REGIONAL DISTRICT
of Fraser-Fort George

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Addendum No. 1

Invitation to Tender ES-21-01
Construction Services for
Cummings Road Regional Transfer Station Redevelopment

The addendum is being issued prior to the closing of the Invitation to Tender to provide further information, make changes to, or to clarify the Contract Documents and is to be read, interpreted and coordinated with all other parts of the Contract Documents. In the case of a conflict with the balance of the documents, this Addendum shall govern. **Tenderers shall attach a signed copy of this addendum to their tender.** This addendum shall form part of the Contract Documents.

Delete and Replace the following pages with the pages attached:

Page 2, Table of Contents – to include the addition of Appendix F – Geotechnical Report, page 198.

Page 11, Change to Section 14.0 Attachments – to include the addition of Appendix F – Geotechnical Report

Page 25, Appendices – to include the addition of Appendix F – Geotechnical Report

Addition to ITT ES-21-01:

APPENDIX F – GEOTECHNICAL REPORT

The Geotechnical Report attached forms part of the Contract for the successful bidder and is referenced as Appendix F – Geotechnical Report in the Invitation to Tender ES-21-01. This report will be added to Article A3 of the CCDC-4 Contract.

Date: January 29, 2021

Addendum 1 Received.

Signature of Tenderer

Name of Tenderer

Inquiries relating to this ITT may be directed to:

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Tenderers are responsible to review the *Freedom of Information and Protection of Privacy Act* for further information.

All documents, including tenders, submitted to the Regional District become the property of the Regional District. The Regional District will provide a debriefing for tenderers, upon request by a tenderer, subject to the *Freedom of Information and Protection of Privacy Act*.

10.0 RIGHTS OF WAIVER

A waiver, or any breach of any provision of this ITT will not constitute or operate as a waiver, or any other breach, of any other provisions, nor will any failure to enforce any provision herein operate as a waiver of such provisions or of any other provisions.

11.0 SUB-CONTRACTORS

The sub-contractors named in the Tender Form will not be changed nor will additional sub-contractors be employed except with the written approval of the Regional District.

12.0 SCOPE OF WORK

The work generally consists of but is not limited to:

a. Removal of existing onsite structures and lock block walls, offsite disposal of any damaged lock blocks, clearing, grubbing, and excavating, offsite disposal of municipal solid waste, reuse of onsite soils, import of site fill, backfilling, compacting materials, and grading and stock piling soils.
b. Provision of lock blocks for retaining wall, concrete curbs, french drain, ditches and swales, riprap, chain link fence and gates.
c. Traffic control.
d. Construct concrete pads and landscaping.
e. Provide site electrical supply including electric fencing, lighting, poles, connections to the attendant booth and a new gate arm and kiosk, and coordination with BC Hydro.
f. Relocation of existing attendant booth.
g. General clean up and demobilization.

This project has a strict construction schedule, with limited flexibility on the Actual Facility-In-Use Date.

13.0 LOCAL CONDITIONS

The Tenderer will, by personal inspection, examination, calculations or tests, or by any other means, satisfy themselves with respect to the local conditions to be encountered and the quantities, quality and practicability of the Work and of their methods of procedure. No verbal agreements or conversation with any officer, agent or employee of the Regional District, either before or after the execution of the Contract, will affect or modify any of the terms or obligations herein contained.

14.0 ATTACHMENTS

The following Appendices are attached to the Invitation to Tender:

- Appendix A – Specifications
- Appendix B – Drawings
- Appendix C – Contract Agreement and General Conditions (Refer to CCDC 4 2011)
- Appendix D – Supplemental General Conditions
- Appendix E – CCDC Insurance Requirements (Refer to CCDC 41)
- Appendix F – Geotechnical Report

APPENDICES

- Appendix A – Specifications
- Appendix B – Drawings
- Appendix C – Contract Agreement and General Conditions (Refer to CCDC 4 2011)
- Appendix D – Supplemental General Conditions
- Appendix E – CCDC Insurance Requirements (Refer to CCDC 41)
- Appendix F – Geotechnical Report

APPENDIX F – GEOTECHNICAL REPORT

GEOTECHNICAL REPORT

PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION, DL 9095, ALPINE DRIVE, REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

Prepared for

MORRISON HERSHFIELD LIMITED
BURNABY, B.C.

Prepared by

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PROJECT No. K-5366

September 18, 2020

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APPENDICES

1.0 INTRODUCTION

The Regional District of Fraser-Fort George (RDFFG) intends to reconstruct the Cummings Road Regional Transfer Station, located southeast of Prince George, B.C. Morrison Hershfield Limited, engineering consultant for the project, commissioned GeoNorth Engineering Ltd. (GeoNorth) to provide geotechnical recommendations for the project. The scope of work is outlined in our proposals dated March 13 and June 22, 2020. Ms. Nathalie Marble, M.Sc., P.Eng. of Morrison Hershfield authorized us to proceed with the work in emails dated April 21 and July 13, 2020. This work was carried out under Morrison Hershfield service order 20102779.

The site is located on District Lot 9095, adjacent to and southwest of Alpine Drive, about 120 m southeast of the Cummings Road intersection. The location of the site is shown on Drawing 5366-A1, in Appendix A. The rectangular shaped transfer station has a footprint of about 30 by 140 m, with its long axis parallel to Alpine Drive. The northeast half of the station is above and separated from the southwest half by a 1.5 to 3 m high interlocking concrete block retaining wall.

We understand the existing station has outgrown its current design, has outdated infrastructure and is unable to handle the present waste quantities. Reconstruction of the transfer station will accommodate seven new 40 cubic yard roll-off containers, each placed on concrete pads, five recycling containers, a one-way access loop for customer vehicles, and a separate service vehicle access road and container pick-up area. The entire station area will be gravel surfaced, but future plans might include paving the customer vehicle access route.

Conceptual design plans dated August 25, 2020 by Morrison Hershfield show the new transfer station will be constructed over the existing facility. The design will include:

- A new concrete block retaining wall to separate the customer and container service vehicle areas; the new wall will be about 30 m southwest of its present location,

- Levelling the customer vehicle area to elevation 702.7 m; this will involve cutting the area northeast of the existing retaining wall and raising the area southwest of the existing retaining wall by about 2 m,
- Concrete pads to support the roll-off containers below the southwest retaining wall at elevation 700.6 m,
- A new access route for service vehicles,
- A one or two lock block high retaining wall along the northeast side of the transfer station below a slope leading up to Alpine Drive, and
- A wider entrance and new right turn lane adjacent to the southbound lane of Alpine Drive.

The conceptual reconstruction plan for the proposed transfer station is shown on Drawing 5366-A1.

This report describes the results of our site investigation and provides geotechnical recommendations for site preparation, and for design and construction of a geogrid reinforced lock-block wall, concrete pads for the roll-off containers and pavement structures.

2.0 BACKGROUND INFORMATION

We understand the proposed location for the reconstructed transfer station was previously used as a landfill. There are no plans that indicate the extent or thickness of the abandoned landfill. RDFFG indicated that the existing station was constructed in 1991. There are no as-built plans of the existing facility.

2.1 Site Geology

Geological Survey of Canada (GSC) Bulletin 196 by Tipper, and the accompanying Map 1288A, identifies the site and surrounding area as being underlain by glacial lake sediments. Glacial Lake Prince George existed for several hundred years at the end of the Fraser Glaciation, and inundated areas below about elevation 760 m, blanketing the ground with deposits of fine-grained sand, silt and clay. Glacial till, typically a mixture of sand, gravel and cobbles in a silt and clay matrix, are above elevation 760 m and underlie the glacial lake sediments.

2.2 Historic Aerial Photos

To obtain background information, we reviewed historic aerial photos of the site and the surrounding area. The photos show the transfer station is located near the head of an elongate, northeast oriented drumlin. Higher ground to the northeast, above elevation 800 m, appears to be bedrock controlled with a veneer of glacial till. Lower elevation areas to the southwest have subdued topography, indicative of a blanket of glacial lake sediment as shown on the surficial geology map.

Aerial photos dated 1981 and 1990 show the present transfer station location and a one hectare area about 150 m south of the transfer station cleared of trees. We understand both of these locations were used as landfills. An access road through the present transfer station terminates at the south landfill. Aerial photos dated 1994 show the existing transfer station. Images dated 2003 available on Google Earth® show similar conditions to the 1994 photos, and images dated 2019 show the landfill areas covered with grass, shrubs and immature trees.

2.3 Present Site Conditions

A topographic ground survey by Koehler Land Survey Inc. of Prince George, carried out prior to our investigation, shows the northeast half of the existing transfer station is at about elevation 703.5 m and the southwest half is at about elevation 700.5 m. Public and container service

vehicles enter on the southwest side of the transfer station, then circle around the southeast end of the interlocking concrete block retaining wall to exit on the northeast side. Alpine Drive overlooks the northeast side of the transfer station and climbs at a 4% grade to the southeast, resulting in a slope between 2 and 10 m high from the transfer station up to Alpine Drive. The abandoned landfill area southwest of the existing transfer station slopes down to the southwest at a gentle gradient.

The existing retaining walls in the transfer station, where they are located over landfilled areas, are visibly leaning outward. We measured an outward lean between 3% and 8%, with the top of the wall overhanging the base by up to 335 mm (13 inches).

3.0 SITE INVESTIGATIONS

On May 26 and 27, 2020, GeoNorth personnel observed soil and groundwater conditions in thirteen test pits, designated TP20-1 to 13, excavated to between 0.8 and 4.0 m depth using a CAT 512D excavator. The results of our test pit investigation were presented to Morrison Hershfield in an email dated June 2, 2020 and after several discussions, we returned to the site on July 14 and 15, 2020 and observed soil conditions in an additional ten drill holes, designated DH20-1 to 10. Drilling was carried out using a track-mounted rig and solid-stem auger methods, contracted from KRG Drilling and Blasting Ltd. of Prince George. DH20-1 to 8 were within the existing station and were advanced to between 5.2 and 10.7 m depth. DH20-9 and 10 were along the new right turn lane adjacent to Alpine Drive and were advanced to 3.0 m depth. The locations of the test pits and drill holes were recorded using a hand-held GPS unit with an accuracy of 3.0 m and are shown on Drawing 5366-A1. The elevations of the test pits and drill holes were estimated from the topographic survey drawings by Koehler Land Survey Inc.

We logged soil and groundwater conditions as the test pits and drill holes were advanced and obtained representative samples for laboratory testing and classification. Test pit and drill hole logs describing subsurface conditions are on Plates 5366-B1 to B24, in Appendix B, and are followed by an explanation of terms and symbols used on the logs. In our laboratory, we carried

out natural moisture content (ASTM D2216), Atterberg limits (ASTM D4318) and grain size distribution (ASTM C117 and C136) tests on selected samples. The results of the moisture content and Atterberg limits tests are shown on the test pit logs and the results of a grain size distribution test are shown on Plate 5366-C1, in Appendix C.

4.0 SUBSURFACE CONDITIONS

4.1 Soil Conditions

Soil conditions varied between test pits and drill holes, but generally encountered the following soil types:

1. Unit 1: Organic soil
2. Unit 2: Existing fill. This unit is further categorized as the following:
   a. Existing road fill: It consists of compact sandy gravel with trace of fines and frequent cobbles. Isolated wood debris was also encountered in this unit.
   b. Sand, silt or clay fill: It consists of varying amounts of sand, silt and clay with isolated to frequent wood, plastic and metal debris.
   c. Municipal Solid Waste (MSW): It consists of very loose to compact domestic garbage consisting of wood, metal and plastic debris, sometimes mixed with mineral soil.
3. Unit 3: Natural, very firm to stiff silty clay.
4. Unit 4: Natural, compact sand with varying amounts of gravel and a trace of fines, or sandy gravel with a trace of fines.
5. Unit 5: Natural, hard clay with varying amounts of silt, sand and gravel, a till deposit.

Drill holes and test pits on the northeast side of the transfer station typically encountered granular fill over clay fill over natural sand or silty clay, but no MSW. These include DH20-05, 06, 07 and 08, and TP20-02.

Drill holes DH20-01, 02 and 03 and test pits TP20-03, 04 and 05 are located along the alignment of the proposed new retaining wall at the grade separation adjacent to the proposed the roll-off disposal bins. DH20-01 and the three test pits encountered between 0.7 and 1.1 of gravel fill, over silt and clay fill to 1.8 m depth in DH20-01, over mixed mineral soil and MSW to between 3.4 and 4.0 m depth (between 2 and 2.7 m thickness), over either natural, compact to dense sand or natural, hard silty clay. DH20-02 and 03, located adjacent to the existing gravelled surface, encountered between 0.3 and 0.6 m of organic soil and clay, over mixed mineral soil and MSW to 2.2 and 3.7 m depth (2.4 and 3.1 m thickness), respectively, over natural very stiff silty clay and hard, sandy, gravelly clay till. Seepage was observed from the MSW and in the natural soil.

The remaining drill holes and test pits on the southwest side of the site typically encountered a layer of organic topsoil over clay fill in some locations, over clay mixed with MSW. The mixed clay and MSW extends to more than 3 m depth, below the depth excavated in some of the test pits.

Drill holes DH20-09 and 10 and test pit TP20-01 are located adjacent to Alpine Drive at the proposed lane widening. TP20-01 encountered 0.4 m of sandy gravel fill over clay fill mixed with sand, gravel and frequent pieces of plastic, wood and metal debris to 1.5 m depth, over natural, very stiff silty clay. DH20-09 encountered 1.1 m of gravel fill over natural, stiff silty clay and DH20-10 encountered 0.6 m of sandy organic soil over natural stiff silty clay.

Cross-sections with summary test pit and drill hole logs are on Drawings 5366-A2 to A4, in Appendix A. The walls of most test pits did not slough for the short time they were left opened, but the walls of TP20-2 and 7 to 12 all slumped as they were excavated. Photographs of the test pits are on Plates 5366-E1 and E2, in Appendix E.

Bedrock was not encountered during our investigations.

4.2 Groundwater Conditions

Seepage was observed in several test pits and drill holes, as summarized in Table 1, below.

Table 1 - Depth and Elevation of Groundwater Seepage

Location	Depth	Elevation	Location	Depth	Elevation
TP20-02	1.5 m	702.0 m	DH20-02	3.7 m	695.3 m
TP20-06	1.6 m	692.8 m	DH20-03	1.7 m	697.9 m
TP20-08	2.0 m	695.3 m	DH20-03	5.3 m	694.3 m
TP20-10	2.0 m	693.0 m	DH20-04	2.1 m	698.3 m
TP20-11	1.8 m	692.8 m	DH20-05	3.2 m	697.4 m
TP20-12	1.0 m	688.7 m	DH20-06	2.4 m	700.5 m
DH20-01	3.0 m	696.0 m	DH20-07	2.9 m	700.7 m

Groundwater levels are irregular, and likely a result of infiltrated surface water perched on lower permeability deposits and will fluctuate seasonally.

4.3 Laboratory Test Results

The results of Atterberg limits tests, used to define soil plasticity, indicate the silty clay, Unit 3 has a plastic limit between 19 and 22% and an average liquid limit of 43%. The Atterberg plastic limit defines the moisture content at which soil behaviour changes from semi-solid to plastic, and the liquid limit defines the moisture content at which soil behaviour changes from plastic to that of a viscous liquid. Laboratory tests show that the natural moisture content of the silty clay varies between 17% and 30%, indicating it will behave as a semi-solid to plastic material. The results of Atterberg limit tests on samples of clay till, Unit 5 indicates a plastic limit between 18 and 21% and an average liquid limit of 40%. Laboratory tests show that the natural moisture content of the clay till varies between 7.4% and 17.7%, indicating it will behave as a semi-solid material.

Results of a laboratory grain size distribution test on a sample of the natural sand, Unit 4 in TP20-04 indicate it is comprised of 81% sand, 11% fines and 8% gravel.

5.0 DISCUSSION AND RECOMMENDATIONS

Our site investigations indicate the presence of a significant amount of MSW below the footprint of both the existing and proposed transfer stations. The MSW is heterogeneous, is unconsolidated, has open voids, and consists of compressible materials. This material, existing fill, organic material, as well as disturbed, wet and soft mineral soil have an unknown bearing capacity and unknown but high potential for settlement. We assume the MSW has not been preloaded. Structures built over unconsolidated waste and existing fill are likely to be damaged by differential settlement and will have a significantly reduced service life in comparison to structures supported on undisturbed, natural ground. This is confirmed by the poor performance of the existing retaining wall, which is built over a lesser thickness of MSW than at the proposed new retaining walls.

We recommend consideration of alternative sites for the new transfer station, where it will not be located over old landfill debris. If relocation to a site not underlain by MSW is not feasible, we recommend one of the following options:

1. Excavate the existing fill and MSW from below the footprint of the proposed retaining wall and slabs and replace it with compacted fill, or

2. Install piles below the concrete lock block facing to prevent settlement and the wall from leaning outward (this option will require relevelling and reconstruction of the wall as the fill on each side of the wall settles, but reduces the potential for toppling failure of the wall), or

3. Construct the new transfer station facilities without removal of the MSW and construct the proposed wall, reinforced fill and concrete slab over a mat of compacted granular fill with geosynthetic reinforcement, and allow for reduced service life and future repair or reconstruction of the retaining wall and concrete slabs as the MSW consolidates, or

4. Construct the new transfer station without removal of the MSW as would be done with Option 3 but preload the footprint of the proposed retaining wall and reinforced fill, and the concrete slabs prior to construction of the mat of geosynthetic reinforced granular fill. This will reduce future settlement, extend the service life of these structures and the time before reconstruction is required.

These options are discussed below.

The following recommendations are based on the necessary assumption that the soil conditions encountered in the test pits and drill holes are representative of soil conditions elsewhere on this site. Please contact our office for additional recommendations if conditions encountered during construction differ in any way from those described in this report.

5.1 Lock Block Retaining Wall Construction

For design of the wall and geogrid, we used methods by the Canadian Engineering Foundation Manual (2006) (CEFM), Federal Highways Administration Manual for Mechanically Stabilized Earth Wall and Reinforced Soil Slopes Guidelines, FHWA-NH-00-043 (2001), and the Professional Practice Guidelines for Retaining Wall Design, prepared by Engineers and Geoscientists British Columbia. The design uses appropriate safety factors for wall overturning, bearing capacity failure, sliding, grid breakage and pullout as recommended in the CEFM.

Preliminary drawings show the wall adjacent to the roll-off disposal containers will be 2.2 m high, using standard 0.75 m high concrete lock blocks. We recommend the bottom block be buried at least 0.4 m below finished grade. Use Tensar UX1600 MSE geogrid, or equivalent, placed below the bottom block and between each row of blocks, extending at least 2.4 m from the back of the wall. A schematic cross section through the wall is on Drawing 5366-D1, in Appendix D.

Fill behind the wall using free draining granular soil that meets the specifications for Select Granular Subbase (SGSB), defined in Table 3 in Section 5.6. Place the fill in layers no more than 300 mm thick and compact each layer to at least 100% Standard Proctor Density (SPD) (ASTM D698). Use a walk-behind compactor operated at least 500 mm from the back of the retaining wall. Larger equipment can be used where the distance to the back of the wall is more than 1 m. Operate the equipment so its direction of travel is parallel to the back of the wall. Place the geogrid with the roll width perpendicular to the back of the wall, without overlapping adjacent roll widths, and pull out any slack, wrinkles or creases. Place the granular fill starting from the back of the lock blocks and spreading toward the back of the reinforced zone to help maintain tension in the geogrid. Do not cut the geogrid to fit over the crosses at the top of the blocks; let the overlying block fix the location of the geogrid. We recommend the block at the top of the wall be anchored to the block below, to reduce the potential for the top block to move if a vehicle hits the guardrail.

5.2 Option 1 - Remove Municipal Solid Waste and Replace with Compacted Fill

This option is to avoid settlement and the associated costs related to maintenance and repair of the concrete slabs and retaining wall within a normal 50 year facility life. To prepare the area for support of the proposed wall and slabs, we recommend that all organic soil, existing fill and MSW be removed from below the footprint of the proposed concrete lock block wall facing, wall reinforcing, and concrete slabs, and out laterally to allow for a 1 horizontal to 1 vertical (1H:1V) slope down to the natural, undisturbed silty clay, sand, or clay till, Units 3, 4 and 5. If seepage is encountered in the excavation, use pumps and sumps to keep the bottom of the excavation dry.

Bring the excavation to grade using mineral soil free from organic material and debris, at a moisture content suitable for compaction. Place the fill out laterally from the edges of the wall facing, the wall reinforcement and the concrete slabs at a distance equal to the depth of fill required below the footing. This is to allow a 1H:1V distribution of stress from the bottom of these structures through the fill to the natural soil. Place the fill in uniform layers and compact each layer to at least 98% SPD. The maximum layer thickness will depend on the type of compaction equipment being used, on the moisture content and gradation of the fill, and on weather conditions at the time of the work, but do not use a layer thickness greater than 300 mm. To provide a level working surface below the wall and the concrete slab, we recommend a layer of Well-Graded Base (WGB) at least 300 mm thick compacted to at least 100% SPD. Use WGB that meets the gradation specification in Table 3.

5.3 Option 2 - Lock Block Retaining Wall Supported on Piles

If the new facilities will be constructed over MSW, differential settlement of the concrete lock blocks at the face of the wall can be avoided by constructing the blocks on a pile supported grade beam. This design concept will likely result in the walls tilting back, away from the disposal bins, as the MSW below the retaining wall reinforcement settles. This approach reduces the potential for the wall to tilt forward and fail by toppling, which can be a hazard to public safety. The wall and roads will require repair or reconstruction depending on the rate and magnitude of settlement.

Suitable pile types include driven steel or timber, or helical (screw) piles, all based in the natural soil deposits below the MSW. This design option will require additional structural and geotechnical engineering analysis and design to determine pile sizes, spacing and required capacities and details of the grade beam dimensions and reinforcing.

If this design option will be considered, we recommend confirming feasibility and design requirements with a structural engineer.

5.4 Option 3 - Lock Block Retaining Wall Constructed Over Municipal Solid Waste

As noted above, the MSW at this site is unconsolidated and susceptible to consolidation under its own weight and any imposed loads, and due to decomposition of organic materials. Construction over MSW will require access roads to be re-levelled, resulting in the concrete slabs settling differentially or cracking and sections of the wall tilting, requiring reconstruction as the fill consolidates. Settlement rates are unknown. We understand the existing facilities are at the end of their serviceable life after 30 years of use. Interpolation of the test pit and drill hole data suggests there is greater thickness of MSW at the proposed wall location than the existing. This implies there will be more settlement at the proposed location than at the existing wall over a similar period of time.

If using this option, we recommend the following:

1. To prepare ground conditions below the proposed retaining walls, access roads and slabs, remove organic soil and debris exposed at surface and to at least 1.2 m below the proposed slabs, concrete lock blocks and wall reinforcement. Slope the surface to drain southeast.
2. Compact the surface with several passes of a vibratory pad foot compactor. Remove areas that are rutted or show excessive deflection and either dry and compact the surface to at least 95% SPD, or replace the rutted soil with suitable mineral soil compacted to at least 95% SPD.
3. Cover the approved subgrade surface with a medium weight, nonwoven geotextile and a biaxial geogrid such as Tensar BX1200, or equivalent.
4. Place a 300 mm thick layer of SGSB over the geotextile and compact this surface to at least 98% SPD.
5. Cover the compacted SGSB with a geogrid such as Tensar BX1200, or approved equivalent.

6. Place a second 300 mm thick layer of SGSB and compact this layer to at least 100% SPD, followed by a third layer of Tensar BX1200 geogrid, or equivalent, then a final 300 mm thick layer of SGSB compacted to at least 100% SPD.
7. Proceed with final ground preparation for the concrete slabs and the retaining wall foundation, as described in Section 5.1.
8. Establish a protocol for regular review of the walls and slabs to check for signs of settlement that might lead to damage, an outward lean to the wall, or other conditions that might be a concern for public safety or efficient operation of the new transfer station.

5.5 Option 4 - Construct Over Municipal Solid Waste Following Preloading

The amount of settlement can be reduced by applying a surcharge load to the footprint of the proposed retaining wall and concrete slabs, prior to construction of the mat of granular fill with geosynthetic reinforcement as described in Option 3. If this option will be considered, we recommend allowing for at least a 3 m high soil surcharge above the design, finished grade. For preliminary planning, we recommend the surcharge load remain in place for one year, but that the fill settlement be monitored to determine when primary consolidation is complete. Settlement plates would be placed across the footprint of the area to be preloaded and readings taken at approximately weekly intervals for the first two months, then at monthly intervals. We recommend additional analysis prior to implementing this option.

5.6 Pavement Structures

The following pavement structures are not intended to protect the subgrade from freezing and developing ice lenses, but are intended to have sufficient strength to allow full operation through spring thaw when the road structure will be weakest. For constructing the new right turn lane,

we recommend matching the new pavement structure thickness to that of Alpine Drive or use the minimum thickness noted in Table 2, below. For constructing the public and service vehicle access routes, we recommend using the following structures:

Table 2 - Recommended Pavement Structures

Pavement Type	**Right Turn Lane**	**Public Vehicle Access Route**		**Haul-Truck Access Route**
		Unpaved	Paved	
Hot Mix Asphaltic Concrete	75 mm	-	65 mm	-
High Fines Surfacing Aggregate, HFSA	-	150 mm	-	200 mm
Well Graded Base	250 mm	200 mm	200 mm	250 mm
Select Granular Subbase	500 mm	500 mm	500 mm	500 mm
Nonwoven Geotextile	yes	yes	yes	yes

We recommend using asphalt that conforms to BCMoT, Standard Specification 502 for 16 mm Medium Mix Asphaltic Pavement.

To prepare the subgrade, remove all organic materials and compact the exposed surface to at least 98% SPD. Excavate rutted areas and replace them with granular fill in layers no more than 300 mm thick and compact each layer to at least 98% SPD.

Construct the right turn lane by saw cutting the asphalt at the white line at the edge of the pavement, offsetting 200 mm, then excavating at a 1H:1V slope to the subgrade elevation, as shown on Drawing 5366-D2, in Appendix D.

Place a layer of geotextile over the bottom and sides of the exposed subgrade surface. Overlap adjacent sheets by at least 450 mm or as recommended by the manufacturer. Provide an outlet for water that might collect on the subgrade surface within the base and subbase gravel by outsloping the subgrade surface at a minimum 2% grade.

Place the SGSB, WGB and HFSA in maximum 300 mm thick layers and compact each layer to at least 100% SPD. Dry or add water to the fill as required to achieve the specified densities.

Construct cut and fill slopes in natural silty clay no steeper than 2.5H:1V and use fill slopes of 2H:1V in granular soil.

5.7 Material Specification

Use a medium weight nonwoven, polyester, needle-punched geotextile that has the following Minimum Average Roll Values (MARV):

- Grab Tensile Strength (ASTM D4632), greater than 700 N
- Static Puncture (ASTM D6241), greater than 1,800 N
- Trapezoid Tear (ASTM D4533), greater than 250 N
- Apparent Opening Size (ASTM D4751), 0.2 mm $\pm$ 0.02 mm.

For WGB and HFSA, use crushed and screened material that meets the requirements of BCMoT Standard Specifications. The SGSB can be a pit run material that meets the specified gradation, below. Use durable aggregate that will not degrade from exposure to water, freeze-thaw cycles or handling, spreading or compacting. It must not contain organic materials or an excess of flat or elongate stones. Do not place fill that is frozen and do not place fill on frozen ground.

Use the gradation specifications for SGSB, WGB and HFSA as described in Table 3, below.

Table 3 - Specified Gradation for Granular Fill

Sieve Size (mm)	Percentage Passing		
	WGB	SGSB	HFSA
100	-	100	-
75	-	95-100	-
40	-	-	-
25	100	-	100
19	80-100	35-100	85-100
9.5	50-85	-	60-85
4.75	35-70	15-60	40-70
2.36	25-50	-	-
1.18	15-35	-	20-50
0.300	5-20	3-15	10-30
0.075	0-5	0-5	7-12

6.0 CONSTRUCTION REVIEW

We recommend that we review the design drawings prior to construction to check that the intent of our recommendations has been adequately communicated and applied to the design, and that the level of investigation is adequate for the project.

We also recommend, and the B.C. Building Code specifies, that an experienced engineer or his designate carry out construction review and testing of the following:

- all foundation excavations, and
- all compacted, structural fill below and behind the proposed retaining structures.

Prior to us being able to complete Schedule C-B of the Code, which is a form titled "Assurance of Professional Field Review and Compliance", we will need to carry out the necessary field reviews. The Schedule C-B form is often required by Building Inspection Officials prior to an Occupancy Permit being issued.

The foundation excavation review will include checks that soil conditions are as expected and that the base is free of water or sloughed or loosened soil. If soil conditions are different than expected, we can provide recommendations for remedial measures, as required.

We recommend that an experienced geotechnical technician review the placement and compaction of all structural fill, starting with the first layer, to confirm that the fill materials and soil density meet the project specifications.

7.0 CLOSURE

This report was prepared by GeoNorth Engineering Ltd. for the use of the Regional District of Fraser-Fort George, Morrison Hershfield Limited and their consultants. The material in it reflects GeoNorth Engineering Ltd.'s judgement in light of the information available to us at the time of preparation. Any use which Third Parties make of this report, or any reliance on decisions to be made based on it, are the responsibility of such Third Parties. GeoNorth Engineering Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. Please call the writers if any part of this report needs to be clarified or discussed in more detail.

Yours truly,
GeoNorth Engineering Ltd.

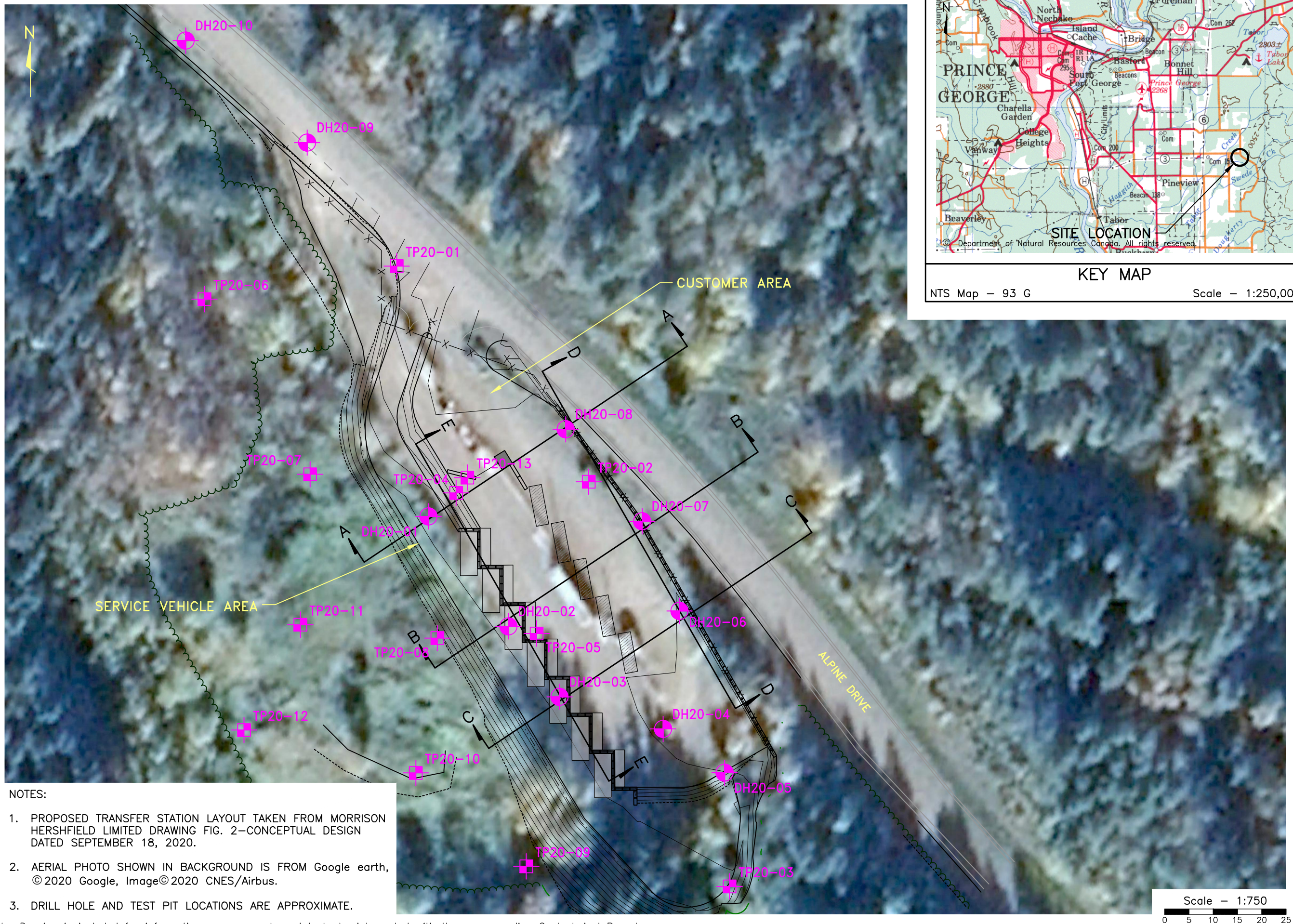
Per: T. Bibra, EIT

Reviewed by,
GeoNorth Engineering Ltd.

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
D. J. McDOUGALL
14614

Per: D.J. McDougall, M.Eng., P.Eng.

APPENDIX A



KEY MAP

NTS Map – 93 G Scale – 1:250,000

NOTES:

1. PROPOSED TRANSFER STATION LAYOUT TAKEN FROM MORRISON HERSHFIELD LIMITED DRAWING FIG. 2–CONCEPTUAL DESIGN DATED SEPTEMBER 18, 2020.
2. AERIAL PHOTO SHOWN IN BACKGROUND IS FROM Google earth, ©2020 Google, Image©2020 CNES/Airbus.
3. DRILL HOLE AND TEST PIT LOCATIONS ARE APPROXIMATE.

Note: Drawing is included for information purposes only and is to be interpreted with the corresponding Geotechnical Report.

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3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

MORRISON HERSHFIELD LIMITED
PROPOSED RECONSTRUCTION OF
CUMMINGS ROAD REGIONAL TRANSFER STATION
DL 9095, ALPINE DRIVE
REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.
SITE PLAN SHOWING DRILL HOLE AND TEST PIT LOCATIONS

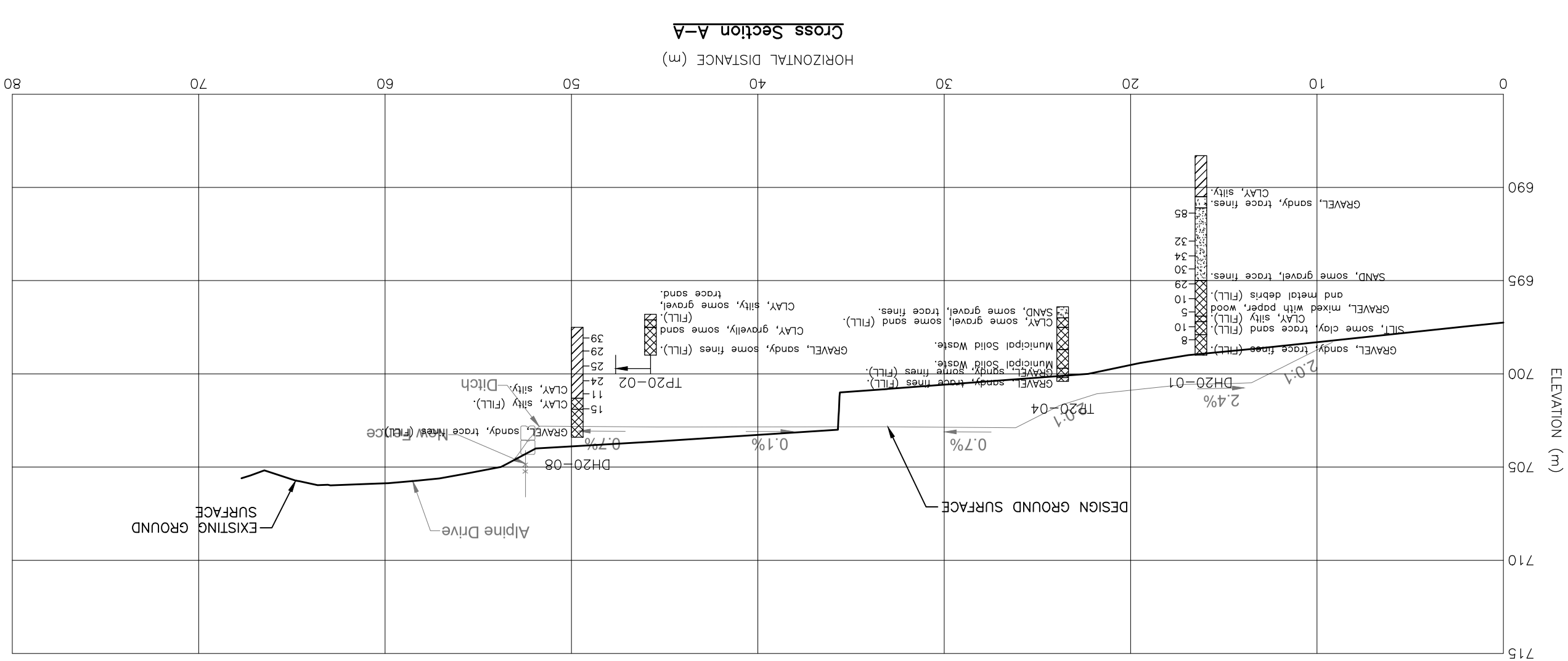
APPROVED:

SCALE: 1:750
DATE: 2020/09/18
DRAWN BY: LU
REVIEWED BY: DJM
DRAWING NO: 5366-A1
REVISION: –
PROJECT NO: K-5366

MORRISON HERSHFIELD LIMITED
PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION
DL 9095, ALPINE DRIVE
REGIONAL DISTRICT OF FRASER–FORT GEORGE, B.C.
CROSS SECTIONS

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250–564–4304 Fax 250–564–9323

SCALE:	1:250
DATE:	2020/09/18
DRAWN BY:	LU
REVIEWED BY:	DJM
APPROVED:	
REVISION:	–
PROJECT NO:	K–5366
DRAWING NO:	5366–A2

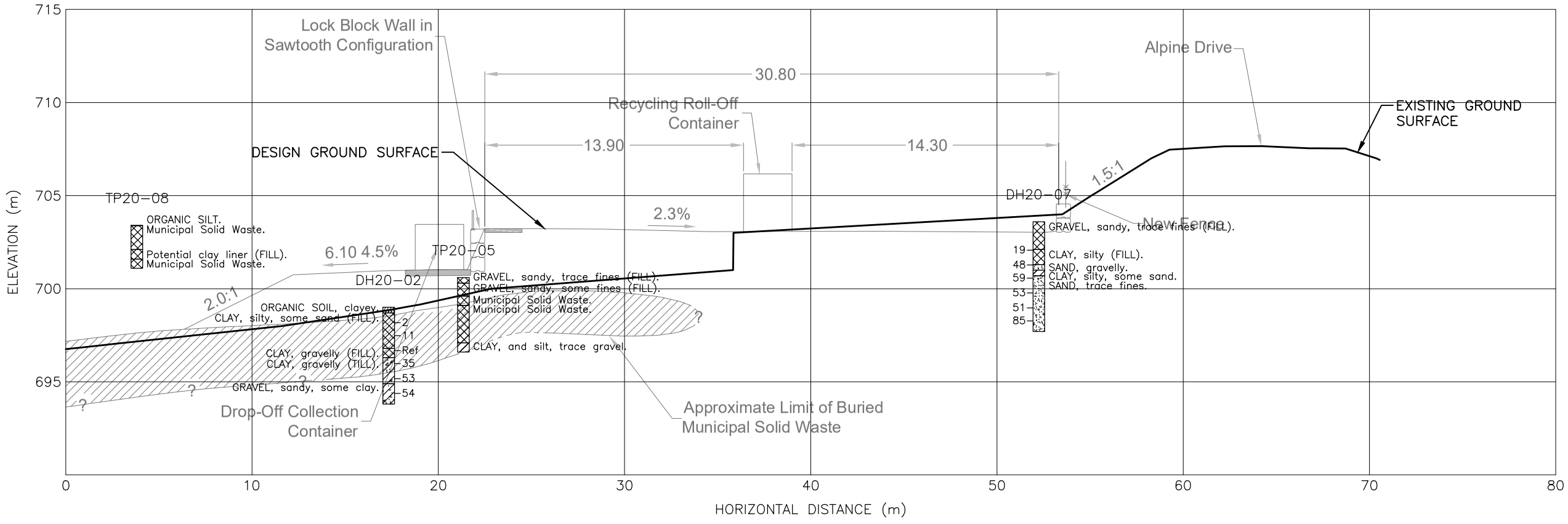


NOTES:

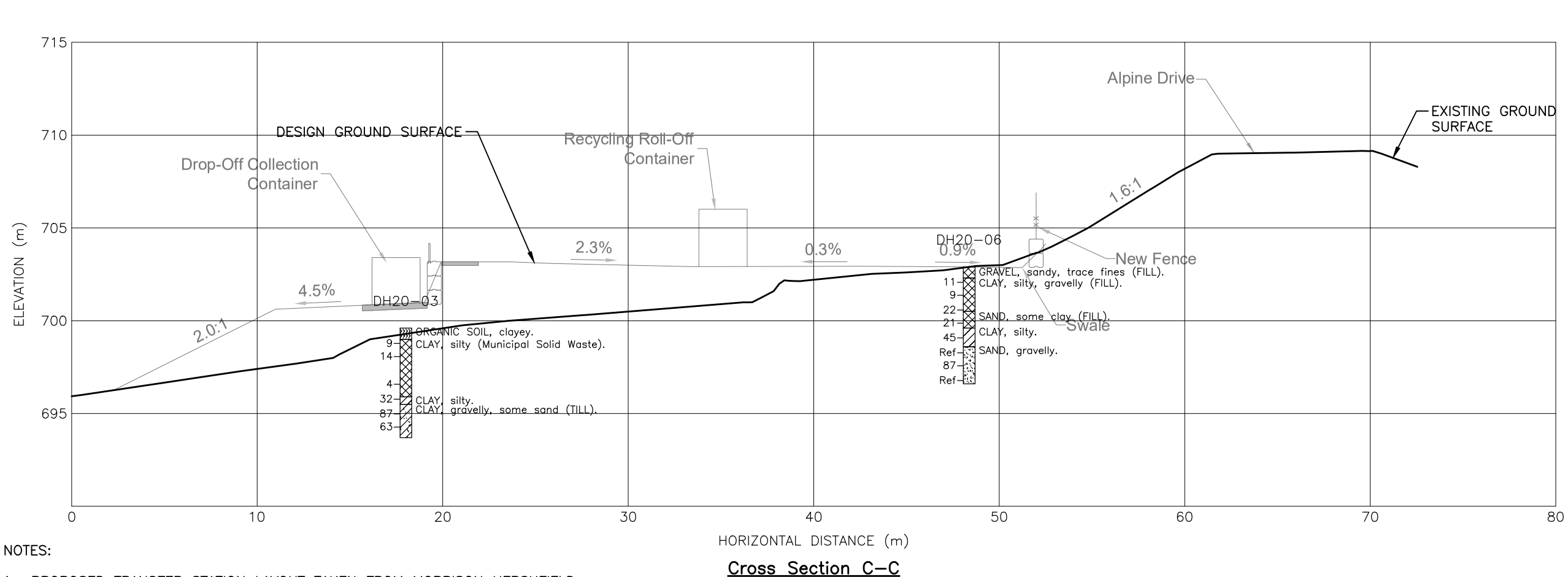
1. PROPOSED TRANSFER STATION LAYOUT TAKEN FROM MORRISON HERSHFIELD LIMITED LIMITED DRAWING FIG. 4, DATED SEPTEMBER 18, 2020.

Scale – 1:250
0 2 4 6 8

Note: Drawing is included for information purposes only and is to be interpreted with the corresponding Geotechnical Report.



Cross Section B–B



Cross Section C–C

NOTES:

1. PROPOSED TRANSFER STATION LAYOUT TAKEN FROM MORRISON HERSHFIELD LIMITED LIMITED DRAWING FIG. 4, DATED SEPTEMBER 18, 2020.

Note: Drawing is included for information purposes only and is to be interpreted with the corresponding Geotechnical Report.

Scale – 1:250

0 2 4 6 8

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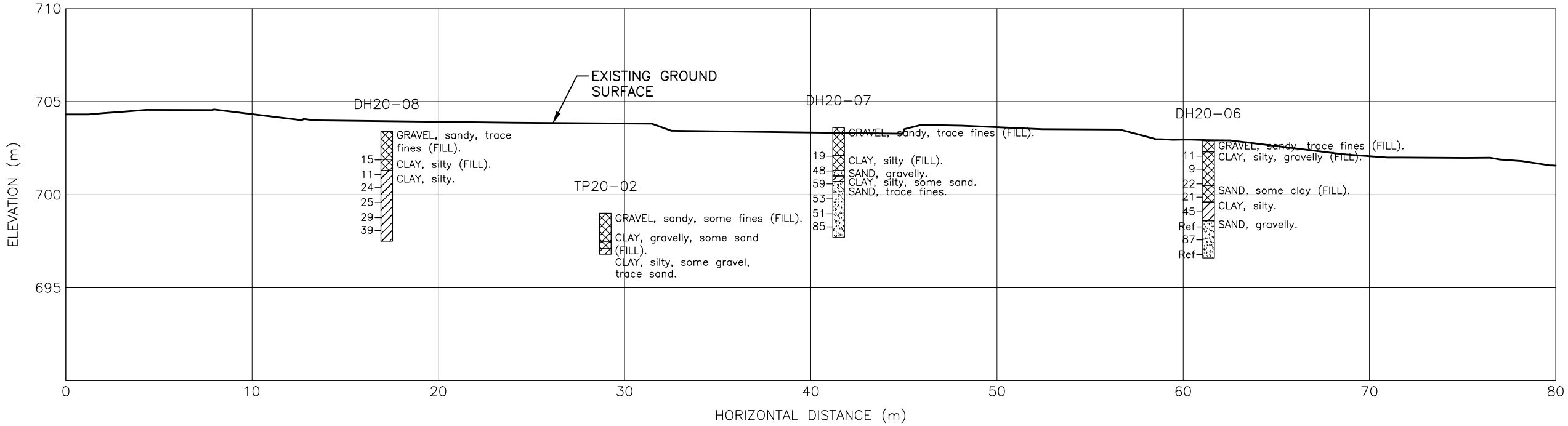
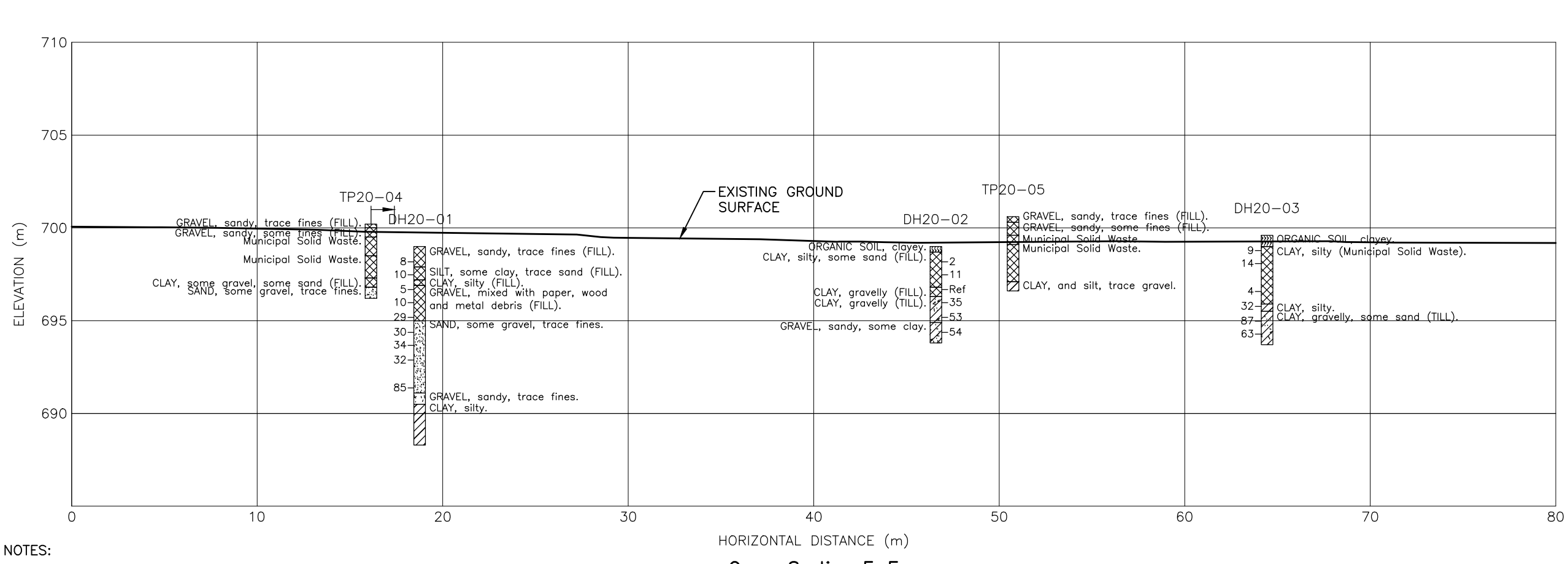
MORRISON HERSHFIELD LIMITED
PROPOSED RECONSTRUCTION OF
CUMMINGS ROAD REGIONAL TRANSFER STATION
DL 9095, ALPINE DRIVE
REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.
CROSS SECTIONS

APPROVED:

SCALE: 1:250
DATE: 2020/09/18
DRAWN BY: LU
REVIEWED BY: DJM
DRAWING NO: 5366-A3
REVISION: –
PROJECT NO: K-5366



Cross Section D–D



Cross Section E–E

NOTES:

1. PROPOSED TRANSFER STATION LAYOUT TAKEN FROM MORRISON HERSHFIELD LIMITED LIMITED DRAWING FIG. 4, DATED SEPTEMBER 18, 2020.

Note: Drawing is included for information purposes only and is to be interpreted with the corresponding Geotechnical Report.

Scale – 1:250

0 2 4 6 8

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MORRISON HERSHFIELD LIMITED
PROPOSED RECONSTRUCTION OF
CUMMINGS ROAD REGIONAL TRANSFER STATION
DL 9095, ALPINE DRIVE
REGIONAL DISTRICT OF FRASER–FORT GEORGE, B.C.
CROSS SECTIONS

APPROVED:

SCALE: As Shown
DATE: 2020/09/18
DRAWN BY: LU
REVIEWED BY: DJM
DRAWING NO: 5366-A4
REVISION: –
PROJECT NO: K-5366

APPENDIX B

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

TEST PIT LOG

HOLE NO: TP20-01

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

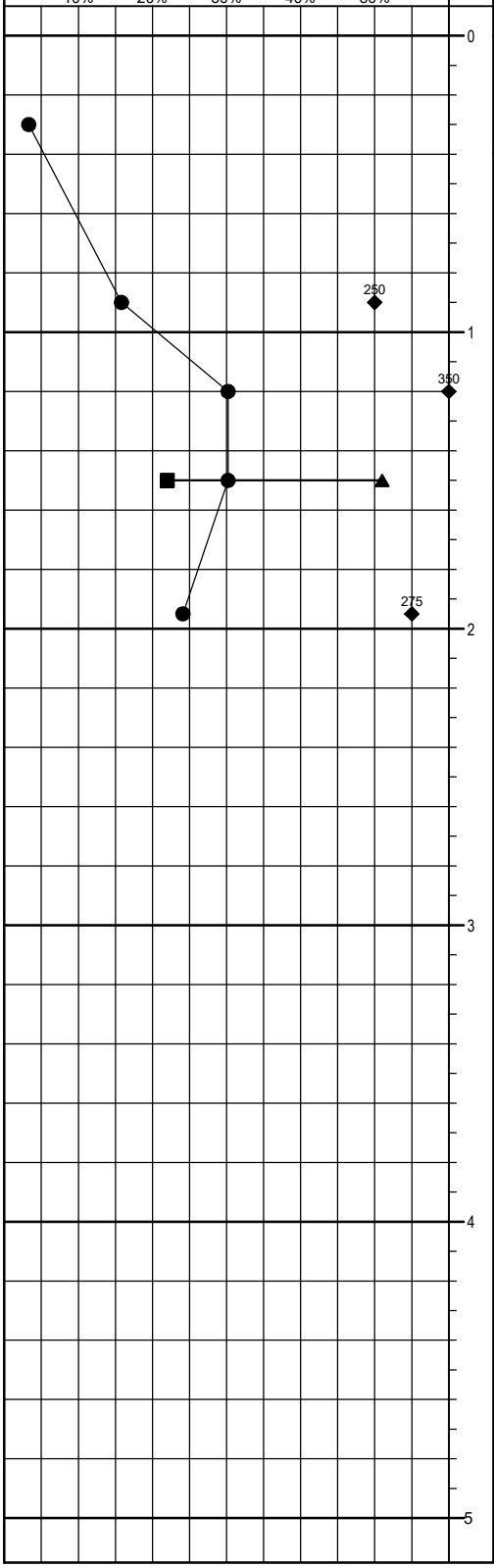
LOGGED: ML | FILE NO: K-5366 | EXCAVATOR: CAT 512D | DATE OF INVEST: 2020/05/26

LOCATION: 10U 528308E 5967006N

SURFACE ELEVATION (m): 702.1

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%



SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	SYMBOL	SAMPLES	COMMENTS
0.0	702.1			
GRAVEL, sandy, trace fines, compact, brown, rounded, some angular gravels, damp (FILL).				
0.4	701.7			
CLAY, some gravel, some sand, very stiff, intermediate plasticity, grey brown, frequent plastic, wood and metal debris, Wp<Wn<Wl (FILL).				
- below 1.0 m, trace gravel, intermediate to high plasticity.				
1.5	700.6			
CLAY, silty, some gravel, trace sand, very stiff, intermediate to high plasticity, brown, Wp<Wn<Wl.				
2.0	700.1			
End of test pit at 2.0 m. No seepage observed. Bedrock not encountered. Test pit walls did not slough.				

PLATE NO. 5366 - B1

GEONORTH ENGINEERING LTD
3975 18th Avenue
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Tel. 250-564-4304 Fax 250-564-9323

TEST PIT LOG

HOLE NO: TP20-02

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: ML | FILE NO: K-5366 | EXCAVATOR: CAT 512D | DATE OF INVEST: 2020/05/26

LOCATION: 10U 528348E 5966957N

SURFACE ELEVATION (m): 703.5

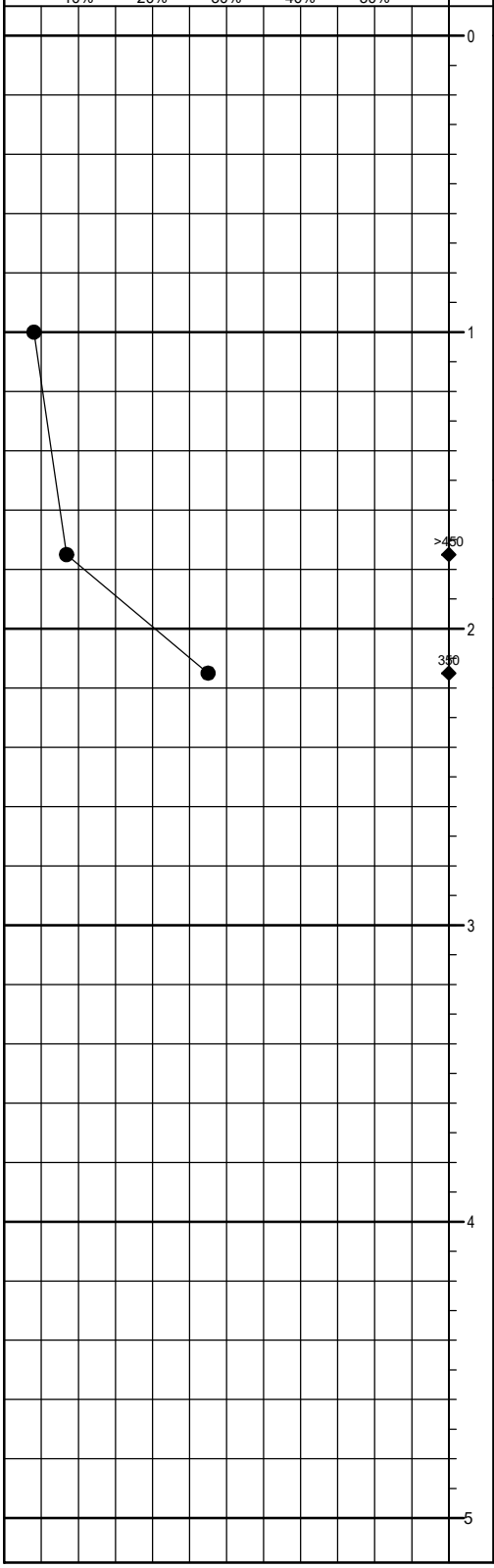
STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%

DEPTH (m) | SYMBOL | SAMPLES

SOIL DESCRIPTION

DEPTH (m)		ELEV (m)
	GRAVEL, sandy, some fines, no visible structure, compact, brown, numerous boulders and cobbles, rounded, some angular, damp (FILL).	
	- at 1.0 m, isolated wood debris.	
1.5		702.0
	CLAY, gravelly, some sand, no visible structure, hard, blue grey, occasional piece of glass and wood, Wn~Wp (FILL).	
1.9		701.6
	CLAY, silty, some gravel, trace sand, very stiff, brown, Wn~Wp.	
2.2		701.3
	End of test pit at 2.2 m. Seepage at 1.5 m. Bedrock not encountered. Test pit walls sloughed to 1.5 m.	



COMMENTS

PLATE NO. 5366 - B2

GEONORTH ENGINEERING LTD
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Tel. 250-564-4304 Fax 250-564-9323

TEST PIT LOG

HOLE NO: TP20-03

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: ML | FILE NO: K-5366 | EXCAVATOR: CAT 512D | DATE OF INVEST: 2020/05/26

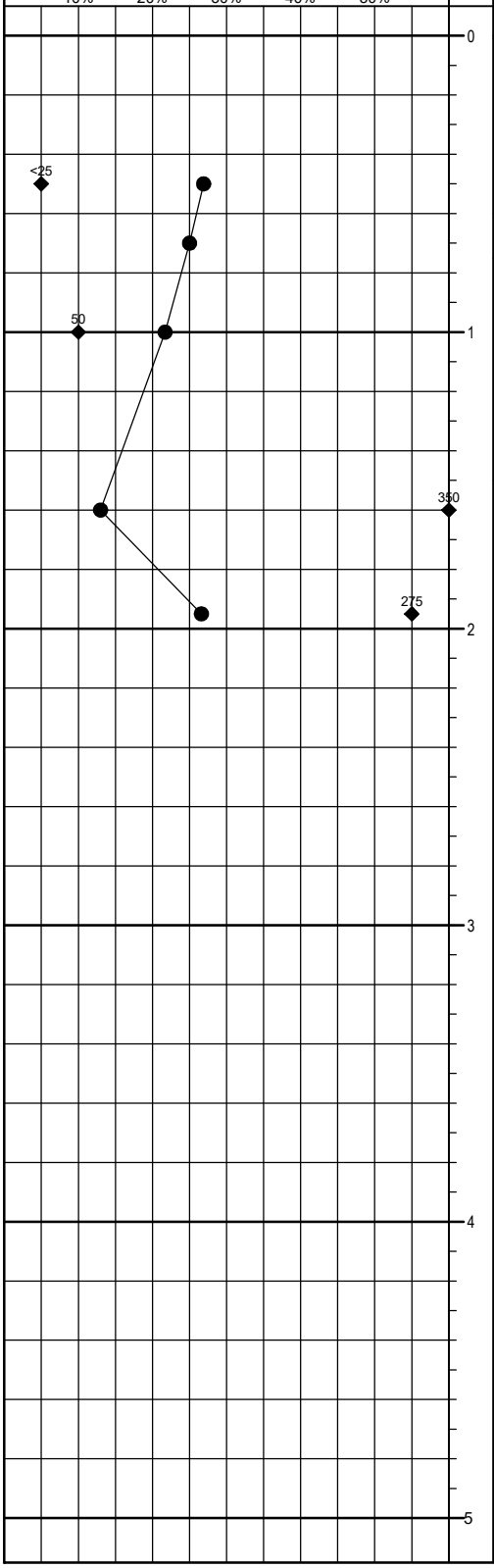
LOCATION: 10U 528371E 5966870N

SURFACE ELEVATION (m): 701.2

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.

50 100 150 200 250 kPa

WATER CONTENT
W_P 10% 20% 30% W_N 40% W_L 50%



DEPTH (m) | SYMBOL | SAMPLES

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	
0.01	701.19	ORGANICS, moss and leaves.
		CLAY, gravelly, trace sand, very soft, intermediate plasticity, dark brown, numerous roots and rootlets, Wp<Wn<Wl (FILL).
0.6	700.6	
0.75	700.45	SAND, and gravel, trace fines, loose to compact, light brown, damp (FILL).
		SILT, some gravel, some sand, trace clay, firm, low plasticity, light brown, isolated roots, cobbles, isolated plastic debris, Wn>Wp (FILL).
1.5	699.7	
		CLAY, silty, some gravel, trace sand, very stiff, low to intermediate plasticity, light brown, Wn≈Wp.
2.0	699.2	
		End of test pit at 2.0 m. No seepage observed. Bedrock not encountered. Test pit walls did not slough.

COMMENTS

PLATE NO. 5366 - B3

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Tel. 250-564-4304 Fax 250-564-9323

TEST PIT LOG

HOLE NO: TP20-04

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

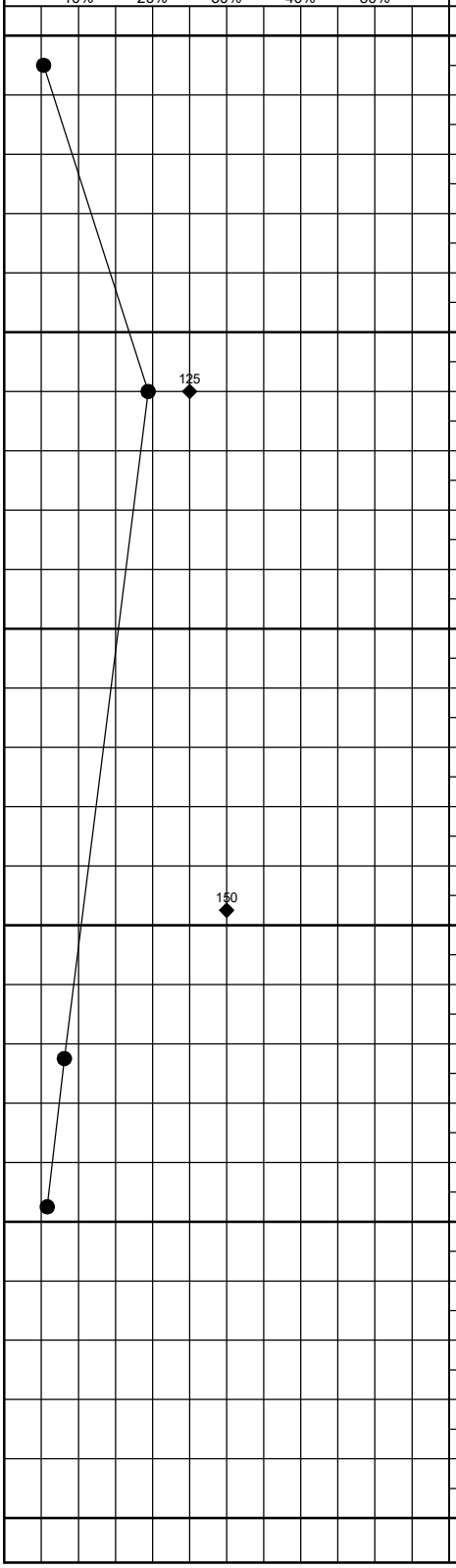
LOGGED: ML | FILE NO: K-5366 | EXCAVATOR: CAT 512D | DATE OF INVEST: 2020/05/26

LOCATION: 10U 528320E 5966957N

SURFACE ELEVATION (m): 700.2

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%



SYMBOL

SAMPLES

SOIL DESCRIPTION

DEPTH (m)		ELEV (m)	COMMENTS
	GRAVEL, sandy, trace fines, no visible structure, compact, brown, damp (FILL).		
0.2		700.0	
	GRAVEL, sandy, some fines, no visible structure, compact, black, angular, damp (FILL).		
0.7	- geotextile at 0.7 m.	699.5	
	CLAY, some gravel, some sand, no visible structure, firm, intermediate plasticity, blue grey, frequent plastic, wood and organic debris, Wp<Wn<WI (FILL) (Municipal Solid Waste).		
1.7		698.5	
	Plastic, wood and metal debris, no soil noted (FILL) (Municipal Solid Waste).		
2.9		697.3	
	CLAY, some gravel, some sand, no visible structure, stiff, intermediate plasticity, blue green, occasional rootlets, isolated wood, WP<Wn<WI (FILL).		
3.4		696.8	
	SAND, some gravel, trace fines, no visible structure, loose to compact, blue grey, moist.		- Grain Size Analysis, See Plate 5366-C1
4.0		696.2	
	End of test pit at 4.0 m. No seepage observed. Bedrock not encountered. Test pit walls did not slough.		

PLATE NO. 5366 - B4

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TEST PIT LOG

HOLE NO: TP20-05

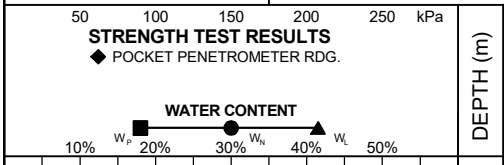
CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: ML | FILE NO: K-5366 | EXCAVATOR: CAT 512D | DATE OF INVEST: 2020/05/26

LOCATION: 10U 528336E 5966927N

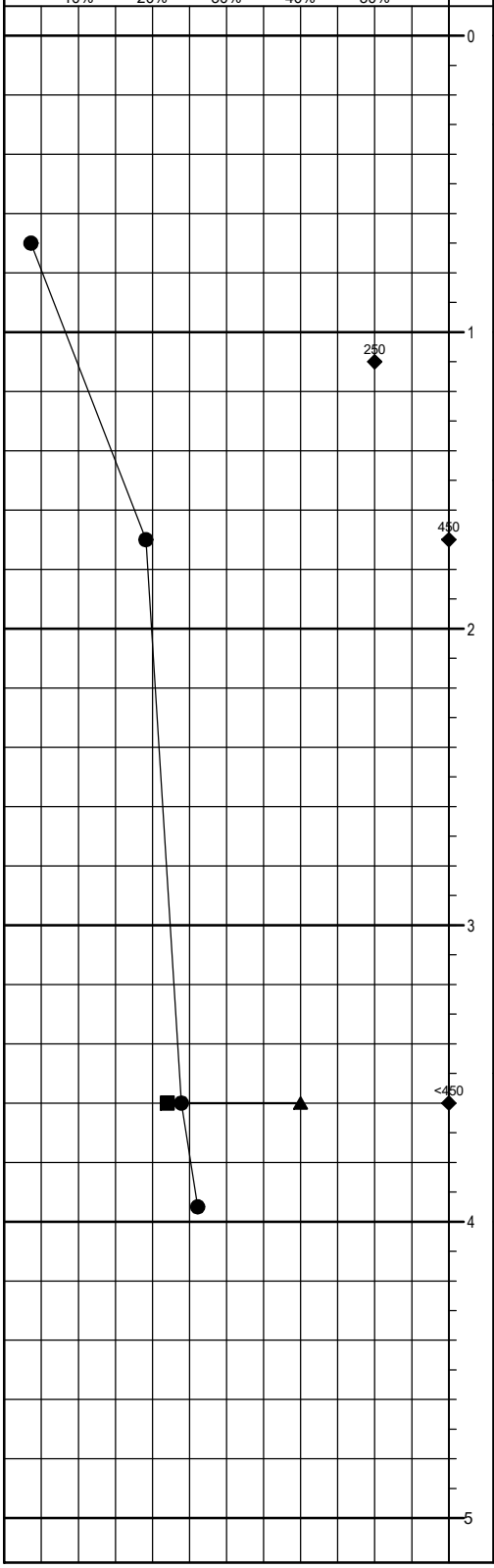
SURFACE ELEVATION (m): 699.8



DEPTH (m) | SYMBOL | SAMPLES

SOIL DESCRIPTION

DEPTH (m)		ELEV (m)
	GRAVEL, sandy, trace fines, no visible structure, compact, brown, damp (FILL).	
0.3		699.5
	GRAVEL, sandy, some fines, no visible structure, compact, black, angular, damp (FILL).	
1.0	- geotextile at 1.0 m.	698.8
	CLAY, gravelly, sandy, no visible structure, very stiff, intermediate plasticity, brown, numerous cobbles, isolated pieces of glass and plastic, Wp<Wn<WI (FILL) (Municipal Solid Waste).	
1.5		698.3
	CLAY, some gravel, trace sand, no visible structure, hard, intermediate plasticity, blue grey, occasional wood, plastic and metal debris, Wn<Wp (FILL) (Municipal Solid Waste).	
3.5		696.3
	CLAY, and silt, trace gravel, hard, low to intermediate plasticity, light brown, isolated rootlets, Wn<Wp.	
4.0		695.8
	End of test pit at 4.0 m. No seepage observed. Bedrock not encountered. Test pit walls did not slough.	



COMMENTS

PLATE NO. 5366 - B5

GEONORTH ENGINEERING LTD
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Tel. 250-564-4304 Fax 250-564-9323

TEST PIT LOG

HOLE NO: TP20-06

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: ML | FILE NO: K-5366 | EXCAVATOR: CAT 512D | DATE OF INVEST: 2020/05/26

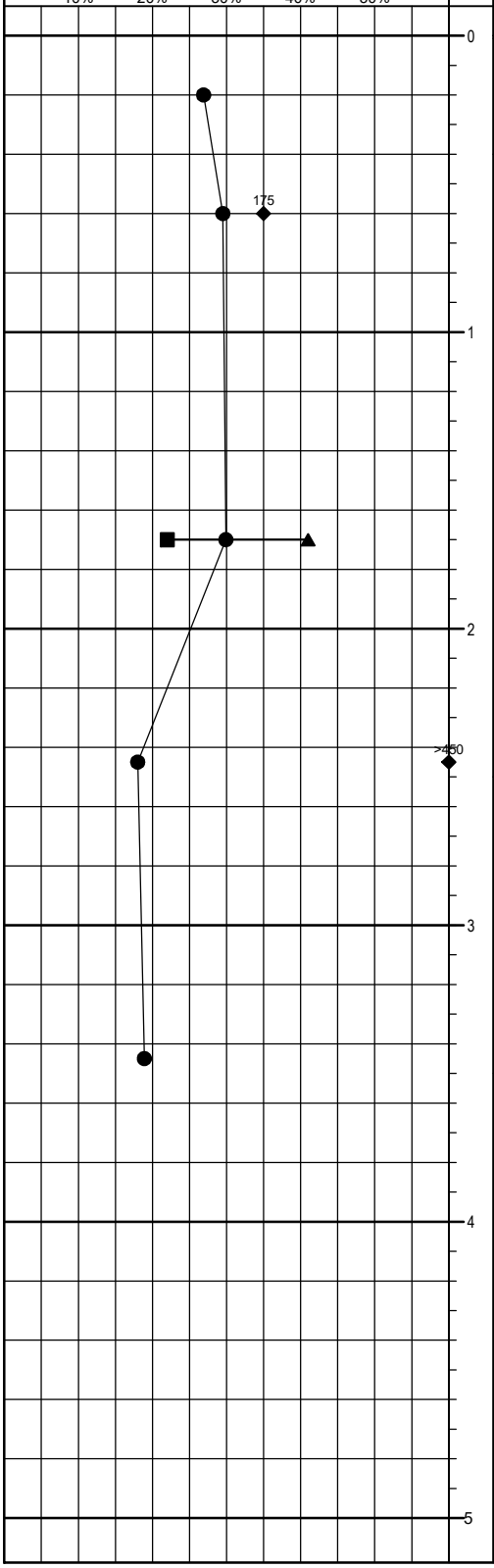
LOCATION: 10U 528273E 5966994N

SURFACE ELEVATION (m): 694.4

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.

50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%



SYMBOL

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	
0.01	694.39	Leaves and moss.
0.4	694.0	CLAY, trace sand, trace gravel, no visible structure, very soft, high plasticity, brown, frequent roots and rootlets, Wp<Wn<Wl.
2.5	691.9	CLAY, silty, trace gravel, trace sand, no visible structure, stiff, intermediate plasticity, light brown, isolated roots, Wp<Wn<Wl. - below 1.7 m, occasional cobbles, hard.
3.5	690.9	CLAY, silty, sandy, some gravel, no visible structure, hard, low to intermediate plasticity, light brown, Wp<Wn<Wl (TILL).
		End of test pit at 3.5 m. Seepage at 1.6 m. Bedrock not encountered. Test pit walls did not slough.

SAMPLES

COMMENTS

PLATE NO. 5366 - B6

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TEST PIT LOG

HOLE NO: TP20-07

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: ML | FILE NO: K-5366 | EXCAVATOR: CAT 512D | DATE OF INVEST: 2020/05/27

LOCATION: 10U 528291E 5966963N

SURFACE ELEVATION (m): 697.1

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.

50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%

DEPTH (m) | SYMBOL | SAMPLES

SOIL DESCRIPTION

DEPTH (m) ELEV (m)

0.01 ORGANIC SOIL. 697.09

CLAY, trace gravel, trace sand, firm, intermediate plasticity, light brown, occasional rootlets, Wp<Wn<Wl (FILL).

0.6 696.5

CLAY, stiff, intermediate plasticity, black, frequent wood, metal and plastic debris, damp (FILL) (Municipal Solid Waste).

3.0 694.1

End of test pit at 3.0 m.
No seepage observed.
Bedrock not encountered.
Test pit walls sloughed.

COMMENTS

PLATE NO. 5366 - B7

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Tel. 250-564-4304 Fax 250-564-9323

TEST PIT LOG

HOLE NO: TP20-08

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: ML | FILE NO: K-5366 | EXCAVATOR: CAT 512D | DATE OF INVEST: 2020/05/27

LOCATION: 10U 528313E 5966925N

SURFACE ELEVATION (m): 697.3

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%

DEPTH (m) | SYMBOL | SAMPLES | COMMENTS

SOIL DESCRIPTION

DEPTH (m)		ELEV (m)
0.02	ORGANIC SILT, brown, frequent rootlets.	697.29
	CLAY, stiff, intermediate plasticity, black, frequent wood, metal and plastic debris, damp (FILL) (Municipal Solid Waste).	
1.3		696.0
	Potential clay liner, no visible structure, intermediate plasticity, blue grey, isolated garbage, Wp<Wn<Wl (FILL).	
1.8		695.5
	CLAY, stiff, intermediate plasticity, black, frequent wood, metal and plastic debris, damp (FILL) (Municipal Solid Waste).	
2.3		695.0
	End of test pit at 2.3 m. Seepage at 2.0 m. Bedrock not encountered. Test pit walls sloughed at 1.5 m.	

PLATE NO. 5366 - B8

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

TEST PIT LOG

HOLE NO: TP20-09

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: ML | FILE NO: K-5366 | EXCAVATOR: CAT 512D | DATE OF INVEST: 2020/05/27

LOCATION: 10U 528333E 5966884N

SURFACE ELEVATION (m): 693.3

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%

DEPTH (m) | SYMBOL | SAMPLES

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	
0.15	693.15	ORGANIC SILT, some sand, brown, frequent rootlets, moist (TOPSOIL).
2.8	690.5	CLAY, silty, trace gravel, firm, intermediate plasticity, dark brown, frequent plastic and metal debris, frequent organics, WP<Wn<WI (FILL) (Municipal Solid Waste).

End of test pit at 2.8 m.
No seepage observed.
Bedrock not encountered.
Test pit walls sloughed at 2.5 m.

COMMENTS

PLATE NO. 5366 - B9

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

TEST PIT LOG

HOLE NO: TP20-10

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: ML | FILE NO: K-5366 | EXCAVATOR: CAT 512D | DATE OF INVEST: 2020/05/27

LOCATION: 10U 528306E 5966895N

SURFACE ELEVATION (m): 695.0

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%

DEPTH (m) | SYMBOL | SAMPLES

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	
0.05	694.95	ORGANIC SILT, some sand, dark brown, numerous rootlets, moist (TOPSOIL).
		CLAY, silty, trace gravel, soft, intermediate plasticity brown, frequent rootlets, frequent plastic and metal debris, frequent organic material, Wn<Wp (FILL) (Municipal Solid Waste).
3.0	692.0	

End of test pit at 3.0 m.
Seepage at 2.0 m.
Bedrock not encountered.
Test pit walls sloughed below 2.5 m.

COMMENTS

PLATE NO. 5366 - B10

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

TEST PIT LOG

HOLE NO: TP20-11

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: ML | FILE NO: K-5366 | EXCAVATOR: CAT 512D | DATE OF INVEST: 2020/05/27

LOCATION: 10U 528290E 5966932N

SURFACE ELEVATION (m): 694.6

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%

DEPTH (m) | SYMBOL | SAMPLES

SOIL DESCRIPTION

DEPTH (m)		ELEV (m)
0	ORGANIC SILT, brown, numerous rootlets, moist.	
0.15		694.45
	CLAY mixed with frequent wood, metal and plasic debris (FILL) (Municipal Solid Waste).	
3.0		691.6
	End of test pit at 3.0 m. Seepage at 1.8 m. Bedrock not encountered. Test pit walls sloughed below 0.5 m.	

COMMENTS

PLATE NO. 5366 - B11

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

TEST PIT LOG

HOLE NO: TP20-12

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: ML | FILE NO: K-5366 | EXCAVATOR: CAT 512D | DATE OF INVEST: 2020/05/27

LOCATION: 10U 528274E 5966912N

SURFACE ELEVATION (m): 689.7

STRENGTH TEST RESULTS
50 100 150 200 250 kPa
◆ POCKET PENETROMETER RDG.

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%

DEPTH (m) | SYMBOL | SOIL DESCRIPTION | SAMPLES | COMMENTS

DEPTH (m)	ELEV (m)
0	689.7

CLAY, some gravel, frequent debris, potential clay cap (blue green clay) at 1.0 m (FILL) (Municipal Solid Waste).

DEPTH (m)	ELEV (m)
1.5	688.2

End of test pit at 1.5 m.
Seepage at 1.0 m.
Bedrock not encountered.
Test pit walls sloughed below 0.5 m.

PLATE NO. 5366 - B12

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

TEST PIT LOG

HOLE NO: TP20-13

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: ML | FILE NO: K-5366 | EXCAVATOR: CAT 512D | DATE OF INVEST: 2020/05/27

LOCATION: 10U 528320E 5966964N

SURFACE ELEVATION (m): 700.4

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.

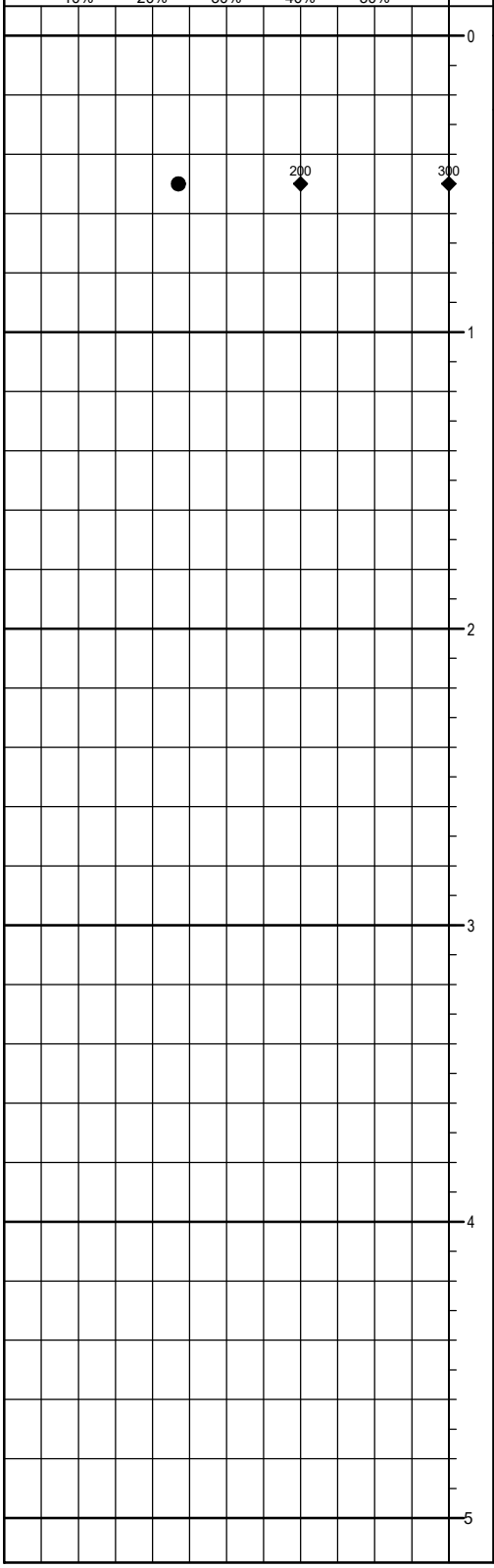
50 100 150 200 250 kPa

WATER CONTENT
W_P 10% 20% 30% W_N 40% W_L 50%

DEPTH (m) | SYMBOL | SAMPLES

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	
		GRAVEL, sandy, trace fines, compact, brown, damp (FILL).
0.25	700.15	
		CLAY, silty, no visible structure, very stiff, intermediate plasticity, brown, Wn<Wp.
0.7	699.7	
		End of test pit at 0.7 m. No seepage observed. Bedrock not encountered. Test pit walls did not slough.



COMMENTS

PLATE NO. 5366 - B13

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH20-01

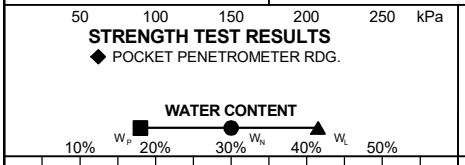
CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: TB | FILE NO: K-5366 | DRILL: Solid Stem Auger | DATE OF INVEST: 2020/07/14

LOCATION: 10U 528312E 5966956N

SURFACE ELEVATION (m): 699.0



SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	SYMBOL	SOIL DESCRIPTION	SPT BLOWS PER 152 mm	SPT 'N' / RECOVERY (mm)
0					
			GRAVEL, sandy, trace fines, compact, brown, isolated rootlets, damp (FILL).	9 3 5 5	8/380
1.1	697.9				
			SILT, some clay, trace sand, stiff, intermediate plasticity, brown, Wn<Wp (FILL).	5 6 4 4	10/530
1.8	697.2				
2			CLAY, silty, firm, intermediate plasticity, dark grey, frequent pieces of paper and plastic, damp - at 2.0 m, piece of metal.	3 2 3 3	5/130
2.1	696.9				
			GRAVEL, mixed with paper, wood and metal debris, loose, brown, damp (Municipal Solid Waste).	5 4 6 4	10/160
3			- below 3.0 m, moist to wet.		
4			- at 3.7 m, piece of geotextile over 0.3 m thick layer of silty clay.	15 16 13 15	29/430
4.0	695.0				
			SAND, coarse grained, some gravel, trace fines, compact, brown, moist to wet.	9 12 18 15	30/520
5				9 11 23 18	34/560
6				12 14 18 19	32/580
7					
7.9	691.1			13 25 60 0	85/500
8			GRAVEL, sandy, trace fines, compact to dense, brown, wet.		
8.5	690.5				
9			CLAY, silty, stiff, intermediate plasticity, grey, Wn <Wp.		
10					

(continued on next page)

SAMPLES | SPT BLOWS PER 152 mm | SPT 'N' / RECOVERY (mm) | COMMENTS

PLATE NO. 5366 - B14

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH20-01

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: TB | FILE NO: K-5366 | DRILL: Solid Stem Auger | DATE OF INVEST: 2020/07/14

LOCATION: 10U 528312E 5966956N

SURFACE ELEVATION (m): 699.0

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%

DEPTH (m) | SYMBOL | SAMPLES | SPT, BLOWS PER 152 mm | SPT 'N' / RECOVERY (mm) | COMMENTS

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	
		CLAY, silty, stiff, intermediate plasticity, grey, Wn <Wp. *(continued)*
10.7	688.3	End of drill hole at 10.7 m. Seepage at 3.0 m. Bedrock not encountered.

PLATE NO. 5366 - B15

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH20-02

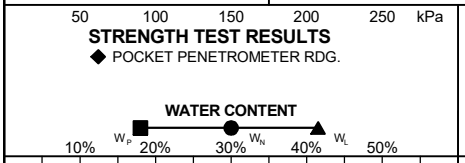
CLIENT: MORRISON HERSHFIELD LIMITED

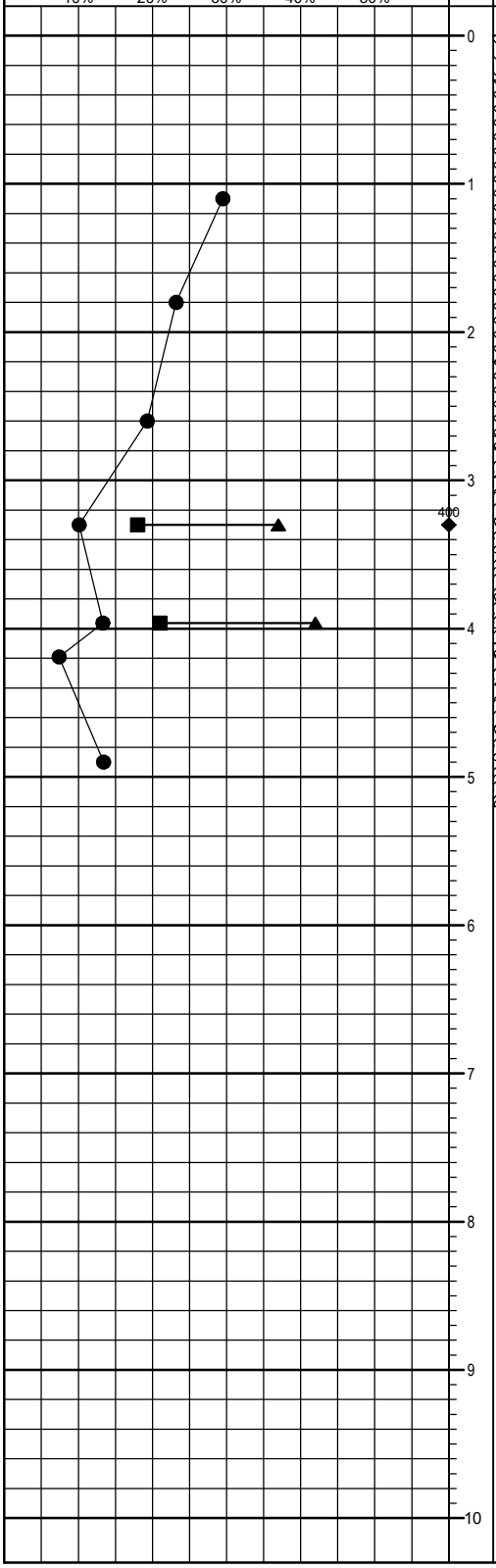
PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: TB | FILE NO: K-5366 | DRILL: Solid Stem Auger | DATE OF INVEST: 2020/07/14

LOCATION: 10U 528328E 5966933N

SURFACE ELEVATION (m): 699.0





SYMBOL

SOIL DESCRIPTION

DEPTH (m)		ELEV (m)	SAMPLES	SPT, BLOWS PER 152 mm	SPT 'N' / RECOVERY (mm)	COMMENTS
0.0	ORGANIC SOIL, clayey, loose, brown, damp.	699.0				
0.3	CLAY, silty, some sand, very soft, brown, frequent plastic, wood and metal debris, damp (Municipal Solid Waste).	698.7		2 1 1 0	2/60	
	- below 1.5 m, gravelly, frequent pieces of wood.			3 4 7 10	11/500	
2.2	CLAY, gravelly, stiff, intermediate plasticity, brown, isolated pieces of plastic, wet (FILL).	696.8		50 0 0 0	Ref/200	
2.7	CLAY, gravelly, hard, intermediate plasticity, brown, Wn<Wp (TILL).	696.3		16 17 18 19	35/530	
	- below 3.7 m, wet.			17 26 27 28	53/510	
4.1	GRAVEL, sandy, some clay, dense, brown, wet (TILL-LIKE).	694.9				
	- below 4.6 m, and clay (TILL).			23 26 28 32	54/100	
5.2	End of drill hole at 5.2 m. Seepage at 3.7 m. Bedrock not encountered.	693.8				

PLATE NO. 5366 - B16

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH20-03

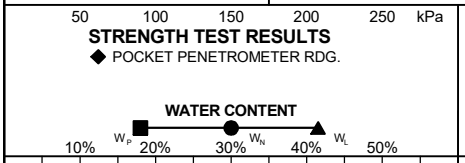
CLIENT: MORRISON HERSHFIELD LIMITED

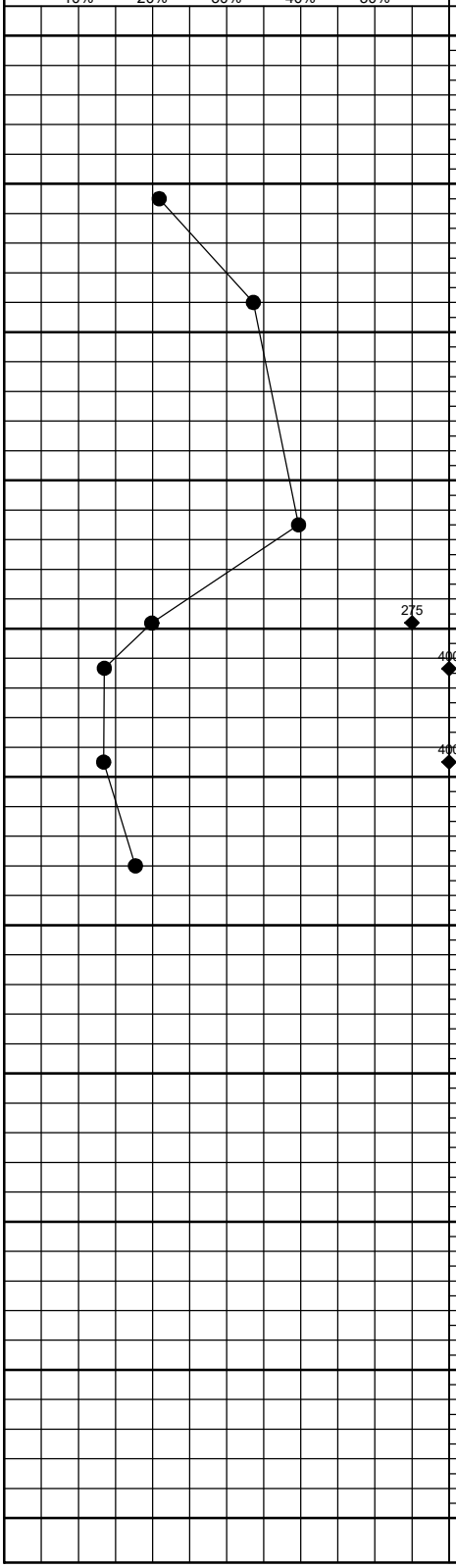
PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: TB | FILE NO: K-5366 | DRILL: Solid Stem Auger | DATE OF INVEST: 2020/07/14

LOCATION: 10U 528339E 5966919N

SURFACE ELEVATION (m): 699.6





DEPTH (m) | SYMBOL | SAMPLES | SPT, BLOWS PER 152 mm | SPT 'N' / RECOVERY (mm) | COMMENTS

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	SOIL DESCRIPTION	SPT, BLOWS PER 152 mm	SPT 'N' / RECOVERY (mm)
		ORGANIC SOIL, clayey, loose, brown, damp.		
0.6	699.0			
		CLAY, silty, soft to stiff, brown, frequent pieces of wood, plastic and metal debris, moist (Municipal Solid Waste).	8, 3, 6, 10	9/50
		- below 1.5 m, soft/loose, wet.	6, 6, 8, 5	14/120
		- at 2.0 m, piece of wood.		
		- below 2.3 m, rubber tire.	60	-/0
		- below 3.0 m, rotten pieces of wood, damp.	1, 2, 2, 4	4/200
3.7	695.9			
		CLAY, silty, very stiff, intermediate plasticity, grey, Wn<Wp.	6, 13, 19, 54	32/680
4.1	695.5			
		CLAY, gravelly, some sand, hard, intermedite plasticity, grey, Wn<Wp (TILL).	30, 36, 51, 54	87/420
		- below 5.3 m, 5 cm lense of coarse sand, wet.	27, 29, 34, 32	63/480
5.9	693.7			
		End of drill hole at 5.9 m. Seepage at 1.7 and 5.3 m. Bedrock not encountered.		

PLATE NO. 5366 - B17

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH20-04

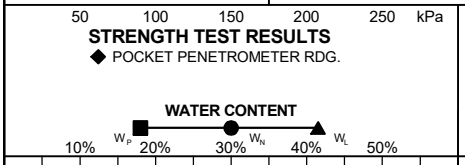
CLIENT: MORRISON HERSHFIELD LIMITED

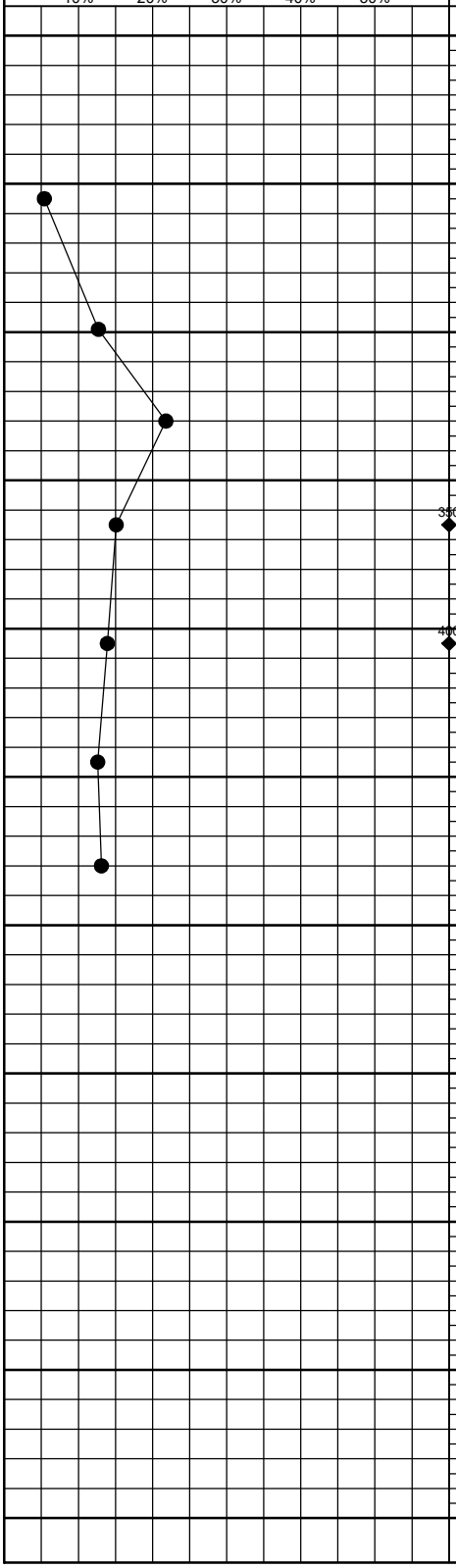
PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: TB | FILE NO: K-5366 | DRILL: Solid Stem Auger | DATE OF INVEST: 2020/07/14

LOCATION: 10U 528360E 5966912N

SURFACE ELEVATION (m): 700.4





SYMBOL

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	SOIL DESCRIPTION
		GRAVEL, sandy, trace fines, compact, brown, damp (FILL).
1.7	698.7	
		CLAY, silty, soft, frequent plastic, wood and metal debris, moist (Municipal Solid Waste).
		- below 2.3 m, piece of wood.
		- below 2.4 m, frequent pieces of fabrics and wood.
3.0	697.4	
		CLAY, silty, gravelly, very stiff, intermediate plasticity, brown, Wn<Wp (TILL).
		- below 4.3 m, hard.
5.9	694.5	
		End of drill hole at 5.9 m. Seepage at 2.1 m. Bedrock not encountered.

SAMPLES	SPT, BLOWS PER 152 mm	SPT 'N' / RECOVERY (mm)
	13 26 39 28	65/260
	12 4 4 5	8/50
	7 2 3 11	5/100
	8 13 15 28	28/500
	20 16 27 60	43/480
	26 34 28 44	62/500
	14 19 27 28	46/310

COMMENTS

PLATE NO. 5366 - B18

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH20-05

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: TB | FILE NO: K-5366 | DRILL: Solid Stem Auger | DATE OF INVEST: 2020/07/14

LOCATION: 10U 528373E 5966903N

SURFACE ELEVATION (m): 700.6

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%

DEPTH (m) | SYMBOL

SOIL DESCRIPTION

DEPTH (m)		ELEV (m)
0.2	ORGANIC SOIL, clayey, loose, brown, damp.	700.4
	CLAY, silty, no visible structure, stiff, intermediate plasticity, brown, Wn<Wp (FILL/disturbed)	
	- below 1.5 m, trace gravel, trace sand.	
2.1		698.5
	SAND, coarse grained, some gravel, some to trace fines, compact, brown, moist.	
3.2		697.4
	CLAY, silty, trace sand, layered, firm, intermediate plasticity, brown, Wn<Wp.	
	- below 3.3 m, grey.	
	- below 3.8 m, frequent fine sand lenses.	
6.1		694.5
	End of drill hole at 6.1 m. Seepage at 3.2 m. Bedrock not encountered.	

SAMPLES	SPT, BLOWS PER 152 mm	SPT 'N' / RECOVERY (mm)	COMMENTS
	4 7 9 14	16/540	
	4 10 14 16	24/580	
	9 11 13 14	24/350	
	14 7 8 10	15/590	
	3 7 10 12	17/510	
	3 1 2 6	3/-	
	5 7 11 11	18/500	

PLATE NO. 5366 - B19

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH20-06

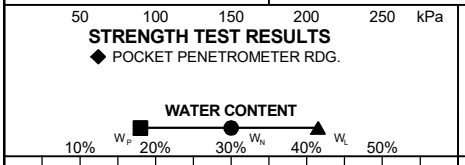
CLIENT: MORRISON HERSHFIELD LIMITED

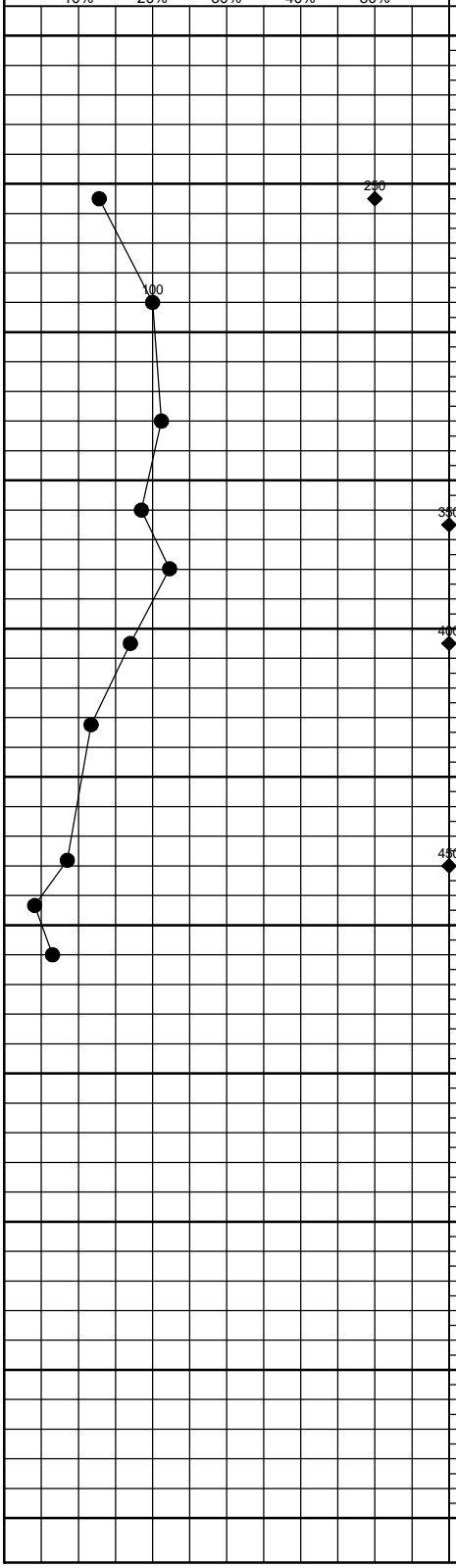
PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: TB | FILE NO: K-5366 | DRILL: Solid Stem Auger | DATE OF INVEST: 2020/07/14

LOCATION: 10U 528364E 5966937N

SURFACE ELEVATION (m): 702.9





DEPTH (m) | SYMBOL | SOIL DESCRIPTION | SAMPLES | SPT, BLOWS PER 152 mm | SPT 'N' / RECOVERY (mm) | COMMENTS

DEPTH (m)	ELEV (m)	SOIL DESCRIPTION	SPT, BLOWS PER 152 mm	SPT 'N' / RECOVERY (mm)
		GRAVEL, sandy, trace fines, compact, brown, isolated cobbles, damp (FILL).		
0.6	702.3			
		CLAY, silty, gravelly, very stiff, intermediate plasticity, brown, Wn<Wp (FILL).	5 6 5 5	11 / 220
		- below 1.5 m, stiff.	3 3 6 8	9 / 300
2.4	700.5			
		SAND, medium grained, some clay, compact, mottled tan brown, isolated peat lenses, wet (FILL).	8 9 13 10	22 / 450
		- below 3.0 m, frequent 5 cm thick lenses of clay.	7 11 10 15	21 / -
3.3	699.6			
		CLAY, silty, layered, very stiff, intermediate plasticity, grey, Wn<Wp.	8 15 30 50	45 / 560
4.3	698.6	- at 4.1 m, isolated 2.5 cm thick lense of medium grained sand.		
		SAND, coarse grained, gravelly, dense, brown, damp.	66	Ref / 200
			8 36 51 33	87 / 560
6.3	696.6		11 50	Ref / 60
		End of drill hole at 6.3 m. Seepage at 2.4 m. Bedrock not encountered.		

PLATE NO. 5366 - B20

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH20-07

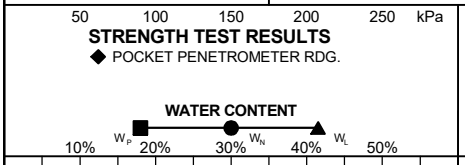
CLIENT: MORRISON HERSHFIELD LIMITED

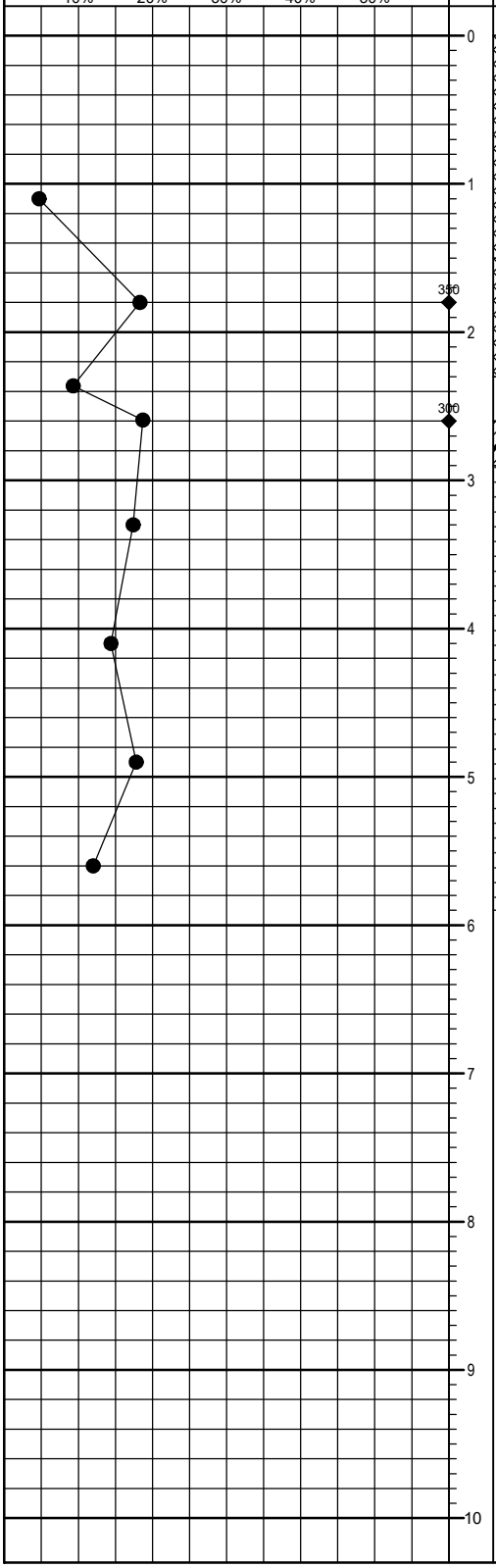
PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: TB | FILE NO: K-5366 | DRILL: Solid Stem Auger | DATE OF INVEST: 2020/07/14

LOCATION: 10U 528356E 5966955N

SURFACE ELEVATION (m): 703.6





SYMBOL

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	SOIL DESCRIPTION	SPT BLOWS PER 152 mm	SPT 'N' / RECOVERY (mm)
0		GRAVEL, sandy, trace fines, brown, frequent cobbles, damp (FILL).		
1.5	702.1			
		CLAY, silty, mottled, very stiff, intermediate plasticity, brown, isolated pockets of sand, Wn<Wp (FILL).	5, 8, 11, 15	19/440
2.3	701.3			
		SAND, coarse grained, gravelly, mottled, compact, tan brown, damp.	23, 31, 17, 14	48/510
2.6	701.0			
		CLAY, silty, some sand, mottled, stiff, intermediate plasicity, brown, isolated rootlets, Wn<Wp.	22, 28, 31, 25	59/600
2.9	700.7			
		SAND, medium to fine grained, trace fines, mottled, compact, brown, wet. - below 3.3 m, frequent 5 to 7.5 cm thick layers of silty clay.	20, 26, 27, 29	53/600
			13, 19, 32, 28	51/600
		- below 5.2 m, coarse grained, gravelly, no silty clay lenses.	15, 34, 51, 50	85/600
5.9	697.7			
		End of drill hole at 5.9 m. Seepage at 2.9 m. Bedrock not encountered.		

SAMPLES | SPT BLOWS PER 152 mm | SPT 'N' / RECOVERY (mm)

COMMENTS

PLATE NO. 5366 - B21

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH20-08

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: TB | FILE NO: K-5366 | DRILL: Solid Stem Auger | DATE OF INVEST: 2020/07/14

LOCATION: 10U 528340E 5966974N

SURFACE ELEVATION (m): 703.4

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.
WATER CONTENT
W_P W_N W_L

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	SOIL DESCRIPTION	SAMPLES	SPT, BLOWS PER 152 mm	SPT 'N' / RECOVERY (mm)	COMMENTS
0		GRAVEL, sandy, trace fines, compact, brown, frequent cobbles, damp (FILL).				
1.5	701.9	CLAY, silty, stiff, intermediate plasticity, brown, frequent peat lenses, Wn<Wp (FILL).		8 9 6 8	15/200	
2.1	701.3	CLAY, silty, hard, intermediate plasticity, varved, brown, Wn<Wp.		10 10 1 18	11/590	
				7 11 13 19	24/500	
				7 10 15 16	25/600	
		- below 4.9 m, grey.		9 13 16 17	29/600	
5.9	697.5	- below 5.8 m, gravelly (TILL-LIKE).		12 20 19 20	39/600	
		End of drill hole at 5.9 m. No seepage observed. Bedrock not encountered.				

PLATE NO. 5366 - B22

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3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH20-09

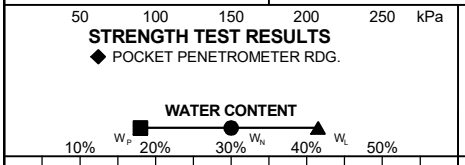
CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: TB | FILE NO: K-5366 | DRILL: Solid Stem Auger | DATE OF INVEST: 2020/07/14

LOCATION: 10U 528287E 5967033N

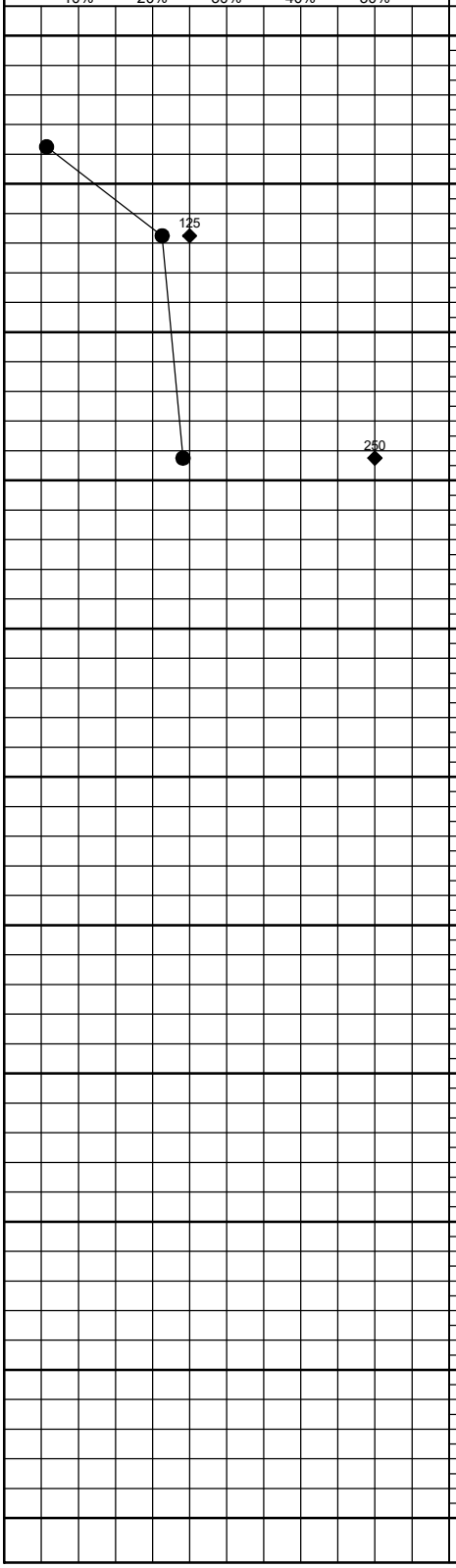
SURFACE ELEVATION (m): 699.9



DEPTH (m) | SYMBOL | SAMPLES

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	
0	699.9	GRAVEL, sandy, trace fines, compact, brown, damp (FILL).
1.1	698.8	CLAY, silty, stiff, intermediate plasticity, brown, isolated rootlets, Wn<Wp.
		- below 1.5 m, very stiff, no rootlets.
3.0	696.9	End of drill hole at 3.0 m. No seepage observed. Bedrock not encountered.



COMMENTS

PLATE NO. 5366 - B23

GEONORTH ENGINEERING LTD
3975 18th Avenue
Prince George, B.C. V2N 1B2
Tel. 250-564-4304 Fax 250-564-9323

DRILL HOLE LOG

HOLE NO: DH20-10

CLIENT: MORRISON HERSHFIELD LIMITED

PROJECT: PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION DL 9095, ALPINE DRIVE REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.

LOGGED: TB | FILE NO: K-5366 | DRILL: Solid Stem Auger | DATE OF INVEST: 2020/07/14

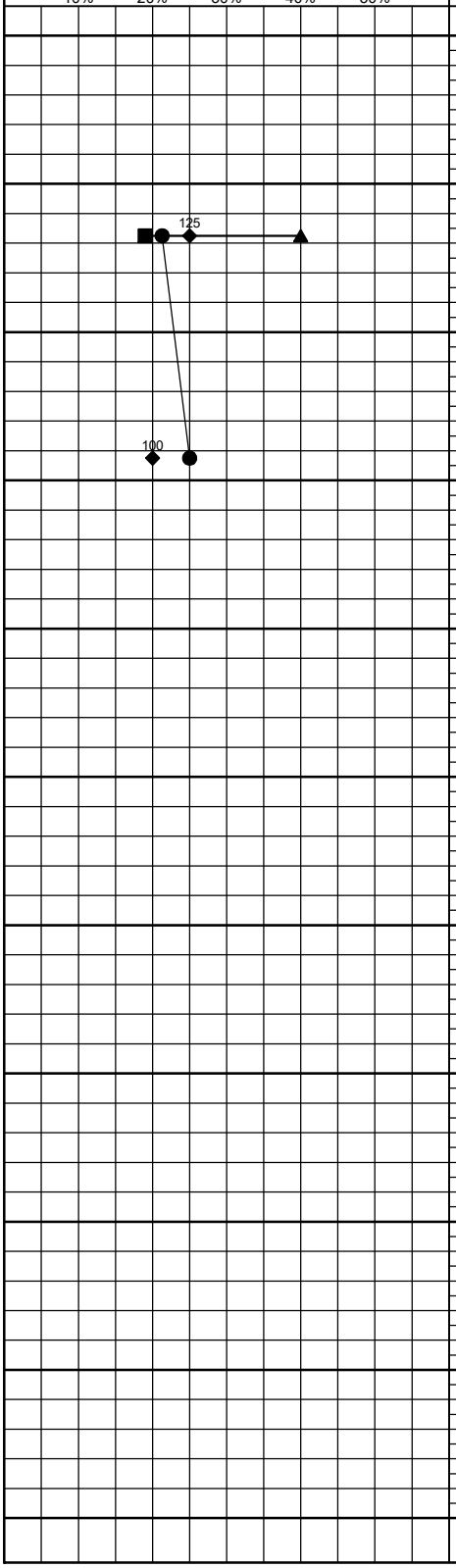
LOCATION: 10U 528262E 5967054N

SURFACE ELEVATION (m): 696.8

STRENGTH TEST RESULTS
◆ POCKET PENETROMETER RDG.

50 100 150 200 250 kPa

WATER CONTENT
10% W_P 20% 30% W_N 40% W_L 50%



DEPTH (m) | SYMBOL | SAMPLES | COMMENTS

SOIL DESCRIPTION

DEPTH (m)	ELEV (m)	
		ORGANIC SOIL, sandy, loose, brown, damp.
0.6	696.2	
		CLAY, silty, stiff, intermediate plasticity, brown, Wn<Wp.
3.0	693.8	
		End of drill hole at 3.0 m. No seepage observed. Bedrock not encountered.

PLATE NO. 5366 - B24

EXPLANATION OF TERMS AND SYMBOLS USED ON DRILL HOLE & TEST PIT LOGS

SOIL DESCRIPTION

Soil is classified is based on the Unified Soil Classification System (ASTM D2487) and the Canadian Foundation Engineering Manual 4th Edition (2006). Descriptions for each soil type encountered are divided by contact lines at interface depths. Each description has a corresponding graphic symbol which relates to soil type.

Major Soil Division
The major soil division is the main fraction of soil and constitutes at least 35% by weight. Soil is classified as GRAVEL, SAND, CLAY, SILT or ORGANIC according to the criteria on page 3.

Interpretation
Where applicable, a bracketed term such as (FILL) or (TILL) is included to describe soil genesis.

Grain Size and Shape
Grain size descriptions for soil follow the criteria on page 3
The shape of coarse and oversized particles is described as:

angular – sharp corners
subangular – slightly rounded corners
subrounded – no angular corners
rounded – smooth rounded surface
platy – flat, plate shaped

Soil Composition
The following terms are used to describe the percentage of soil components by weight based on laboratory sieve analyses or field estimates.

Descriptive Term		Percentage Passing
"and"	and sand, and gravel, etc.	>35%
"___y"	clayey, sandy, etc.	20 to 35%
"some"	some silt, some gravel, etc.	10 to 20%
"trace"	trace of sand, trace of silt, etc.	0 to 10%

The amount of cobbles and boulders, in increasing proportion, are described as:
isolated < occasional < frequent < numerous.

Compactness and Consistency
The following terms are used to describe the compactness of cohesionless soil based on the Standard Penetration Test (SPT) or field estimates:

Descriptive Term	SPT 'N' Value
very loose	0 to 4
loose	4 to 10
compact	10 to 30
dense	30 to 50
very dense	over 50

The following terms are used to describe the consistency of fine grained soils based on unconfined compressive strength as determined by field or laboratory tests, or estimates:

Descriptive Term	Unconfined Compressive Strength (kPa)
very soft	<25
soft	25 to 50
firm	50 to 100
stiff	100 to 200
very stiff	200 to 400
hard	>400

Structure
Soil macrostructure and microstructure are described.

Plasticity
Plasticity of fine grained soil is estimated or determined from Atterberg Limit tests based on the plasticity chart on page 3.

EXPLANATION OF TERMS AND SYMBOLS USED ON DRILL HOLE & TEST PIT LOGS

SOIL DESCRIPTION (cont'd)

Colour and Odour
Colour and odour of soil is described, especially where it may indicate organic inclusions or give evidence of soil contamination.

Inclusions
The quantity of inclusions is described using the same relative–amount terms used for cobbles and boulders, noted above.

Water Content
Soil moisture, in increasing amount, is subjectively described as:
dry < damp < moist < wet < saturated < excess water.

SOIL SAMPLES

Graphic symbols indicate the depth and condition of soil samples:

 Disturbed

 Undisturbed

Undisturbed samples may be taken with tubes, from blocks or by coring. All other types of samples are disturbed.

FIELD TESTS

Standard Penetration Test (SPT) (ASTM D1586)
The SPT results are reported as the 'N' value at the appropriate depth. The 'N' value denotes the number of blows of a 63.5 kg hammer, freely dropping 760 mm, required to drive a 50.8 mm diameter split–spoon sampler from 150 mm to 460 mm into the bottom of a drill hole.

Dynamic Penetration Test (DPT)
Dynamic penetration test results are shown graphically. The number of blows required to drive a 50.8 mm diameter cone 305 mm is shown opposite the depth. The method of driving the cone is the same as for the SPT test described above.

Field Vane Test (FVT) (ASTM D2573–72)
Undrained shear strength of cohesive soil is measured using a 100 mm long by 50 mm diameter vane. Test results for peak and residual strengths are graphically reported at the appropriate depths using the following symbols:

 Peak Shear Strength
Residual Shear Strength

Pocket Penetrometer and Torvane Tests
The pocket penetrometer and torvane provide an indication of a soil's unconfined compressive strength and undrained shear strength, respectively. Pocket penetrometer results are shown graphically using ◊ symbols. Torvane results are reported using the same symbols used for the field vane test.

LABORATORY TESTS

The following symbols are used to denote laboratory test results:

○	Natural water content, w_N (ASTM D2216)
□	Atterberg Plastic Limit, w_P (ASTM D424)
△	Atterberg Liquid Limit, w_L (ASTM D423)
MA	Mechanical grain size (sieve) analysis or hydrometer test, or both (ASTM D422)
qu	Unconfined compressive strength test on an undisturbed sample (ASTM D2166)
SO_4	Test for concentration of water–soluble sulphates
γ	Unit weight of soil or rock
γ_d	Dry unit weight of soil or rock

COMMENTS

Groundwater conditions are indicated using the following symbols:

 groundwater table
seepage

Comments often included are additional test results, drilling progress, monitoring equipment installation details and other relevant information.

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SOIL CLASSIFICATION DESCRIPTION

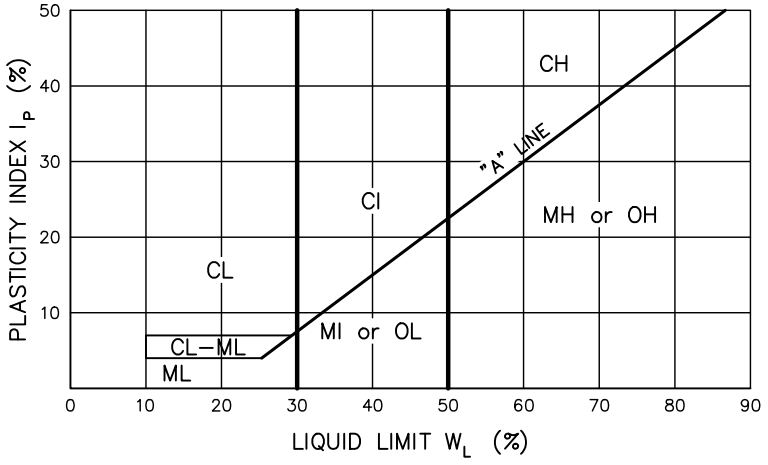
MAJOR DIVISION			GROUP SYMBOL	GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE-GRAINED SOIL	GRAVEL 4.75 – 75.0 mm DIAMETER	CLEAN GRAVEL	GW		WELL-GRADED GRAVEL AND SANDY GRAVEL MIXTURES WITH LESS THAN 5% FINES.	$C_u = \frac{D_{60}}{D_{10}} > 6,\ C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$
			GP		POORLY-GRADED GRAVEL AND SANDY GRAVE MIXTURES WITH LESS THAN 5% FINES.	NOT MEETING ABOVE REQUIREMENTS.
		DIRTY GRAVEL	GM		SILTY GRAVEL AND SILT-SAND-GRAVEL MIXTURES WITH MORE THAN 15% FINES.	ATTERBERG LIMITS BELOW "A" LINE.
			GC		CLAYEY GRAVEL AND CLAY-SAND-GRAVEL MIXTURES WITH MORE THAN 15% FINES.	ATTERBERG LIMITS ABOVE "A" LINE.
	SAND 0.075 – 4.75 mm DIAMETER	CLEAN SAND	SW		WELL-GRADED SAND AND GRAVELLY SAND MIXTURES WITH LESS THAN 5% FINES.	$C_u = \frac{D_{60}}{D_{10}} > 6,\ C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$
			SP		POORLY-GRADED SAND AND GRAVELLY SAND MIXTURES WITH LESS THAN 5% FINES.	NOT MEETING ABOVE REQUIREMENTS.
		DIRTY SAND	SM		SILTY SAND AND SILT-GRAVEL-SAND MIXTURES WITH MORE THAN 15% FINES.	ATTERBERG LIMITS BELOW "A" LINE.
			SC		CLAYEY SAND AND CLAY-GRAVEL-SAND MIXTURES WITH MORE THAN 15% FINES.	ATTERBERG LIMITS ABOVE "A" LINE.
FINE-GRAINED SOIL	SILT BELOW "A" LINE ON PLASTICITY CHART NEGLIGIBLE ORGANIC CONTENT		ML		INORGANIC SILT, VERY FINE SAND, ROCK FLOUR, AND SANDY SILT OF LOW PLASTICITY.	SEE PLASTICITY CHART BELOW
			MI		INORGANIC SILT OF INTERMEDIATE PLASTICITY.	
			MH		INORGANIC SILT AND MICACEOUS OR DIATOMACEOUS SOIL OF HIGH PLASTICITY.	
	CLAY ABOVE "A" LINE ON PLASTICITY CHART NEGLIGIBLE ORGANIC CONTENT		CL		INORGANIC CLAY OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAY, 'LEAN' CLAY.	
			CI		INORGANIC CLAY OF INTERMEDIATE PLASTICITY, SILTY CLAY.	
			CH		INORGANIC CLAY OF HIGH PLASTICITY, 'FAT' CLAY.	
	ORGANIC SILT & CLAY BELOW "A" LINE ON PLASTICITY CHART		OL		ORGANIC SILT OR CLAY OF LOW PLASTICITY.	
			OH		ORGANIC SILT OR CLAY OF HIGH PLASTICITY.	
HIGHLY ORGANIC SOIL			Pt		PEAT AND OTHER HIGHLY ORGANIC SOIL.	HIGH ORGANIC CONTENT AND FIBROUS TEXTURE.

GRAIN SIZE

Coarse-grained soil and silt is identified on the basis of grain size diameter as follows:

SILT & CLAY:		< 0.075 mm
SAND:	Fine	0.075 – 0.425 mm
	Medium	0.425 – 2.00 mm
	Coarse	2.00 – 4.75 mm
GRAVEL:	Fine	4.75 – 19.0 mm
	Coarse	19.0 – 75.0 mm
COBBLES:		75.0 – 300 mm
BOULDERS:		> 300 mm

PLASTICITY CHART



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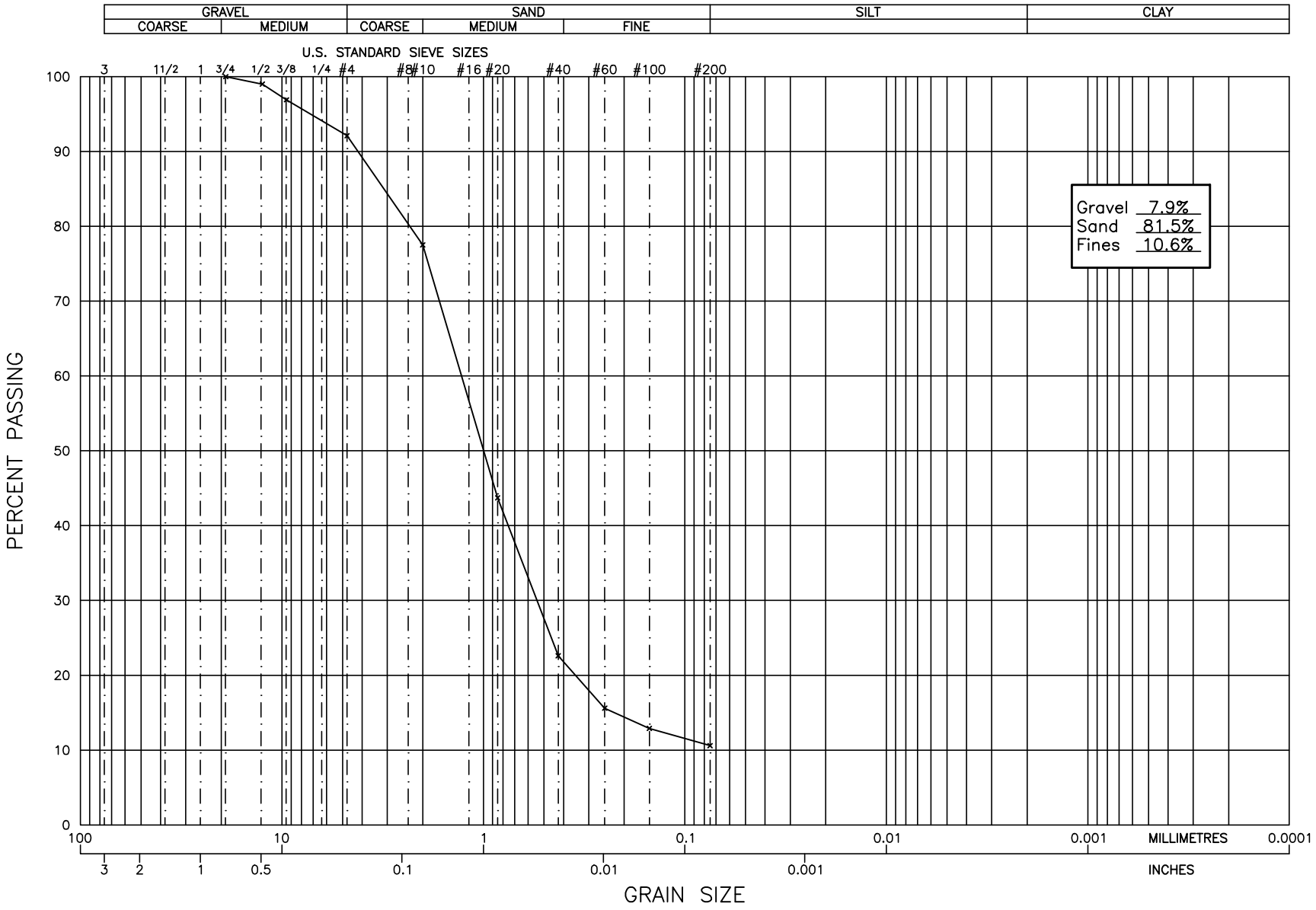
APPENDIX C



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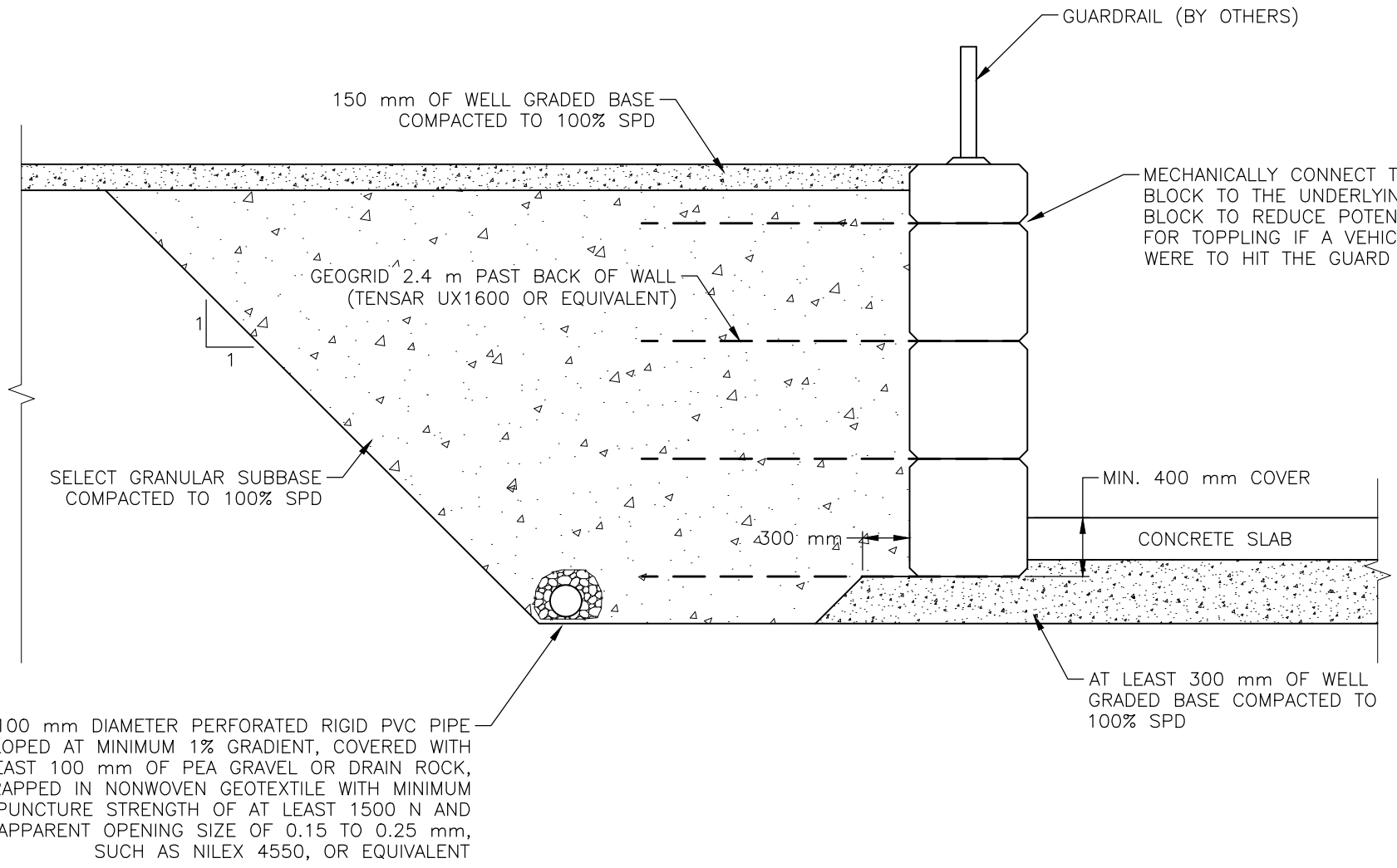
MORRISON HERSHFIELD LIMITED
PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION, DL 9095, ALPINE DRIVE
REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.
GRAIN SIZE ANALYSIS OF TP20-04, 3.4 m DEPTH

PROJECT NO. K-5366

PLATE NO. 5366-C1

APPENDIX D



Note: Drawing is included for information purposes only and is to be interpreted with the corresponding Geotechnical Report.

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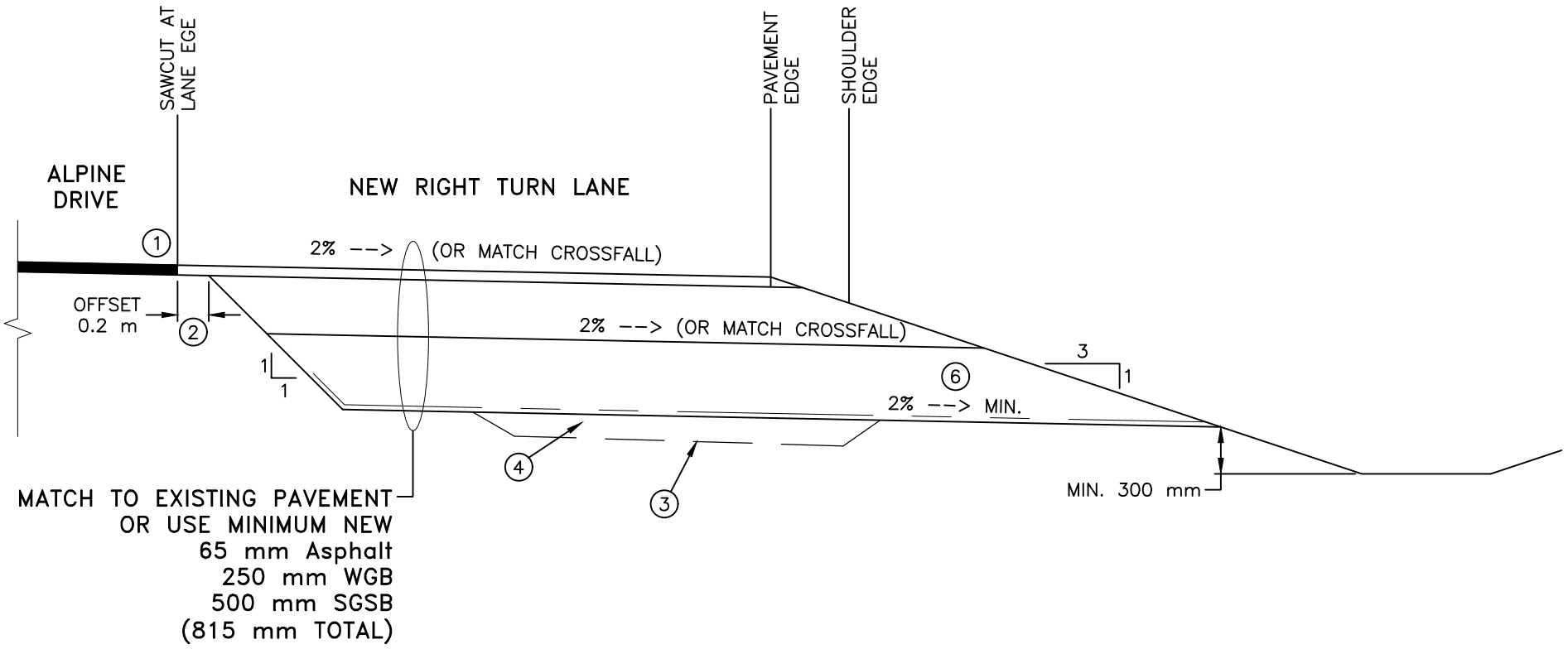
MORRISON HERSHFIELD LIMITED
PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION, DL 9095, ALPINE DRIVE
REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.
SCHEMATIC DESIGN OF LOCK BLOCK RETAINING WALL

SCALE: N.T.S.	DATE: 2020/09/18
DRAWN BY: LU	REVIEWED BY: DJM
PROJECT NO: K-5366	DWG NO: 5366-D1



NOTES:

(1) MAKE CUT LINE AT 0.2 m AWAY FROM EDGE OF EXISTING PAVEMENT.

(2) FROM CUT LINE, OFFSET RIGHT 0.2 m AND EXCAVATE DOWN AT 1H:1V TO THE TOP OF THE NEW SUBGRADE AT 815 mm DEPTH.

(3) AS REQUIRED, SUBEXCAVATE TO REMOVE SOFT SOIL FROM EXISTING DITCH OR WET AREA.

(4) FILL DITCH BOTTOM WITH A GRADATION SIMILAR TO SUBGRADE SOIL OR USE SGSB.

(5) SLOPE SUBGRADE AT 2% CROSSFALL TO OUTSIDE EVERYWHERE, AND ALL OTHER COMPONENTS AT 2% OR TO MATCH.

Note: Drawing is included for information purposes only and is to be interpreted with the corresponding Geotechnical Report.

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MORRISON HERSHFIELD LIMITED
PROPOSED RECONSTRUCTION OF CUMMINGS ROAD REGIONAL TRANSFER STATION, DL 9095, ALPINE DRIVE, REGIONAL DISTRICT OF FRASER-FORT GEORGE, B.C.
PROPOSED RIGHT TURN LANE

SCALE: N.T.S.	DATE: 2020/09/18
DRAWN BY: LU	REVIEWED BY: DJM
PROJECT NO: K-5366	DWG NO: 5366-D2

APPENDIX E

TP20–01

TP20–02

TP20–03

TP20–04

TP20–05

TP20–06

Note: Photo Plate is included for information purposes only and is to be interpreted with the corresponding Geotechnical Report.

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MORRISON HERSHFIELD LIMITED
PROPOSED RECONSTRUCTION OF
CUMMINGS ROAD REGIONAL TRANSFER STATION
DL 9095, ALPINE DRIVE
REGIONAL DISTRICT OF FRASER–FORT GEORGE, B.C.
SITE PHOTOGRAPHS
FILE No. K–5366 PLATE No. 5366–E1

TP20–07

TP20–08

TP20–09

TP20–10

TP20–11

TP20–13

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DL 9095, ALPINE DRIVE
REGIONAL DISTRICT OF FRASER–FORT GEORGE, B.C.
SITE PHOTOGRAPHS
FILE No. K–5366 PLATE No. 5366–E2