Rush story itself, is a key pillar upon which Dawson City’s status as a premier Yukon destination is based. In recent years there have been a number of initiatives aimed at broadening Dawson City’s visitor offer for a shifting visitor demographic and interest (i.e. meetings and incentives, outdoor activities, winter tourism, etc.)

The City of Dawson municipality has a population 1,375-strong (Statistics Canada, 2017) and serves a population of 2,341 (Yukon Bureau of Statistics, September 2018) when peripheral rural subdivisions are included. Dawson is by far the fastest growing community in the Yukon, with its population projected to rise by 24% to 2,906 in 2030 and by 49% to 3,480 by 2040, a total further increase of 1,139 people (Yukon Bureau of Statistics, 2018).

According to census data, the municipality, compared to the Yukon as a whole, has a:

- smaller proportion of First Nation, female and immigrant residents;
- similar age profile;
- much lower average household size; and,
- much lower income and much higher cost of living.



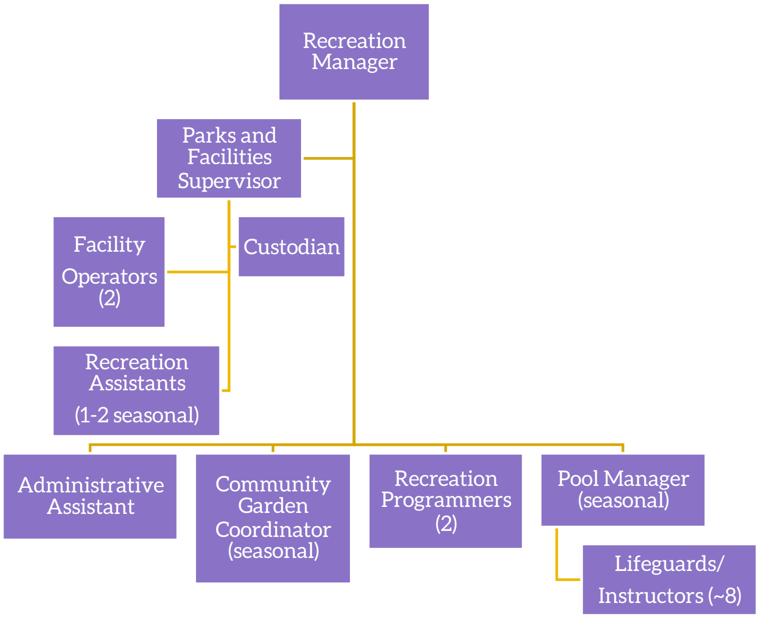
Dawson’s population is aging and, combined with broader societal shifts, growth is predicted to occur almost exclusively in 1-2-person adult households. The over-60 segment is projected to increase by 326 people, or 65%, by 2030 and account for 58% of growth over the next 12 years.

3.0 Service Delivery Overview

The City of Dawson's Recreation Department delivers a wide range of both direct and indirect parks and recreation services to community residents, as illustrated below. The department's name is somewhat misleading given its much broader responsibilities around parks, playgrounds, and open spaces.

Department Structure

The City's Recreation Department is overseen by a full-time manager and includes two programmers, an administrative assistant, and numerous facility staff. A six-member Recreation Board reviews recreation-related funding applications.



Policy Framework

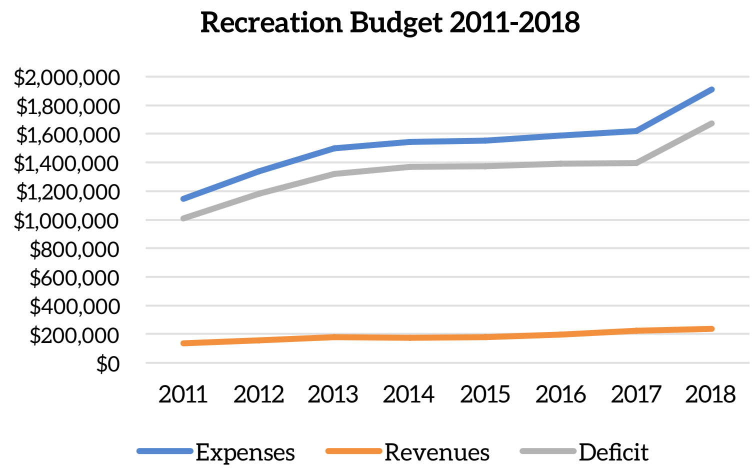
Numerous municipal and Recreation Department policies guide the delivery of recreation in Dawson, including:

- *Official Community Plan*
- *Community Grants Policy*
- *Fees and Charges Bylaw*
- *Fitness Centre Policy*
- *Property and Facility Rental Policy*
- *Recreation Grants Policy*
- *Recreation Board Policy*
- *Recreation Tiered Fee Structure Policy*

In addition to the City-level policies governing recreation delivery, the Recreation Department has developed and enacted a number of other policies and guidelines, including arena and pool rules, procedures for program delivery and tournaments, and a parent handbook for youth programs.

Financial Resources

The City has spent heavily on recreation in recent years, increasing its budget by 67% to $1.91 million in the 7 years to 2018, a compound annual rate of 8% that is far in excess of population growth.



Recreation consumes 23% of the total municipal budget. Despite a steady growth in user fee revenues, the recreation deficit has continued to rise, reaching a record $1.67 million in 2018. $35,000 is set aside annually in recreation reserve funds.

The cost recovery rate for Dawson recreation services is 12%, with only the Fitness Centre generating a surplus. The City's ability to offset recreation costs, even at the current level of service, is limited. For example, a hypothetical general tax rate rise of 1% over inflation and 5% user fee increase would represent a meagre 1.6% increase to the recreation budget. A substantial increase to levels of service could pose significant financial challenges to the City.

	Revenues	Expenses	2018 Cost Recovery
Dept Total	$238,000	$1,911,000	12%
AMFRC	$52,000	$621,000	8%
Pool	$32,000	$300,000	11%
Fitness Centre	$59,000	$54,000	109%
Programming	$60,000	$264,000	23%
Green spaces	$12,000	$292,000	4%

Facilities and Amenities

The City owns and maintains a variety of indoor and outdoor facilities. The two most significant indoor facility assets are the Art and Margaret Fry Recreation Centre (AMFRC) and Dawson City swimming pool, both of which were built about 20 years ago. Unstable subsurface conditions have plagued AMFRC since the beginning; the building has deemed seismically unsound and in 2017 Council voted unanimously to build a new centre (as opposed to spending an estimated $19.5 million on repairs). The City operates several smaller indoor facilities, including the new (as of 2018) Minto Park concession building and fitness centre, which received continuous upgrades between 2015 and 2018. The pool underwent substantial upgrades over the past four years to extend its operating life.

Indoor Facilities	Outdoor Facilities/Amenities	
Art and Margaret Fry Recreation Centre (arena, concession, office/ meeting room)	Ball diamonds (Minto Park* and Crocus Bluff)	Playgrounds (Minto Park*/community garden)
	Basketball court (shared with tennis)	Skateboard/scooter park
Fitness centre	Community garden	Soccer field (Crocus Bluff)
Minto Park concession building*	Parks - waterfront* (inc. gazebo, picnic shelter), Crocus Bluff day use area*, Victory Gardens, etc.	Tennis court (shared with basketball)
Swimming pool		Trails (9th Avenue/Dyke/ Dome trails, etc.)

*Land leased from the Government of Yukon

The City also owns and maintains a range of outdoor amenities, including sport fields, a hard surfaced court, playgrounds, parks, and gardens. A 2017 trail management plan established a 35-kilometre municipal multi-use network concept and the City completed its third season of trail development and upgrades in 2019.

City Recreation Facilities and Amenities


Front Street public washrooms


North End playground


Art and Margaret Fry Rec Centre


Crocus Bluff soccer field


Crocus Bluff day use area viewing deck


Front Street/Dyke gazebo


Community garden


Victory Gardens


Arena


Minto Park playground


Fitness centre


Tennis/basketball court


Waterfront and fire pit


Minto Park ball diamond


Gazebo park


Moosehide Trail

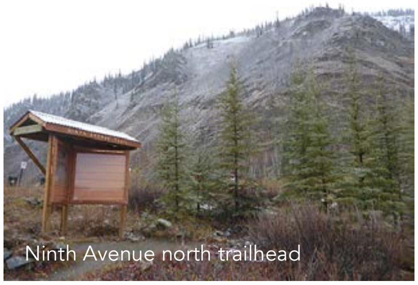

Front Street picnic shelter


Swimming pool


Crocus Bluff concession building


Skate park


Waterfront building (administration/Fitness Centre)


Ninth Avenue north trailhead


Minto Park concession building


Crocus Bluff ball field

Other Recreation Facilities & Amenities


Robert Service School playground


Moose Mountain alpine facility


Moose Mountain cross-country trails


Klondike Institute of Arts and Culture


TH Youth Centre

With the second storey of AMFRC never completed, the City has relied on other venues to accommodate programming. The most utilized spaces have been the school gym and ancillary room, the latter of which was lost for programming in Fall 2019 due to conversion to a classroom. Other spaces operated by various community organizations and utilized for recreation purposes include community halls, the Klondike Institute of Arts and Culture, and Tr'ondëk Hwëch'in Youth Centre. Community groups also operate cross-country ski trails, an alpine ski facility, golf course, and off-leash dog park (virtually all of which are leased from the City).

The City's larger-scale recreation investments typically rely on territorial and/or federal funding. In addition to annual capital plans, there is a 10-year Equipment Replacement Plan funded by the Recreation Reserve. The City is working to formalize its maintenance activities for parks and open spaces and integrate a new asset management system into its maintenance record keeping and capital planning activities. The City requires liability insurance for third party use of its facilities; this has been a challenge for private bookings in particular.

The arena is well utilized during winter evenings and weekends but highly underutilized during the weekdays; the pool, in contrast, experiences a steadier stream of traffic throughout its summer operating hours. Space at the school gymnasium and (prior to Fall 2019) ancillary room is oversubscribed, and some in the community feel that there is a lack of other "neutral" (i.e. lacking religious or other affiliation) recreation spaces in Dawson.

Programming and Events

The City offers a variety of programs for a broad demographic spectrum of Dawson residents. The City's recreation programmers "scan" the community for recreation-related expertise to develop programs around, try to avoid duplication with other organizations' efforts, and constantly monitor and adapt their efforts based on uptake and feedback. The City views its role as a "leader" for elementary age after-school and summer programming and a "gap filler" for age groups and demographics served by other organizations. The City has been recruiting more third-party instructors to provide specialized programming and expanding its seniors and "5 & under" offerings. Various other groups deliver sports, arts, cultural, and outdoor programs to community members. Dawson's event calendar is full, with the City organizing Canada Day festivities, Discovery Days parade, and Festival of Lights at Christmas, along with other smaller community events.

Community Support, Partnerships and Outreach

The City distributes about $62,000 in funding to individuals and recreation groups each year, with funding levels and project eligibility considered to be supportive. The process for accommodating informal requests for in-kind support from the City is not clearly established and people can get "bounced around" between departments. The golf course and Moose Mountain alpine ski area receive annual grants from the City, and City staff operates the latter facility during Spring Break. The City conducts outreach primarily via its website, quarterly newsletters, and Facebook page but notes some challenges in getting the word, and the *facts*, out reliably. User group meetings are held on an annual basis as well.

Departmental Capacity and Training

The City's Recreation Department staff generally feels that they work well as a team and have an "all hands in" approach. An overarching "can do" attitude extends to program and service delivery, City staff generally feels that they have sufficient capacity to continue delivering recreation programs at the current level of service. This structure lends itself to an ongoing reliance on the Manager position for decision-making. In addition, some routine administrative tasks such as third-party contracts, are still under the purview of the Manager.

4.0 What We Heard

Dawson residents actively participated in the development of the 2020 Parks and Recreation Master Plan via various input opportunities. Resident input was supplemented with surveys and one-on-one interviews with various community organizations to form a complete picture of how Dawson recreation in general, and the City's role specifically, are perceived.

Input Opportunity	Timeline	Participation
User Group Online Survey	March 2019	12 surveys
Household Survey		173 surveys
User Group Drop-in Session		1 group
Graffiti Walls		70-110 ppl
User Group Online Survey	Jan/Feb 2020	TBD
Household Survey		TBD

Household Survey Findings

Participation and Values

- The **majority** of the community's **"Top 10" activities** were **outdoors-based**, including (in order of popularity) hiking/walking, camping, picnicking/gathering, gardening, wildlife/nature appreciation, and cross-country skiing/snowshoeing.
- **Inconvenient times**, poor/inadequate **facilities**, **lack of time and/or awareness**, and **cost** of programs were cited as the **"Top 5" barriers** to participation in recreation (ordered from greatest to least).

- Respondents indicated that **recreation is important** to both their own **quality of life** and the **social and economic vitality** of the community as a whole.

Facility Utilization, Quantity and Quality

- **Parks, trails, and greenspaces** received the **broadest visitation** by households of survey respondents, with the Dyke/9th Avenue trails receiving the highest level of frequent use of all amenities.
- The **most broadly used indoor facilities** included the **Robert Service School, arena**, and **facilities** operated by local **non-profit groups**. Single-purpose or more specialized facilities were most likely to receive no use.
- Respondents conferred the **highest overall ratings to parks** and major **trails** (Dyke/9th Avenue).
- The **highest ratings for indoor facilities** were assigned to the **Minto Park concession** building, **Fitness Centre**, and facilities operated by other groups. The spaces that received the **lowest and most mixed ratings** were the **Recreation Centre's non-arena spaces**, **swimming pool**, and **arena**.

Financial Considerations & Investment Criteria

- While **most respondents preferred maintaining** the current **user fees**, **one-quarter supported** an **increase**.
- The **"Top 3" criteria** for prioritizing **new facilities** included **multiple uses/users**, **year-round function**, and responsiveness to **resident demands/requests**. **Economic sustainability** took a distant **4th place**.

Comments from the public

"The arena unfortunately needs to be addressed before it is condemned. In my mind this is the number one issue as it serves so many people during a critical time of year that people need to recreate along with creating a major social scene... Indoor gym space would be next on my list."

"We have a darned good recreation dept. We need a full-bore year-round recreation complex!"

"Year-round swimming pool please!"

"I think that the top priority for indoor spaces is multi-purpose gym space that can be used for soccer, fitness classes, yoga, basketball, etc. I think the top priority for outdoor space is continuing to increase the trail network for biking and hiking."

"Dawson needs is a space for parents to take their young kids that can't move in the snow in the depths of winter."

"We need to increase our activity level! This reduces health costs long term. Work with what we have and keep things modest. Affordability is important in the long run, which (I think) means focusing more on simple outdoor activities that would not cost much."

'I don't want to sound critical, as I know how hard working the Rec Dept is, but I think the staff has grown complacent and just keep repeating the same stuff. This happens to anyone in a job for a long time...send them out for some training, workshops and give them time to do research on new stuff happening in the rec world! There must be cool stuff being done elsewhere!"

"The town does a great job of programming. We're getting bigger, though. Might be time to get more staff and more programs."

"This town seems an ideal place to raise children - up to a certain age. After that, families often face making the decision about whether to leave town to see to older children's needs /well-being."

"Many people are not athletes or artists, so I think more passive forms of rec could be implemented (games nights, cards, chess or ???). There is a void."

"Year round (winter specifically) multi-use spaces are what I would emphasize are needed in Dawson."

"You folks are doing a great job. We enjoy great services for a town or size."

"I would say outside of recreation, but within the lens of access, is the ill-graded streets and boardwalks. The inaccess to those with mobility issues or small kids on foot, makes it difficult to get out and access what is already available and being done well."

"Rec dept budget and spending should be included in newsletters and program guides so tax payers can make informed decisions about the value of recreation in town."

"Overall, I think what the rec department offers is pretty impressive given the number of staff they have to run programs."

"0-5 programming is underrepresented big time. It's a very lonely existence during these years".

"Programming should occur on weekends so working parents can attend with their children".

"Sign up system needs to be more accessible...seems like the same families.. are able to access after school programming as a result of accessibility for sign up and limited space."

"Under 5 and over 60. Both of these groups are very neglected."

"Space and partnerships for early childhood care are very important if families are going to stay in Dawson. I am considering leaving because of care and extra-curricular opportunities for my child, and I have already seen a number of other families make that choice (or are making it.)"

Comments from user groups

"I have found the advertising and communication at times to be slower and more complicated than expected or needed."

"Rec programmers should be working evenings and weekends, not 9-5 weekdays."

"We partner on events all the time and the City's funding programs are easy to access and have a good range of eligible expenses."

"It's challenging to have liability insurance in order to use the City's facilities i.e. the waterfront."

"City requests volunteers to help offer certain programs but City provides no training or support e.g. baseball (kids). Need to host volunteer drives, provide training and structured programs for those activities not directed by a Sport Governing Body..."

"The City has been supportive of our efforts..."

"(City) needs to include user groups in discussions regarding facility usage upgrades/staffing before decisions are made. More effort needs to be made to keep facilities clean and operating efficiently."

Facility Priorities

- Virtually all respondents indicated a **need for new and/or enhanced facilities** within the next decade.
- The "Top 5" indoor facilities that should be more available or enhanced included the **swimming pool**, **ice arena**, **fitness/exercise spaces**, **pool amenities** (i.e. hot tub/sauna) and **indoor playground**. The accompanying "Top 5" outdoor space enhancements and/or additions were **natural surface trails**, **outdoor aquatics spaces**, **day use/gathering spaces**, **outdoor rinks**, and **event spaces**.

Programming

- The availability and quality of **recreation programs** in Dawson for **adults** was **rated most highly**, followed by elementary age **children's programming**. Options for **seniors** and **children 5 & under** were rated **lowest**.
- Respondents suggested a **greater variety of options**, more **frequent offerings**, and more **convenient hours** (i.e., to accommodate 9-to-5 workdays and flexibility for parents of young children) as improvements.

Roles of City vs. Others

- Most viewed recreation delivery as a **shared responsibility** between the **City and other groups**. A majority felt that the **City should lead on community events**, and that **other groups should lead in arts and culture**.

User Group Survey Findings

- Most respondent groups predicted **future growth in participation** for the program(s) they deliver.
- **One-quarter** of respondents indicated that their **needs were completely met** by **facilities** while almost **two-thirds** indicated **needs** being **somewhat met**. A strong **majority** felt that **new facilities** would be **needed** within the next decade.
- A **majority** reported being **"satisfied"** or **"very satisfied"** with their interactions with the City.

Interview Findings

- **Facilities** are considered the **primary barrier** to **quality recreation** in Dawson and there is a legacy of frustration and disappointment. The **potential loss** of an **indoor recreation space** for one or two winters is a **concern**. The **needs and expectations** for a new centre are varied.
- The City is making **valued contributions** to recreation and quality of life in Dawson.
- Some **partnerships and relationships** between the Department and other groups are highly **successful**, while others **need more attention**.
- **Pressures** on the Department **are high** and **expectations** can be **unrealistic**.
- The recreation calendar is **busier than ever**, and some non-profits a feeling **"stretched thin"**.
- The Department is perceived as being **isolated** and **unapproachable** by some, and **communication**s and internal/external **process needs improvement**.

External Interviewees

City of Dawson Recreation Board
Dänojà Zho Cultural Centre
Dawson City Chamber of Commerce
Dawson City Museum
Government of Yukon – Community Affairs Branch
Government of Yukon – Sport and Recreation Branch
Klondike Institute of Arts and Culture
Klondike Visitors Association
Little Blue Daycare
McDonald Lodge
Recreation and Parks Association of Yukon
Robert Service School (2 interviews)
Royal Canadian Legion
Tr'inke Zho Daycare
Tr'ondëk Hwëch'in Health and Social Services (2 interviews)
Tr'ondek Hwëch'in Youth Centre

5.0 Recreation Trends and Best Practices

Health, Fitness and Activity Trends

- Almost 1/3 of children and adults in Canada are obese.
- Only 35% of children and youth and 15% of adults meet recommended physical activity guidelines.
- Almost three-quarters of Canadian children and youth exceed recommended guidelines for screen time.
- Most Canadian youth and adults prefer spontaneous, unstructured recreation pursuits, with walking, bicycling, and swimming landing in the "Top 5" for both groups.
- Recreation participation varies by age, gender and socioeconomic status, with men and youth being more likely to play organized sports, women more likely to participate in exercise classes and wellness pursuits such as yoga, and higher income and education correlating strongly with higher participation.

Policy Guidance

Sport and recreation policy is evolving to reflect a growing recognition of the complex, interrelated societal and individual factors linked to participation. The 2015 Framework for Recreation in Canada is the current national guiding document for public recreation providers.

Five pillars of the Framework for Recreation in Canada

Recreation Delivery Trends

Social Determinants of Health – shifting the focus from "how do we get individuals to choose healthier lifestyles" to "how can we create the community environments that make the healthier choice the easier choice"

Physical Literacy and Lifelong Participation - physical literacy is the motivation, confidence, and skills to engage in physical activity and is seen as a pre-condition for lifelong participation; early childhood is the focus

Places and Spaces – evolution of the parks and green space movement to place-making that supports social connections and cohesion with support amenities like Wi-Fi, seating, all ages and abilities design, art, etc.

Multi-Use Functionality and Clustering – continuation of multi-use emphasis for facility investments, accompanied by clustering with complementary services such as community libraries

Revenue Generation – municipal response to fiscal and service delivery pressures through non-traditional revenue streams such as adopt-a-park programs, facility sponsorships, planned giving programs, etc.

Active Transportation - encouraging human-powered travel modes through infrastructure and good design

Changing Volunteerism – overall national decline in volunteerism and shift to shorter commitments that provide participants with work and/or other valued experience

Return to Outdoor, "Adventurous" Play – giving children and youth spaces to explore, play and push limits

Integration of Wellness and Community Development – evolution of the recreation field to include broader wellness and community development aims such as reducing barriers, healthy eating/nutrition, mental and physical health, social inclusion, etc.

6.0 Strengths/Weaknesses/Opportunities/Threats (SWOT) Summary

GOVERNANCE	
STRENGTHS (Internal/City)	WEAKNESSES (Internal/City)
• Current and past Councils strongly support recreation and are willing to make significant investments • Policy and procedures support decision-making • Creation of new Supervisor position better distributes responsibilities across the department • Recreation Board helps administer funding applications	• Department and staff titles are a mismatch with services • Routine administrative tasks reside with the Manager due to organizational structure, office space and task allocation • Collective agreement of department employees disallows last-minute rescheduling required to help groups at times • The mandate for the Recreation Board is vague
OPPORTUNITIES (External)	THREATS (External)
• Projected population growth will increase revenues and distribute fixed costs across larger population base • Policy and governance advice and support is available • External project-based funding may allow for short-term project management assistance • Residents highly value recreation and potentially support tax/fee increases	• Revenue generating potential of recreation is limited with a small population and desire for access and affordability • Seasonal worker population and non-City tax paying residents create pressure with low cost recovery potential • Low incomes and high living costs limit disposable spending on recreation; particularly for seniors • New policy development and adaptation
FACILITIES	
STRENGTHS (Internal/City)	WEAKNESSES (Internal/City)
• Impressive mix/variety of outdoor and indoor amenities • Parks, trails and outdoor spaces are well rated and used • Facilities are in generally good condition • Access to capital funding is good • Asset management (AM) system is being implemented and will facilitate better decision-making over time • Staff generally have capacity/skills to maintain assets • Fees and charges are low • Trail investments and planning aligns with resident priorities for parks and open space amenities • Few facility allocation conflicts, even with limited spaces • Facilities are scheduled with a mix of programmed and spontaneous, drop-in opportunities	• Rec Centre has structural issues and an unknown lifespan • Multi-purpose spaces are in very limited supply • Options for wintertime indoor recreation limited • Residents desire a year-round or new pool despite significant recent investments and high operating costs • Maintenance roles need formalizing and internal agreement among City staff • Issues with existing facilities limit functionality and use • Parks offer is mostly passive (gardens, landscaping, seating) • High costs of construction, operations and maintenance • Front-end effort to integrate AM could be considerable • The arena is heavily underutilized during daytime hours
OPPORTUNITIES (External)	THREATS (External)
• Government of Yukon is committed to helping fund a new recreation centre that can address not only priority gaps in the facility offer but compensate for likelihood that a year-round pool is not financially feasible • Dawson resident criteria for facility investment and top facility priorities align with best practices and likely funding reality (with exception of new pool) • Non-profit groups manage and maintain quality facilities that the City does not have to • TH plans to develop a new Youth Centre • National, territorial and local data points to a strong preference for participation in unstructured activities that require open spaces with lower operating costs as compared to indoor facilities (i.e., arenas and pools)	• Government expectations around recreation centre and appropriate funding levels may not satisfy all needs/expectations of public and key stakeholders • Land use constraints/topography pose limitations to continued open space development/protection • The potential amenities included in a new recreation centre will be highly site-dependent; trade-offs between location and features should be anticipated • Dawson's built environment poses many physical barriers for an aging population • Climate change policies such as carbon pricing could raise operating costs of large indoor facilities considerably • Dawson residents have high skepticism and negativity around facilities; pressure to "get it right" is equally high

PROGRAMMING

STRENGTHS (Internal/City)	WEAKNESSES (Internal/City)
• City offers a range of programs for all ages and interests • City has experienced, capable programmers • Children's programs are highly rated and utilized • City delivers major family-oriented community events • Third party instructors have improved options available • City programs are very affordable • Quarterly newsletters showcase City offerings as well as other recreation opportunities (i.e., drop-in leagues, etc.) • City adapts to constantly changing circumstances • Inter-agency coordination has been initiated	• Programs for seniors and 5 & under less available • City capacity to deliver programming is limited • Lack of facility space is a key constraint and City sometimes has to "bump" other groups to run its own programs • Programs can be vulnerable to low numbers of participants, conflicting scheduling, availability of instructors, etc. • Specialized programming challenging to sustain due to dependence on instructors in a transient community • Residents cite inconvenient scheduling as a constraint • City's registration system and communications approach may pose barriers to participation/awareness
OPPORTUNITIES (External)	THREATS (External)
• Growing and more diverse population creates new programming opportunities and new instructors • Other groups provide quality programs in arts and culture and residents feel these groups should lead • There are a wide variety of partners for the City • Participation, lifestyle and population trends point to an increased need for wellness, active living facilitation • Dawson has a full events calendar • A new recreation centre could "spark" new programs • More distance, online training available	• Many Dawson events have an adult, alcoholic element; not as many family events • Non-profits are feeling "stretched thin" with events in Dawson and an aging population could exacerbate issue • Growing cohort of seniors will create new needs • Time constraints, excessive screen time, and low rates of physical activity are known barriers to participation • It can be difficult for Dawson residents to stay informed of opportunities, with communications stratified and no one shared repository for recreation news

PARTNERSHIPS & COMMUNITY DEVELOPMENT

STRENGTHS (Internal/City)	WEAKNESSES (Internal/City)
• Funding is readily available to community groups and individuals, usually within a very short time frame • Direct funding is in place for certain partners • Some partnerships are highly successful and the City has productive, positive working relationships • City has some effective communications channels • There is a mechanism for third party usage of City facilities and rentals are affordable	• Communications capacity and effectiveness is limited • The City does not have a streamlined, effective way of assisting individuals and groups seeking support • Some partnerships and funding relationships are not clearly rationalized/articulated; there may be inconsistent approaches towards major partners • Third party liability issues, such as private rentals, need further clarity and policy work
OPPORTUNITIES (External)	THREATS (External)
• Dawson is an active, engaged community with a strong volunteer ethic • The relatively small number of external groups and partners makes communications easier • A high proportion of Dawson children are in City camps; opportunity to reach families through them • There are numerous successful partnerships to build on • Major partners continue to provide services in Dawson and the City can evolve these relationships • City recreation facilities are well visited and a great venue to share information and seek input	• Some partnerships need renewed attention; feeling that the City does not value major partners equally • There are some perceptions that the department is isolated from the community and not receptive to residents' ideas • Dawson residents can have unrealistic expectations of service delivery and lack awareness of costs/capacity issues • Non-profits are feeling "stretched thin" with events in Dawson and aging population could worsen situation • City policy and organizational framework may not always "mesh" with a non-bureaucratic community culture

7.0 Vision, Guiding Principles, and Plan Elements

VISION 2030

"Dawson City is home to recreation spaces and opportunities as vibrant and diverse as its people."

GUIDING PRINCIPLES

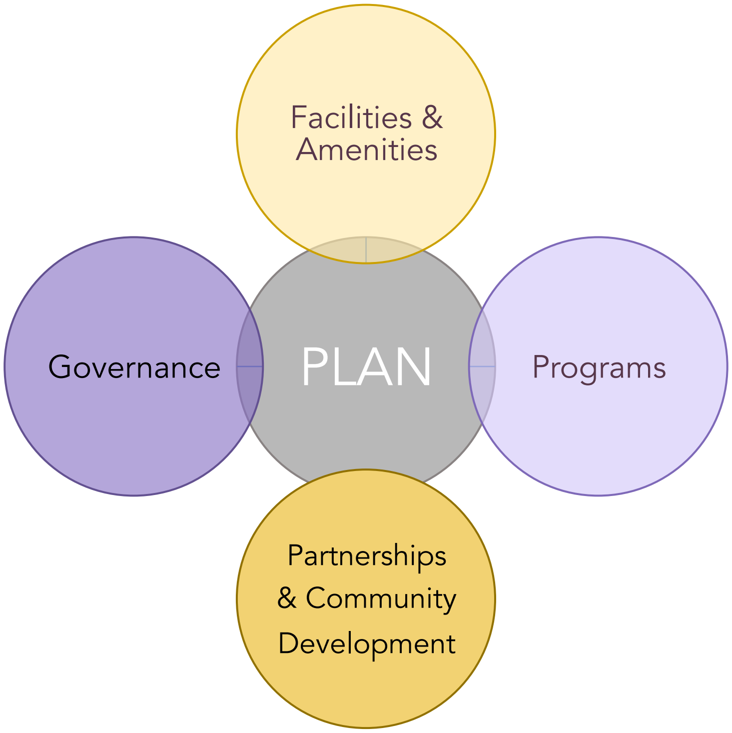
Accountability – The City involves and communicates with Dawson residents in regards to key aspects of recreation delivery and facilitates decision-making with facts and best practices.

Diversity – The City encourages and accommodates a wide variety of recreational interests and activities in the community.

Accessibility – The City works to ensure that recreation opportunities are available to all residents of Dawson.

Feasibility – The City recognizes that its own resources and those of the broader community may pose constraints to recreation at times and strives to find practical and innovative ways to meet core needs.

Sustainability – The City strives to ensure that its current delivery of recreation programming and facilities protects the environmental, financial, and other resources needed to maintain and/or increase future levels of recreation service delivery in Dawson.



THE FOUR PLAN ELEMENTS

8.0 City Roles and Service Standards

THE CITY'S ROLES IN RECREATION

Steward – The City cares for the natural and built recreation spaces that are under its jurisdiction and encourage residents to take pride in and care for them.

Funder – The City provides direct and indirect financial support to individuals and groups to pursue, provide, and promote recreational opportunities.

Facility provider – The City provides safe, functional spaces that accommodate a range of recreational activities for the community and makes these available for both City and other activities.

Facilitator/partner – The City works with other individuals and groups to facilitate the delivery of recreational opportunities to Dawson residents.

Program provider – The City designs and delivers programs that offer leisure and opportunities for individual and community well being.

Listener/learner – The City strives to listen to and learn from the views of local residents, volunteer groups, and the broader community in its approach to planning and delivering recreational opportunities.

Leader – The City helps to create and foster a local culture in which recreation participation and active living are valued and promoted.

SERVICE STANDARDS

Facilities

Our Service Objective: To provide safe, functional and enjoyable outdoor and indoor spaces in which Dawson residents and visitors can spend their leisure time.

Maintenance Priorities

1) Safety
2) Functionality
3) Aesthetics

Maintenance Priority by Spaces

1) Highly utilized locations, particularly by vulnerable populations (i.e., children, seniors)
2) High maintenance requirements due to specific features or amenities
3) Highly visible locations
4) Less used and/or visible locations

Programs

Our Service Objective: To provide, facilitate, and support a range of recreation opportunities for Dawson residents.

Delivery Priorities

1) Safety
2) Quality
3) Diversity

In-House Programming Priority by Recipient Group

1) Demographic and/or other groups not well served by third party programs
2) Children and youth
3) Families

9.0 Goals and Actions

GOVERNANCE

Goal #1 Continue to restructure the Recreation department to reflect its mandate, improve efficiencies and increase capacity.

Action 1.1 Rename the department and manager position title to incorporate the parks function.

Action 1.2 Explore and implement ways to devolve programming tasks from Manager position and increase capacity to deliver programming.

Action 1.3 Streamline interactions with user groups seeking City assistance (see Action 12.3)

Goal #2 Utilize the Recreation Board more efficiently and effectively.

Action 2.1 Update the Recreation Board policy to:

- Reduce the number of annual meetings to four; and
- Clarify the role of the Board*

Action 2.2 Enable City staff to make Level 1 funding recommendations in between Board meetings.

Goal #3 Develop more tools and capacity to strengthen the Department's community development function.

Action 3.1 Pursue staff training in:

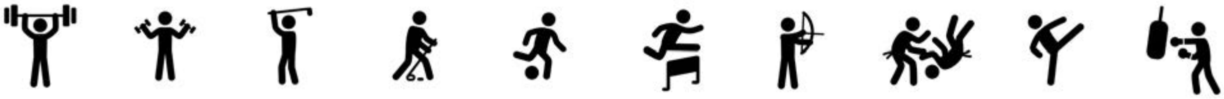
- Communications and marketing;
- Public engagement;
- Administrative and project management skills; and
- Research and policy development.

Action 3.2 Create an image library of City recreation spaces and activities to support communications.

Action 3.3 Develop corporate sponsorship program and expand the commemorative parks program to include planned giving.

**Proposed Recreation Board role to include advising Council and City administration on:*

- *Funding requests;*
- *Incorporating public input into larger planning/policy initiatives; and,*
- *Annual workplans and achievement of Master Plan goals/objectives; and*
- *Considering concerns and complaints from the general public and user groups in regards to recreation service delivery.*



FACILITIES

Goal #4 Maximize utilization and enjoyment of existing facilities.

Action 4.1 Replace playground surfacing material at Minto Park.

Action 4.2 Address heating and acoustics issues in the Minto Park concession building.

Action 4.3 Consider upgrading skate park surface and features to better accommodate a full range of wheeled uses.

Action 4.4 Consider opportunities for off-season use of indoor facilities (e.g., arena, curling rink).

Action 4.5 Provide support as needed to ensure public use of the Moose Mountain ski trails.

Action 4.6 Improve the multi-sport functionality and safety of outdoor courts.

Goal #5 Build a new, year-round multi-purpose recreation facility[3].

Action 5.1 Continue the facility planning process to confirm both amenities and location with the input of residents and user groups.

Action 5.2 Work with government partners and Council to secure funding and construct the new facility.

Goal #6 Increase and diversify the City's open space amenities and opportunities.

Action 6.1 Enhance greenspaces with more year-round active uses and "place making" features (i.e. outdoor volleyball court, natural skating rink, chess/checkers, etc.)

Action 6.2 Modify and add amenities to support active leisure for seniors (i.e., pickle ball at tennis court, shuffleboard, horseshoes, etc.)

Action 6.3 Continue to implement the Trail Plan.

Action 6.4 Ensure new neighbourhoods have convenient access to parks, green space and trails.

Goal #7 Invest in active transportation and universal accessibility infrastructure.

Action 7.1 Investigate enhanced surfacing options for the Dyke/Millennium Trail between Callison and Downtown Core and improve accessibility from Front Street at key access points.

Action 7.2 Provide active transportation options for newly developed residential areas.

Goal #8 Increase Departmental capacity to maintain, manage and plan for facilities effectively.

Action 8.1 Create general maintenance guidelines and procedures for parks and open spaces.

Action 8.2 Integrate the City's new asset management system into the daily workflow and the annual capital planning process.

---

[3] Refer to Appendix A for consultant facility recommendations.

PROGRAMMING

Goal #9 Continue to facilitate and/or deliver a diversity of recreation for all ages.

Action 9.1 Increase programming focus in the following areas:

- Wellness, healthy living, and active aging;
- Family-oriented programs;
- Outdoor skills and safety programs; and,
- Workshop formats and evening/weekend scheduling options.

Action 9.2 Provide programming to encourage use of City's outdoor amenities by youth and seniors (i.e., tennis, pickle ball, basketball, mountain biking, skateboarding, etc.)

Action 9.3 Pilot community challenges and mass participation events such as:

- Corporate sport/fitness challenges (involving City, TH, other major employers)
- Active transportation challenges; and,
- Trail network or town scavenger hunts.

Action 9.4 Provide a mix of established and new programs on an ongoing basis.

- Endeavour to ensure available spaces meet demand

Action 9.5 Support and/or collaborate with TH to provide quality recreation for youth.

Goal #10 Reduce barriers to participation in recreation.

Action 10.1 Continue to refine the program registration process, with consideration for:

- Maximizing equity (i.e. everyone gets to play); and
- Improving access, options and convenience for community members.

Action 10.2 Expand communications networks to increase awareness of City programs and registration timelines (i.e., school, TH, seniors, new Canadians, etc.)

Action 10.3 Increase community awareness of other recreation opportunities, including:

- A bi-weekly or monthly Dawson recreation e-newsletter;
- A recreation-specific bulletin board in a high profile location; and,
- Highlighting other programs for specific age groups in City's newsletter.

Goal #11 Support staff to deliver high quality, relevant programming.

Action 11.1 Provide staff training in:

- National/territorial standards and supports (i.e. HIGH FIVE, Yukon Physical Literacy Coordinator, safe sport, etc.);
- Program and curriculum development training; and,
- Increased focus on mental health and wellness support skills.

PARTNERSHIPS & COMMUNITY DEVELOPMENT

Goal #12 Support and strengthen relationships with community groups delivering programming.

Action 12.1 Coordinate joint meetings with other program providers on an ongoing basis.

Action 12.2 Complete a new facility rental policy that resolves the issue of third party insurance requirements for City property.

Action 12.3 Develop a "one-window" approach (including user-friendly information) for individuals or groups seeking support from or use of City property for recreation.

Action 12.4 Schedule more user group meetings and discussions to identify and resolve issues.

Action 12.5 Make staff available to attend user group meetings on a bi-annual basis to provide information and seek input.

Goal #13 Raise the Department's profile and facilitate more community input.

Action 13.1 Report annually to the community on key outcomes and statistics – financials, programs, participants - in a user-friendly, accessible format via:

- Posters/displays at recreation facilities
- Recreation newsletter
- Website and social media

Action 13.2 Periodically attend/support other community events (preferably on a rotating basis) as a Department.

Action 13.3 Provide suggestion/comment boards in facilities and online.

Goal #14 Create a fair, efficient framework for City partnerships and recurring support.

Action 14.1 Review direct funding and in-kind arrangements for fairness and consistency.

Action 14.2 Articulate criteria/rationale for direct funding and in-kind arrangements in City policy, and formalize agreements with current (and future) partners accordingly.

Action 14.3 Advocate for an increase to the Comprehensive Municipal Grant to reflect the City's actual service population for recreation services (municipal and peripheral resident users)

Action 14.4 Investigate additional opportunities to recuperate costs for recreational services related to peripheral users

10.0 Implementation

ACTION	IMPLEMENTATION TIMEFRAME				EXTRA BUDGET
	SHORT-TERM (0-2 yrs)	MEDIUM-TERM (3-6 yrs)	LONG-TERM (7-10 yrs)	ONGOING	
GOVERNANCE					
1.1 New department and manager titles	✓				
1.2 Restructure program delivery	✓				
1.3 Streamline user group interactions	✓				
2.1 Update Recreation Board policy	✓				
2.2 Enable City staff to make Level 1 recommendations	✓				
3.1 Pursue staff training in communications, engagement, etc.				✓	
3.2 Create image library				✓	$
3.3 Develop sponsorship and expand commemorative parks program		✓			$
FACILITIES & AMENITIES					
4.1 Replace Minto Park playground surface	✓				$
4.2 Address Minto Park concession building issues		✓			$
4.3 Consider upgrading skate park			✓		$
4.4 Consider off-season facility uses			✓		
4.5 Provide support for XC ski trails		✓		✓	$
4.6 Improve multi-sport functionality and safety of outdoor courts	✓				
5.1 Continue facility planning process	✓				
5.2 Construct new facility		✓			
6.1 Enhance greenspaces with year-round active uses and place making features		✓	✓		$
6.2 Modify/add amenities to support active leisure for seniors		✓	✓		$
6.3 Continue implementing Trail Plan				✓	$
6.4 Ensure access to parks, trails, greenspace for new neighbourhoods				✓	$
7.1 Investigate surfacing of Dyke Trail					$
7.2 Provide active transportation options for new neighbourhoods			✓	✓	$
8.1 Create parks/open space maintenance guidelines and procedures		✓			
8.2 Integrate City's asset management system into operations				✓	

ACTION	IMPLEMENTATION TIMEFRAME			ONGOING	EXTRA BUDGET
	SHORT-TERM (0-2 yrs)	MEDIUM-TERM (3-6 yrs)	LONG-TERM (7-10 yrs)		
PROGRAMMING					
9.1 Increase focus on wellness, active aging, families, outdoors, short offers				✓	
9.2 Provide programming geared to use of outdoor amenities by youth and seniors				✓	
9.3 Pilot community challenges and events that encourage active living	✓			✓	
9.4 Provide mix of established/new programs				✓	
9.5 Work with TH on youth programs				✓	
10.1 Continue to refine City registration process to improve access				✓	
10.2 Expand communications network to increase awareness of City programs	✓				$
10.3 Increase community awareness of non-City programs				✓	
11.1 Utilize national/international standards and supports				✓	
11.2 Pursue more program and curriculum development training				✓	$
PARTNERSHIPS & COMMUNITY DEVELOPMENT					
12.1 Hold inter-agency meetings with other program providers				✓	
12.2 Complete new facility rental policy	✓				
12.3 Simplify and streamline process for City support	✓				
12.4 Host more user group meetings to identify and resolve issues				✓	
12.5 Offer to attend user group meetings on a bi-annual basis				✓	
13.1 Report annually to community on Department activities				✓	
13.2 Attend and/or support other community events				✓	
13.3 Install suggestion boxes		✓			
14.1 Review direct funding and/or in-kind arrangements		✓			$
14.2 Articulate direct funding/in-kind in City policy and formalize arrangements		✓			$
14.3 Advocate for increase to CMG		✓			

Appendix A

Recreation Facility Recommendations

Early in the process, it was determined that the Parks and Recreation Master Plan (PRMP) would not address Dawson's future indoor recreation facility in detail due to the decision to undertake a separate facility planning process. Mayor and Council worked with Stantec Consulting on a preliminary facility planning exercise in 2019, but that effort did not attempt to connect to the PRMP, which was still in progress.

In the interests of connecting the PRMP – specifically the considerable public input and City recreation capacity analysis that underpinned it – to facility planning, Groundswell is including its own recommendations for facility amenities for consideration here. These recommendations did not attempt to factor in facility siting opportunities and constraints (such as appropriate geotechnical conditions); these will obviously impact final decisions.

PRIORITY LEVEL	***RATIONALE***
High	
Flexible, multi-use spaces	*Strong public support; current lack of these spaces a serious recreation constraint*
Front desk/office function	*Public and user groups need reasonable access to facility staff*
Ice surfaces/arena	*Strong public support and central to established winter recreation programs*
Indoor playground	*User groups/public placed high priority on winter options for children and families*
Gathering/viewing spaces	*Social cohesion and integration functions of facility should be maximized*
Sauna/steam room	*Strong public support; wellness/therapy benefits (particularly for aging population); provides some benefits of year-round pool without very high capital/O&M*
Medium	
Bouldering wall	*Strong public support; strategic use of underutilized vertical space*
Fitness centre	*Co-location with other amenities more convenient for families and builds community*
Historic townsite location	*Interviewees stressed importance; convenient access promotes walking and use by youth*
Recreation staff office space	*Could create efficiencies and raise community profile for staff*
Sufficient space for pool	*Option to build future pool (seasonal or year-round) on same site would be ideal*
Walking route/track	*Strong public support; safe seniors-oriented exercise option in winter; ideally designed to require minimal additional facility footprint*

Given the high priority that the public and some interviewees placed on a year-round pool, the Groundswell planning team undertook a very brief analysis of feasibility utilizing two small Northern communities: Fort Simpson and Inuvik, NWT. The planning team concluded that, at this juncture, it did not support the pursuit of a year-round pool due to the following considerations:

- Based on the projected budget for Old Crow's community centre and a Yellowknife pool in the planning stages, the team's "back of napkin" capital cost estimate for a new year-round pool is $12 million dollars. Government of Yukon has signalled that a new facility will be planned and constructed in a conservative funding environment. Upgrading the current seasonal pool to a year-round one may come at the expense of other amenities for which there are currently no (seasonal or otherwise) options.
- Even if sufficient capital funding could be secured, it's the operations and maintenance (O&M) burden that ultimately dictates whether a year-round pool is viable for Dawson. The other examples suggest that a $200-$300K budget could be required; possibly a 15% increase over current expenses. Dawson's current allocation of municipal budget to recreation is already substantially higher than other Yukon communities.
- Dawson's small population poses an ongoing challenge to the sustainability of both City and volunteer-led programming. In a community with a limited number of participants and a society with increasingly limited time, a winter pool could potentially undermine the viability of winter recreation such as soccer, minor hockey and Moose Mountain. It also poses a risk that a year-round pool wouldn't result in higher overall recreation participation and increased City revenues, but simply spread those same revenues across more facilities.

Report to Council

☒ For Council Decision ☐ For Council Direction ☐ For Council Information

☐ In Camera

SUBJECT:	**Council Remuneration Bylaw Review**	
PREPARED BY:	Cory Bellmore, CAO	**ATTACHMENTS:** • Council Remuneration Bylaw #2018-10
DATE:	January 20, 2021	
RELEVANT BYLAWS / POLICY / LEGISLATION: • Council Remuneration Bylaw #2018-10 • Travel Policy #08-01		

RECOMMENDATION

That Committee of the Whole review Bylaw# 2018-10.

ISSUE

As per Bylaw #2018-10, during the final year of Council's term, Council shall schedule a review of the bylaw and proceed to amend it as deemed advisable at the time.

BACKGROUND SUMMARY

The City of Dawson has a history of revising the remuneration bylaw every three years prior to a municipal election. As Council reviews the bylaw, it is reasonable for Council to consider the cost to the City, the ability to attract elected officials to run for office, and the changing taxation environment.

ANALYSIS / DISCUSSION

For 2019 and later tax years, non-accountable allowances paid to elected officers will be included in their income. This change was stated in the 2017 federal budget, which received royal assent on June 22, 2017 (Bill C 44).

The cost to the City is an important and necessary cost of ensuring good government and perceived as good value for tax payers' dollars. Cost of living increases are included in the current bylaw, the time commitment involved in being a Councillor has increased over time and with increased funding and regulatory changes federally, territorially and municipally, it isn't likely that the time commitment will be reduced.

APPROVAL		
NAME:	Cory Bellmore, CAO	**SIGNATURE:** CL Bellmore
DATE:	Jan 28, 2021	

THE CITY OF DAWSON

Bylaw No. 2018-10

WHEREAS section 173 of the *Municipal Act*, RSY 2002, c. 154, and amendments thereto, provides that council may, by bylaw, establish the amount and any criteria in relation to the remuneration of a member of council (including the type of or rate or conditions for remuneration) in relation to

(a) attendance at a council meeting or a council committee meeting;

(b) expenses incurred in the course of attending a council meeting or a council committee meeting; or

(c) any other expenses incurred in the course of performing any duty required to be performed by a member of council.

THEREFORE, pursuant to the provisions of the *Municipal Act* of the Yukon, the council of the City of Dawson, in open meeting assembled, **ENACT AS FOLLOWS**:

PART I - INTERPRETATION

1.00 Short Title

1.01 This bylaw may be cited as the ***Council Remuneration Bylaw***.

2.00 Purpose

2.01 The purpose of this bylaw is to provide for remuneration to be paid to the Mayor and Councillors.

3.00 Definitions

3.01 In this Bylaw:

(a) Unless expressly provided for elsewhere within this bylaw the provisions of the *Interpretations Act (RSY 2002, c. 125)* shall apply;

(b) “CAO” means the Chief Administrative Officer for the City of Dawson;

(c) “city” means the City of Dawson;

(d) “council” means the council of the City of Dawson.

PART II – APPLICATION

4.00 Annual Remuneration

4.01 The base annual remuneration for the Mayor for the 2018—2021 term of office shall be $15,215.66 effective from November 1st, 2018 to October 31, 2021.

4.02 The base annual remuneration for each Councillor during the 2018—2021 term of office shall be $10,143.97 effective from November 1st, 2018 to October 31st, 2021.

4.03 (a) on an annual basis, the base annual remuneration shall be adjusted by applying a factor equal to the change in Consumer Price Index (Nov.- Nov.) calculated by Statistics Canada for Whitehorse, subject to the following:

  I. annual increase shall not exceed 2.5% in any given year; and

  II. where the Consumer Price Index indicates a negative adjustment, no adjustment shall be applied.

(b) the adjusted base annual remuneration shall become effective on January 1st of the following calendar year.

4.04 Annual remuneration shall be paid bi-weekly and, where a member of council fails for any reason to serve in the respective office for a full twelve months, the remuneration shall be prorated on a bi-weekly basis for the period served.

5.00 Remuneration Review

5.01 During the final year of council's term of Office, council shall schedule a review of the *Council Remuneration Bylaw* and proceed to amend it as deemed advisable at that time.

6.00 Additional Payments

6.01 In addition to the annual remuneration provided pursuant to this bylaw, a member of council may be paid a per diem for each day the member of council is engaged in representing the City at any training session, event or meeting where such representation has been approved in advance by council resolution. The per diem shall be prorated as follows:

Representation	Entitlement	Amount
More than 4 hours	Full-Day	$200.00
4 hours or less	½ Day	$150.00

6.02 The per diem provided pursuant to this bylaw shall be paid with respect to such day or days on which a member of council:

(a) represents the City at an approved training session, event or meeting; or

(b) is required to be absent from the municipality for four or more hours for the purpose of travelling to and from an approved training session, event or meeting.

7.00 Expenses

7.01 Prior approval of council is required for funding or reimbursement of expenses incurred in conjunction with the travel of any member of council outside the City of Dawson.

7.02 Members of council shall be reimbursed for travel expenses in accordance with the *City of Dawson Travel Policy*.

PART III – FORCE AND EFFECT

8.00 Severability

8.01 If any section, subsection, sentence, clause or phrase of this bylaw is for any reason held to be invalid by the decision of a court of competent jurisdiction, the invalid portion shall be severed and the part that is invalid shall not affect the validity of the remainder unless the court makes an order to the contrary.

9.00 Bylaw Repealed

9.01 Bylaw 15-05, and amendments thereto, are hereby repealed.

10.00 Enactment

10.01 This bylaw shall come into force on the day of the passing by council of the third and final reading.

11.00 Bylaw Readings

Readings	Date of Reading
FIRST	**July 17, 2018**
SECOND	**August 14, 2018**
THIRD and FINAL	**August 14, 2018**

Original Signed By:

Wayne Potoroka, Mayor

Presiding Officer

Cory Bellmore, CAO

Chief Administrative Officer

Report to Council

☐ For Council Decision ☒ For Council Direction ☐ For Council Information

☐ In Camera

AGENDA ITEM:	Art Procurement Policy	
PREPARED BY:	Cory Bellmore	**ATTACHMENTS:** Draft – Art Procurement Policy #2021-01
DATE:	January 26, 2021	
RELEVANT BYLAWS / POLICY / LEGISLATION: OCP Bylaw #2018-18		

RECOMMENDATION

It is respectfully recommended that Committee of the Whole provide feedback on this draft council policy.

ISSUE / PURPOSE

The City of Dawson recognizes that arts and culture is essential to the community’s growth and good health.

Festivals and Programming support for Arts and Culture in the community currently reside between the Facility & Property Use Policy as well as the Community Grants Policy. These policies are under review to ensure they are meeting the needs and goals of the City of Dawson in supporting these activities.

The Art Procurement Policy is designed specifically for the physical acquisition of art for display in public buildings and spaces.

BACKGOUND SUMMARY

A policy to support Arts and Culture has been a priority for the City of Dawson for some time. In preparation and discussion to the creation of a procurement policy, it was determined that support for cultural festivals and events as well as programming should remain separate from procurement of art.

Council had previously provided comments on this policy. With staff attendance and changeover in 2020, those edits are no longer available. Administration is bringing this policy back as it was initially for comment again.

ANALYSIS / DISCUSSION

City of Dawson’s long term goals relating to culture in our Official Community Plan include showcasing Tr’ondëk Hwëch’in heritage alongside our gold rush history as well as to be recognized as the cultural capital of the Yukon.

Implementation approaches include:
Public Art

- May include permanent and temporary installations of statuary, murals, and other visual art displays,
- Should showcase the heritage of the Tr’ondëk Hwëch’in, the history of Dawson City, or local culture, and
- Should be completed or designated by local artists, or those with ties to the community.

APPROVAL		
NAME:	Cory Bellmore, CAO	**SIGNATURE:** CL Bellmore
DATE:	Jan 28, 2021	

City of Dawson

Art Procurement Policy

2021-01

POLICY STATEMENT

The City of Dawson is dedicated to enhancing Arts and Culture as an integral part of our community. The City of Dawson's goal is for a vibrant, dynamic arts and cultural community as identified in the municipal Sustainability Plan and Official Community Plan. The City of Dawson recognizes that arts and culture is an essential part of the community's growth and overall good health.

1.00 Purpose

1.01 An Art Procurement Program will contribute to the appearance of our public buildings and spaces, and help provide education about the importance of arts and culture to our residents. The program will reflect the professional interests of visual arts in the town, serving as a means to publicly promote local talent and artistic accomplishments and contribute to the professional development and economic success of our local artists.

2.00 Definitions

2.01 The following terms are used within this policy and are defined as follows:

a) "artwork" means a physical work of art installed in the public realm. These works of art may be installed within buildings, or outdoors on public lands.

b) "installed" means a piece of artwork that is fully prepared by the artist for public viewing with no assistance from City staff.

c) "program" means the City of Dawson Art Procurement Program as described in this policy.

d) "public space" means interior or exterior spaces frequented by the public, or within public view, and accessible to or visible by the public during normal business hours or longer.

e) "selection committee" means the appointed members who will review the submissions and make recommendations to Council for purchase.

f) "City" means the Council and Staff of the City of Dawson, Yukon.

3.00 Objective

a) To support the growth of a vibrant arts and culture community;

b) To attract and retain creative, entrepreneurial, skilled, committed and enthusiastic businesses, workforce, and volunteers;

c) To strengthen the community as a cultural tourism destination, supporting and enhancing other attractive features of the City;

d) Enhance Public spaces with the presence of public art.

Procedure

4.00 Artist Eligibility

Artists will be eligible to participate in the Program provided that they meet the following criteria;

a) Artists wishing to participate in the Program MUST have been a resident of Dawson for at least 12 consecutive months.

b) Artist eligibility will not be reliant on an artist's professional status but rather on the artwork.

c) No work by any members of the selection committee or their immediate family will be considered for purchase.

5.00 Artwork Criteria

The suitability of the artwork for the Program will depend upon whether or not the artwork meets the following established criteria:

a) The artwork should originate from the primary art market/artist where the artist maintains ownership of the work. Artwork from a secondary market, including artist's estates, will NOT be considered for the Program.

b) Artwork presented for selection must be an original design. Reproductions or photographic reproductions of artwork will not be accepted under the Program.

c) Creative works in any discipline will be eligible for selection, provided it is a two-dimensional or three-dimensional art form, is accessible to the public and is an original or limited edition which includes, but is not limited to:

i) Paintings and drawings, produced entirely by hand on any support or in any material (excluding industrial designs and manufactured articles decorated by hand);
ii) Original prints, posters and photographs, as the media for original creativity;
iii) Original artistic assemblages and montages in any material;
iv) Work of statutory art and sculpture in any material;
v) Works of applied art in such materials as glass, ceramics, metal, wood, etc.

d) Illustrated and detailed proposals for artwork are only eligible for a sculpture piece. All other artwork submitted must be complete and available for procurement as of the date of submission.

e) Submitted artwork must be sturdy, vandal resistant (if an outside piece) and low maintenance.

6.00 Submission Guidelines

a) Artists can submit a maximum of three (3) artworks for consideration, either in person and/or through a commercial representative of the Artist.

b) Descriptive details of each work must be submitted, including the title, date completed, medium, dimensions and cost. Each submission must be on a separate form (Appendix A). There will be no limit on the date of creation of artwork submitted for the Program.

c) Artwork proposals for outdoor sculptures must include specific details on potential placement, size, materials used and expected days to complete.

d) Artists may present prices for their work as installed or uninstalled. These prices should be clearly stated with each submission.

7.00 Selection Committee Composition

a) An Art Procurement selection committee will be appointed by Mayor and Council to oversee the selection of artworks. The committee will consist of one (1) arts professional from the School of Visual Arts (SOVA), two (2) representatives from the community at large and two (2) City of Dawson staff members.

b) Committee members will be appointed in December on an annual basis and will serve for a period of one (1) year.

c) A schedule will be established for the selection of artwork by the committee.

d) The decisions of the committee will be final.

8.00 Selection process

The selection process for the Program will be administered in accordance with the clauses outlined below:

a) A call for submissions will be announced in January of each year and will include the submission deadline in July, date of adjudication in September and date of the public meeting of Council in December at which the selected artworks will be announced.

b) The following general selection criteria will be used in the selection of artworks. Each criteria will receive a weighting but the weighting will be determined on a project by project basis by the committee. For example, in certain circumstances the "Relevance of theme" may weight higher in one year over another.

Example of Public Art Project Weighting

Description	Indoor Pieces	Outdoor Pieces
Compliance with submission requirements and budget	40	40
Artistic Merit – imagination and innovation	20	20
Experience in delivering projects of similar scope	5	5
Feasibility of construction or installation (Indoor)	5	
Installed outdoor pieces		0
Relevance of theme and local content	25	25
Durability and ease of long term maintenance (indoor pieces)	5	
Durability and ease of long term maintenance (outdoor pieces)		10
Total Points	100	100

c) All submissions received will be available for public viewing from the date of adjudication until the announcement of selected works in December.

9.00 Program Financing

a) Minimum funding of $3000.00 annually will be budgeted for the Art Procurement Program. This funding is subject to review by Council through the annual budgetary process.

b) The committee may recommend that Council consider additional funding if a piece is thought to be particularly beneficial to the City's collection.

10.00 Conditions of Purchase

a) Purchase contracts between the artists and the City will include the use of artwork for display in a public place. These contracts will also include permission for the use of the images on the City's website for brief periods throughout the year in which the artwork is chosen.

b) After the selection process, payment will be issued to the artist once the artwork has been received and all contracts have been signed.

11.00 Display of Artwork

a) With the exception of outside pieces, selected artwork will be displayed at City Hall for the first year of acquisition. Following that year, the piece may be relocated to another city owned building.

b) The City will maintain the artwork for a lifespan that is reasonable for the piece.

c) The City has the right and responsibility to deaccession public art. All reasonable efforts shall be made to rectify problems or re-site artwork where appropriate. Reasons for de-accession include:

   i. Endangerment to public safety
   ii. Excessive repairs or maintenance, or repair is not feasible
   iii. Public accessibility is no longer available
   iv. Demolition of a structure incorporating public art or redevelopment of site incorporating public art
   v. Expiry of lifespan

Roll of Staff:

1. Ensure the proper maintenance of all existing artworks.

2. Determine suitable public places and spaces for the display of the artwork.

3. Develop a list of potential committee members.

4. Coordinate the Call for Submissions and assist the committee in arranging and scheduling the selection process.

5. Ensure that copyright, ownership, publication. Exhibition and jury feedback are appropriately considered an fulfilled in accordance with any legal requirements

POLICY TITLE:	*Art Procurement Program*
POLICY #:	2021-01
EFFECTIVE DATE:	
ADOPTED BY COUNCIL ON:	
RESOLUTION #:	

Original signed by: