REQUEST FOR PROPOSAL No. 24-034

French Creek Pollution Control Centre
Morningstar Creek Crossing
Arch Culvert and MSE Wall Design and Supply

ISSUED: May 13, 2024

CLOSING DATE AND TIME:
Submissions must be received on or before:
3:00 PM (15:00 hrs) Local Time on May 23, 2024

Submissions and Questions are to be directed to:

Rob Wood, Project Engineer
Regional District of Nanaimo
French Creek Pollution Control Centre
957 Lee Road
Parksville, BC V9P 1Z4
250-713-6356
rwood@rdn.bc.ca

Questions are requested at least five (5) business days before the closing date

Proposals will not be opened in public

Instructions to Proponents

The Regional District of Nanaimo (RDN) invites qualified firms to submit a proposal to design and supply an open-bottom corrugated steel-plate arch culvert with precast concrete foundations and vegetated MSE headwalls to replace the existing concrete bridge across Morningstar Creek at the French Creek Pollution Control Centre (FCPCC) as set forth in this Request for Proposal (RFP).

Closing Date / Time / Submission Method

Submissions must be received on or before **3:00 PM (15:00 hrs), Local Time, on May 23, 2024**.

Submission Method:

By Email: In PDF format with "**RFP No. 24-034 FCPCC Morningstar Creek Crossing Arch Culvert and MSE Wall**" as the subject line at this electronic address: rwood@rdn.bc.ca

Please note: Maximum email file size limit is 20MB, or less. The Regional District of Nanaimo (RDN) will not be liable for any technological delays of submissions.

Submissions received in any other manner will not be accepted.

Amendment to Proposals

Proposals may be amended in writing and sent via email to the RDN contact person identified on the cover page on or before the closing. Such amendments should be signed by the authorized signatory of the Proponent.

Addenda

If the RDN determines that an amendment is required to this RFP, the RDN will post the Addendum on the RDN (www.rdn.bc.ca/current-bid-opportunities) and BC Bid (www.bcbid.gov.bc.ca) websites. Each addendum will be incorporated into and become part of the RFP. No amendment of any kind to the RFP is effective unless it is contained in a written addendum issued by the RDN. It is the sole responsibility of the Proponent to check and ensure all amendments are included prior to submitting their final Proposal submission.

Withdrawal of Proposals

The Proponent may withdraw their Proposal at any time by submitting a written withdrawal email to the RDN contact person identified on the cover page on or before the closing.

Unsuccessful Vendors

The RDN will offer debriefings to unsuccessful Proponents, on request, at a mutually agreeable time.

1. INTRODUCTION

The purpose of this Request for Proposal (RFP) is to solicit submissions from qualified firms to design and supply an open-bottom corrugated steel-plate arch culvert with precast concrete foundations and vegetated MSE headwalls to replace the existing concrete bridge across Morningstar Creek at the French Creek Pollution Control Centre (FCPCC). The work is in preparation for an expansion of the FCPCC planned to commence several months after completion of the new creek crossing.

2. BACKGROUND

French Creek Pollution Control Centre Background

Wastewater from approximately 29,000 people and businesses in Qualicum Beach, Parksville and the service areas of French Creek, Pacific Shores, Surfside and Barclay Crescent flows to the French Creek Pollution Control Centre (FCPCC), constructed in 1977. FCPCC also treats septage from septic systems and wastewater from properties with holding tanks.

FCPCC currently provides primary and secondary treatment to remove more than 90% of the biochemical oxygen demand (BOD) and total suspended solids (TSS). Solids removed during the treatment process are treated further to become biosolids. FCPCC treated 3.6 billion litres of wastewater in 2020. Treated wastewater is discharged into the Strait of Georgia 2,440 m offshore at a depth of 61 m.

Expansion Project Background (Not In Scope)

The planned plant expansion project is being delivered using the Integrated Project Delivery (IPD) method and is currently in the Validation phase. The expansion project will construct new secondary treatment facilities on the north side of Morningstar Creek.

Morningstar Creek Crossing Project Background

The existing concrete bridge across Morningstar Creek is required to be replaced for a number of reasons: it is not able to accommodate design storm flows; it has limited load capacity; and it is unable to accommodate the additional linear infrastructure required for the plant expansion project. The RDN has obtained a permit from the Department of Fisheries and Oceans (DFO) to undertake the **in-stream work between August 15 to September 15**.

Geotechnical information on the site is available in **Appendix B**. An additional geotechnical investigation will be undertaken at Morningstar Creek for design of the arch culvert footings. The geotechnical report from the additional investigation is expected to be available by **June 28**, 2024.

3. SCOPE OF SERVICES

The Proponent is required to provide the following services:

1. Design and supply of a corrugated steel-plate arch culvert with precast concrete foundations and all assembly hardware and special installation tools (if any) as further detailed in the drawings contained in **Appendix A**.
2. Design and supply of vegetated MSE headwalls at each end of the arch culvert as detailed in the drawings contained **Appendix A**.

3. Designs for above items to meet the following criteria:

    a. Design Life: 100 years

    b. Seismic Performance: Normal

    c. Live Load: CL-800 from CSA S6-19

    d. Dead Load: To be calculated per the site plan shown in **Appendix A** and Section 3 Loads as per CSA S6-19 for all applicable loads and load factors.

    e. Foundation Bearing Capacity: TBC

    f. Foundation Friction Angle: TBC

    g. SLS/ULS: TBC

    h. Engineering Backfill Unit Weight: 20kN/m3

    i. Engineering Backfill Friction Angle: 34 Degrees

    j. Embankment Fill Unit Weight: 20kN/m3

    k. Embankment Fill Friction Angle: 34 Degrees

    l. Structural Plate Corrugated Steel pipe (SPCSP) to CSA G401

4. Delivery to site. Offloading to be by others (civil contractor) who will install the arch culvert and headwalls.

5. Field services, meeting EGBC requirements, to verify the installation was made according to the design.

4. OWNER PROVIDED MATERIALS AND SERVICES

1. Updated foundation design criteria based on an upcoming geotechnical investigation to be available by **June 28, 2024**.

2. Vegetation for the MSE headwalls.

5. DELIVERABLES AND SUBMITTALS

Where applicable, deliverables are to be submitted to the RDN a minimum of six (6) weeks in advance of the planned work commencement. The deliverables shall be reviewed and accepted by the RDN prior to commencing work. The RDN will review submittals within seven (7) calendar days.

1. GANTT chart schedule detailing the various major activities required to complete the project within the required schedule outlined in Section 6 below. The schedule shall assume the following shop drawing review process and specifically define the following items:

    a. Draft shop drawing submittal dates for each item.

    b. Allowed review time by Owner, Installation Contractor and Engineer for each shop drawing submittal.

c. Time required for resubmittal of shop drawings following review comments for each shop drawing submittal.

d. Allowed review time by Owner and Engineer to confirm changes have been made and issue approval for each shop drawing submittal.

e. Ship dates for each item.

f. Delivery dates at site for each item.

2. Shop drawings sealed by a Qualified Professional Engineer licensed to practice in the Province of British Columbia.

3. Detailed installation and maintenance manuals.

6. SCHEDULE

- Contract award is expected to be made by **May 31, 2024**.
- Updated geotechnical information is expected to be available by **June 28, 2024**.
- Delivery at site of all materials by **August 14, 2024**.
- The installation contractor must perform the in-stream portion of the works between **August 15, 2024 and September 15, 2024** per regulatory requirements.

The Proponent shall confirm in their submission that they can complete the project within the schedule window.

7. REFERENCE / BACKGROUND INFORMATION

The following reference documents are included in the appendices for additional facility and project background.

- **Appendix A** – Drawings
- **Appendix B** – Geotechnical Information
- **Appendix C** – Sample Form of Contract

8. PROPOSAL SUBMISSION AND EVALUATION

The RDN requests submissions, from qualified suppliers, of a detailed proposal demonstrating that their solution meets the criteria provided above and further detailed in the appendices. To assist in receiving similar and relevant information, and to ensure your Proposal receives fair evaluation, the RDN asks Proponents to provide the following information for evaluation:

Submission Requirements and Evaluation Criteria	**Points**
Firm price, in Canadian dollars (CAD), for design and supply of materials specified herein per Incoterms 2020 Delivery Duty Paid (DDP), French Creek Pollution Control Centre, 957 Lee Road, Parksville, BC.	60
GANTT chart schedule detailing the various major activities required to complete the project within the required schedule outlined in Section 6 above.	15
Any deviations or alternates from the requirements stated in this RFP. Proposals meeting and/or exceeding all the requirements of the RFP will be evaluated more favourably. Alternates will be evaluated based on their technical merits and price.	10

Warranty information.	10
Fees for additional field services not included in the Scope of Services.	5
TOTAL	**100**

Proposals will be evaluated on the following basis 35% Technical, 65% Financial, per the above table.

The lowest price proposal will receive full marks for the financial score. Other proposals will receive reduced scores based on the proportion higher than the lowest price. i.e. Score = Min Cost/Cost x Fee Points.

Proposals submitted should be in enough detail to allow the RDN to determine the Proponent's qualifications and capabilities from the documents received. The selection committee, formed at the RDN's sole discretion, will score the Proposals in accordance with the criteria provided.

The RDN may evaluate proposals on a comparative basis by comparing one Proponent's proposal to another Proponent's proposal. The RDN reserves the right to not complete a detailed evaluation if the RDN concludes the proposal is materially incomplete, irregular or if it contains any financial or commercial terms that are unacceptable to the RDN.

The selection committee may proceed with an award recommendation or the RDN may proceed to negotiate with the highest evaluated Proponent with the intent of developing an agreement. If the parties after having bargained in good faith are unable to conclude a formal agreement, the RDN and the Proponent will be released without penalty or further obligations other than any surviving obligations regarding confidentiality and the RDN may, at its discretion, contact the Proponent of the next best rated Proposal and attempt to conclude a formal agreement with it, and so on until a contract is concluded or the proposal process is cancelled.

The RDN reserves the right to award the assignment in whole or in part or to add or delete any portion of the work. Throughout the evaluation process, the evaluation committee may seek additional clarification on any aspect of the Proposal to verify or clarify the information provided and conduct any background investigation and/or seek any additional information it considers necessary.

9. *PROPOSED PURCHASE CONTRACT*

The RDN's preferred form of Contract is attached herein in **Appendix C**. Proponents should carefully review this form of Contract. Proponents may (but are not required to) request that the RDN consider revisions to the form of Contract and include any clauses of concern in their proposal along with suggested language changes. Failure to do so means acceptance of the agreement as presented.

REGIONAL DISTRICT OF NANAIMO

Appendix A
Drawings

REGIONAL DISTRICT OF NANAIMO

AECOM

Regional District of Nanaimo

FRENCH CREEK POLLUTION CONTROL CENTRE

STAGE 4 EXPANSION
EARLY WORKS

ISSUED FOR RFP
APRIL 2024

AECOM Project No. 60714632

GENERAL NOTES:

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, DRAWINGS AND SPECIFICATIONS, OWNER STANDARDS, AND LOCAL, PROVINCIAL AND FEDERAL REQUIREMENTS.
2. THE CONTRACTOR SHALL OBTAIN APPROVALS REQUIRED FOR THE WORKS FROM AUTHORITIES AND AGENCIES PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION.
3. INFORMATION ON EXISTING UTILITIES IS BASED ON RECORD DRAWINGS AND IS APPROXIMATE ONLY. CONTRACTOR TO CONTACT BC ONE CALL TO CONFIRM LOCATION OF EXISTING UTILITIES AND PROVE ALL EXISTING UTILITIES AND CONNECTIONS BY TRIAL EXCAVATION PRIOR TO CONSTRUCTION. ADVISE ENGINEER IN WRITING MINIMUM 72 HOURS IN ADVANCE OF CONSTRUCTION START.
4. ALL DIMENSIONS ARE IN METRIC UNITS UNLESS NOTED OTHERWISE.
5. ANY SIGNIFICANT REVISIONS TO THESE DRAWINGS MUST BE APPROVED BY THE ENGINEER IN WRITING, WHO SHALL REVIEW ANY CHANGES WITH THE OWNER PRIOR TO ANY CONSTRUCTION.
6. THE CONTRACTOR IS REQUIRED TO BE IN GOOD STANDING WITH WORKSAFE BC AND COMPLY WITH ALL WORKSAFE BC REQUIREMENTS, INCLUDING, BUT NOT LIMITED TO, NOTIFICATION OF THE CONSTRUCTION WORKS
7. MAINTAIN PLANT OPERATIONS AT ALL TIMES UNLESS AUTHORIZED SHUTDOWNS AS APPROVED BY ENGINEER AND OWNER.
8. REPAIR ANY DAMAGE CAUSED TO EXISTING STREETS OR SERVICES BY CONSTRUCTION EQUIPMENT AND/OR TRUCKS HAULING MATERIALS TO AND FROM THE SITE. THIS WILL INCLUDE DAILY CLEANING AND SWEEPING OF EXISTING ROADS OF DIRT AND DEBRIS CAUSED BY CONSTRUCTION ACTIVITY TO THE SATISFACTION OF THE ENGINEER.
9. DAMAGE TO UTILITIES AND THE RESULTING COSTS AND REPAIR REPAIR SHALL BE BORNE BY THE CONTRACTOR. PAVEMENT AND PAVEMENT MARKINGS SHALL BE REINSTATED AS PER ORIGINAL CONDITION OR BETTER.
10. THE PROJECT SITE IS LOCATED ADJACENT TO MORNINGSTAR CREEK TO THE SOUTH ALONG ISLAND HIGHWAY. ENSURE THAT NO MUD, DIRT, SOIL, SILT OR ANY OTHER SUBSTANCES ARE SPILLED, DROPPED, WASHED OR TRACKED INTO THE CREEK, DITCH OR PUBLIC ROADS.
11. PARKING AND LAYDOWN AREAS ARE IDENTIFIED ON THE DRAWINGS AND TO BE CONFIRMED IN THE FIELD BY THE ENGINEER AND OWNER.

PROCESS YARD PIPING UTILITY NOTES:

1. COMPLETE THE RELOCATION, REQUIRED TESTING AND INSPECTION OF ALL TEMPORARILY OR PERMANENTLY RELOCATED UTILITIES AS SHOWN ON THE DRAWINGS PRIOR TO DECOMMISSIONING, DISCONNECTION, CUTTING, AND REMOVAL OF ANY UTILITY LINE.
2. NOTIFY THE OWNER AT LEAST 10 DAYS PRIOR TO DISCONNECTING, REMOVING, CUTTING, OR DECOMMISSIONING ANY UTILITY AND CLOSING OR OPENING ANY VALVES.
3. CONFIRM ALL POWER AND PROCESS LINES ARE DISCONNECTED/ISOLATED BY THE OWNER PRIOR TO RELOCATION, CUTTING, OR OPENING ANY LINE.
4. DISPOSE ALL REMOVED UTILITIES OFF-SITE AT A PERMITTED DISPOSAL FACILITY. NO DEMOLITION MATERIAL SHALL BE STORED ON-SITE UNLESS SPECIFIED ON THE DRAWINGS.
5. VERIFY THE LIMITS OF DEMOLITION WITH THE ENGINEER PRIOR TO STARTING DEMOLITION OF ANY STRUCTURE OR UTILITY.
6. VERIFY THAT ALL UTILITIES HAVE BEEN DISCONNECTED AT THE SOURCE OR RE-ROUTED AS REQUIRED IN ACCORDANCE WITH THIS CONTACT.
7. ALL ELEVATIONS ARE IN METERS AND REFER TO GEODETIC DATUM.
8. ALL CONSTRUCTION WORKS SHALL CONFORM TO MMCD STANDARD DETAILS AND SPECIFICATIONS.
9. CONTRACTOR TO CONFIRM EXACT LOCATION AND ELEVATION OF EXISTING UTILITIES BY CAREFUL TRIAL EXCAVATION ON SITE. IN CASE OF CONFLICTS ADVISE ENGINEER MIN 4 HOURS IN ADVANCE OF INSTALLATION OF PROPOSED WORKS.
10. GATE VALVES SHALL BE TERMINAL CITY RESILIENT SEATED FULL PORT VALVES.
11. ALL HDPE PROCESS PIPING TO BE PE 4710 DR17 HDPE PIP. FABRICATED HDPE FITTINGS TO HAVE AN EQUIVALENT PRESSURE RATING. MOLDED FITTINGS ARE TO BE USED FOR PIPE 200mm OR LESS WITH A PRESSURE CLASS OF 150. FLANGES TO BE IN ACCORDANCE WITH AWWA C208 CLASS D
12. ALL JOINTS TO BE VISUALLY INSPECTED BY ENGINEER WHILE IN SERVICE PRIOR TO BACKFILLING. NO LEAKAGE ALLOWED.
13. ALL HARDWARE SUCH AS NUTS, BOLTS, TIE RODS ETC ARE TO BE 316 STAINLESS STEEL. COAT ALL METALLIC HARDWARE WITH PRIMER AND PETROLATUM TAPE TO AWWA C217.
14. ALL THE FITTINGS AND METAL PIECES SHALL BE CORROSION RESISTANT OR PROTECT WITH WITH PRIMER AND PETROLATUM TAPE TO AWWA C21
15. CONTRACTOR TO PROVIDE SPECIFICATION OF VALVES, FITTINGS AND ANY OTHER PIECE FOR TIE-IN CONNECTION AND ANY OTHER USE FOR REVIEW AND APPROVAL.

WATERWORKS:

1. ALL PRODUCTS IN CONTACT WITH POTABLE WATER TO BE NSF-61 CERTIFIED
2. PROVIDE A MINIMUM 1.0m COVER FOR ALL WATERMAINS.
3. WRAP WATERMAIN JOINTS WITH PETROLATUM TAPE 3m EITHER SIDE OF SANITARY AND STORM CROSSINGS.
4. MAINTAIN A MINIMUM OF 1.5m HORIZONTAL CENTRE TO CENTRE AND 300mm CLEAR VERTICAL SEPARATION BETWEEN WATERMAINS AND ELECTRICAL CONDUITS, GAS MAINS, TELECOM, AND TELEPHONE CONDUITS EXCEPT WHERE NOTED.
5. CONTRACTOR SHALL PRESSURE TEST, FLUSH AND DISINFECT WATERMAINS IN ACCORDANCE WITH AWWA C651 IN THE PRESENCE OF THE ENGINEER. WATER SAMPLES FOR HEALTH TESTS TO BE COLLECTED AND PROCESSED BY ISLAND HEALTH APPROVED LAB, COORDINATED BY CONTRACTOR. DISINFECTION AND DECHLORINATION PLAN TO BE SUBMITTED FOR ENGINEERS REVIEW AND APPROVAL 10 BUSINESS DAYS BEFORE WORKS.
6. NEUTRALIZE CHLORINE SOLUTIONS IN ACCORDANCE WITH MINISTRY OF ENVIRONMENT AND FISHERIES AND OCEANS CANADA REGULATIONS PRIOR TO DISCHARGE TO ANY DRAINAGE COURSE OR STORM DRAINAGE SYSTEM.
7. ANY TEMPORARY OR PERMANENT CONNECTION TO THE WATER DISTRIBUTION SYSTEM SHALL BE COORDINATED WITH ENGINEER AND THE OWNER.
8. NEW 75mm WATERMAIN TO BE PE 4710 HDPE DR11 OTHERWISE NOTED FITINGS TO BE PRESSURE CLASS 200 HDPE MOLDED FITTINGS.
9. VALVES TO BE DUCTILE IRON COATED WITH PRIMER AND PETROLATUM TAPE TO AWWA C 217, 14.5kg MAGNESIUM ANODE TO BE INSTALLED ON EACH VALVE AND FITTINGS AS PER MMCD STANDARD DETAIL W119.
10. PROVIDE MECHANICAL RESTRAINTS FOR ALL NON FUSED JOINTS. WRAP NON FUSED JOINTS AND RESTRAINTS WITH PETROLATUM TAPE. ALL JOINTS NEED TO BE WRAPPED WHERE HORIZONTAL DISTANCE FROM STM OR SAN IS < 3m.
11. TIE RODS, NUTS AND BOLTS TO BE CARBON STEEL COATED WITH DENSO PASTE AND WRAPPED WITH PETROLATUM TAPE.
12. PROVIDE THRUST BLACKS ON TEES, BENDS AND CAPS.
13. ABANDONED PIPES 300mm DIAMETER AND SMALLER TO BE CAPPED WATERTIGHT WITH GROUT, DETAIL TO BE PROVIDED BY CONTRACTOR TO ENGINEER FOR REVIEW.

DRAWING NUMBER	TITLE
FCPPC-SHT-G-001	COVER SHEET
FCPPC-SHT-C-001	GENERAL NOTES AND LOCATION PLAN
FCPPC-SHT-C-002	EROSION AND SEDIMENT CONTROL NOTES AND DETAILS
FCPPC-SHT-C-003	STANDARD DETAILS
FCPPC-SHT-C-1000	OVERALL SITE PLAN
FCPPC-SHT-C-1003	EXISTING SITE UTILITIES PLAN
FCPPC-SHT-C-1005	REMOVALS AND SITE PREPARATION PLAN
FCPPC-SHT-C-1006	MORNINGSTAR CREEK SITE CROSSING PLAN
FCPPC-SHT-C-1007	MORNINGSTAR CREEK UTILITY PLAN
FCPPC-SHT-C-1008	MORNINGSTAR CREEK CULVERT PLAN
FCPPC-SHT-C-1009	MORNINGSTAR CREEK CULVERT SECTIONS AND DETAILS
FCPPC-SHT-C-1015	SITE ACCESS PLAN
FCPPC-SHT-C-1018	SITE ACCESS AND CULVERT CROSSING PROFILES
FCPPC-SHT-C-1021	PRIMARY & FINAL EFFLUENT PROFILES

LOCATION PLAN
SCALE: 1:5000

STORM CULVERTS:

1. STRUCTURAL PLATE ARCHED CORRUGATED STEEL CULVERT, FOOTINGS AND MSE HEADWALLS ARE TO BE DESIGNED BY THE CULVERT SUPPLIER WITH CONSTRUCTION DRAWINGS SEALED BY PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA.
2. CULVERTS 500Ømm OR LESS TO BE CORRUGATED STEEL PIPE IN ACCORDANCE WITH CSA-G401

TRAFFIC/ROADWAY NOTES:

1. PREPARE A TRAFFIC MANAGEMENT PLAN IN ACCORDANCE WITH BC MOTI REQUIREMENTS, SEALED BY PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA.
2. SUBMIT THE TRAFFIC MANAGEMENT PLAN TO THE OWNER, ENGINEER AND THE MOTI FOR APPROVAL. CONSTRUCTION SHALL NOT COMMENCE UNTIL ALL APPROVALS HAVE BEEN RECEIVED.
3. PROVIDE FLAG PERSONS AND SUPPLY, ERECT AND MAINTAIN ALL TRAFFIC CONTROL AND SIGNAGE DEVICES DURING ENTIRE DURATION OF PROJECT. ALL TRAFFIC REGULATIONS MUST ADHERE TO THE CONTRACT SPECIFICATIONS AND TRAFFIC MANAGEMENT PLAN.
4. OBTAIN AND COMPLY WITH ANY ROAD CLOSURE PERMITS FROM THE MOTI. COPIES OF THE PERMITS ARE TO BE PROVIDED TO THE ENGINEER.
5. LOCAL TRAFFIC AND DRIVEWAY ACCESS MUST BE MAINTAINED AT ALL TIMES UNLESS NOTIFIED OTHERWISE.
6. NOTIFY ALL EMERGENCY SERVICES (POLICE, FIRE, AMBULANCE) VEHICLES OF UP-TO-DATE DETOUR ROUTES, ON A DAY-TO-DAY, WEEK-TO-WEEK BASIS AS REQUIRED. A MIN 4 HOURS NOTIFICATION MUST BE PROVIDED TO THESE AUTHORITIES PRIOR TO CHANGING DETOUR ROUTES FROM ONE PHASE/SECTION TO ANOTHER.
7. REPLACE ALL PAVEMENT, PAVEMENT MARKING AND TRAFFIC SIGNAGE TO MATCH EXISTING CONDITIONS OR BETTER AS PER MOTI CONSTRUCTION STANDARDS.

EROSION AND SEDIMENT CONTROL NOTES:

1. EROSION AND SEDIMENT CONTROL FOR THIS PROJECT WILL BE AS OUTLINED IN THE FISHERIES AND OCEANS CANADA AND MINISTRY OF WATER, LANDS AND AIR PROTECTION HANDBOOK ENTITLED "LAND DEVELOPMENT GUIDELINES FOR THE PROTECTION OF AQUATIC HABITAT, SEPTEMBER 1993" AND "ENVIRONMENTAL BEST MANAGEMENT PRACTICES FOR URBAN AND RURAL LAND DEVELOPMENT IN BRITISH COLUMBIA, JUNE 2004" AND "EROSION & SEDIMENT CONTROL GUIDELINE" BY THE REGIONAL DISTRICT OF NANAIMO (RDN). IT IS INCUMBENT UPON THE CONTRACTOR TO ACQUIRE THESE GUIDELINES AND FAMILIARIZE HIMSELF WITH THE REQUIREMENTS THEREIN.
2. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR DAMAGES RESULTING FROM IMPROPER EROSION AND SEDIMENT CONTROL MEASURES UNDERTAKEN BY THE CONTRACTOR.
3. ANY DIRECTION GIVEN BY THE ENGINEER TO THE CONTRACTOR FOR EROSION AND SEDIMENT CONTROL AND NOT FOLLOWED BY THE CONTRACTOR IS TO BE REPORTED TO THE OWNER IMMEDIATELY.
4. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE THAT NO MUD, DIRT, SOIL, SILT OR ANY OTHER SUBSTANCES ARE SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHT-OF WAYS, OR AREAS THAT LEAD TO CATCH BASINS CONNECTED TO PUBLIC SYSTEMS. THE CONTRACTOR IS TO CLEAN ANY SUCH MATERIAL IMMEDIATELY. STREETS ARE TO BE SWEPT WITH A VACUUM STREET SWEEPER DAILY., TO THE SATISFACTION OF THE ENGINEER
5. PRIOR TO CONSTRUCTION, CLEARLY FLAG OR FENCE AREAS OF NO DISTURBANCE AS WELL AS ANY DESIGNATED TREES AND SHRUBS THAT ARE TO BE PRESERVED. MARKINGS SHOULD REMAIN IN PLACE THROUGHOUT CONSTRUCTION.

REFERENCE DRAWINGS

DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
-	-	1

REV	YY/MM/DD	DESCRIPTION	DRWN	CHKD	APVD
0	24/04/19	ISSUED FOR RFP	MW	BB	NS

REGIONAL DISTRICT OF NANAIMO

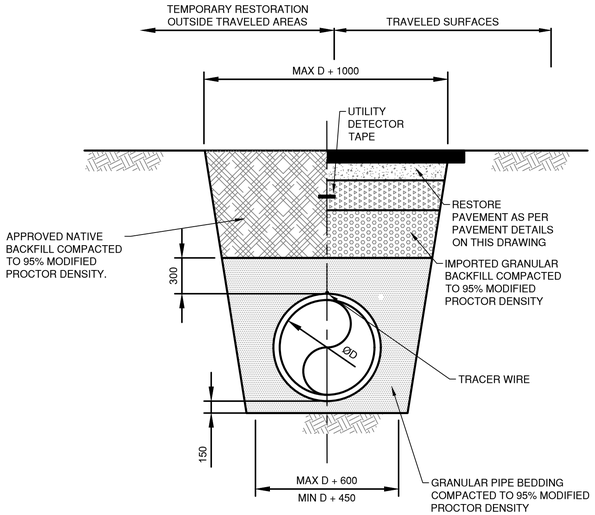
CONSULTANT
AECOM

TITLE: **GENERAL NOTES AND LOCATION PLAN**

PROJECT NO:	60714632	DSGN:	MW	DATE:	-
RDN PROJECT NO:	-				
DRAWING SIZE:	ANSI "D"	CHKD:	-	DATE:	-
SCALE:	AS NOTED	APVD:	-	DATE:	-

PROJECT: **FRENCH CREEK POLLUTION CONTROL CENTRE STAGE 4 EXPANSION - EARLY WORKS**

DWG NO: **FCPCC-SHT-C-001** REV: **0**

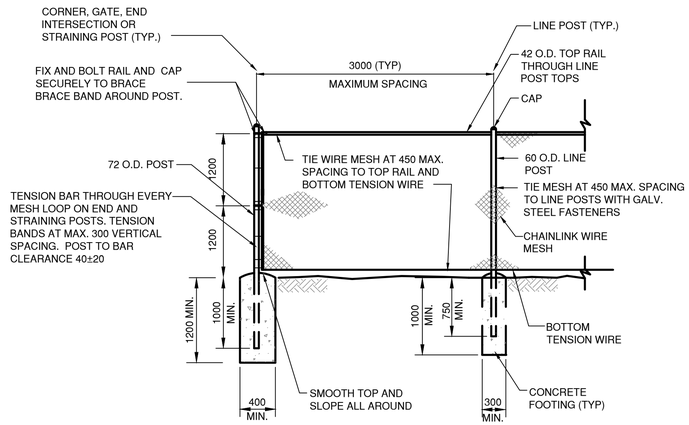


NOTE:

1. TRENCHING TO COMPLY WITH ALL REQUIREMENTS OF WORKSAFE B.C.

TYPICAL TRENCH DETAIL

NTS



FENCE DETAIL

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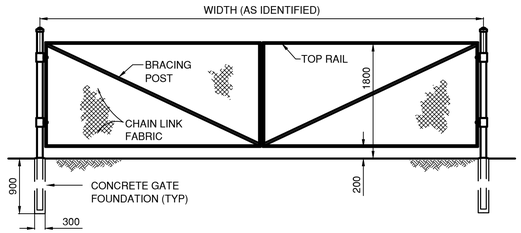

SWING GATE DETAIL

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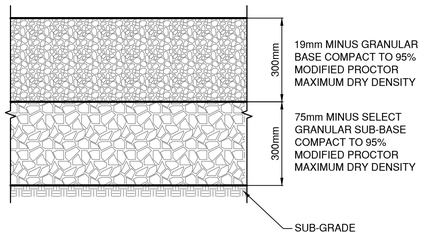
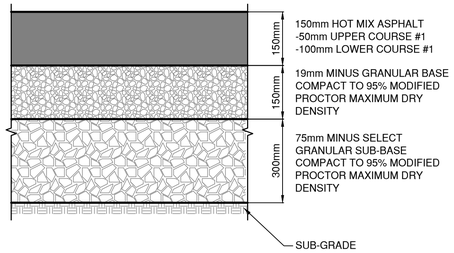


DETAIL 'A'

GRAVEL PAVEMENT SECTION

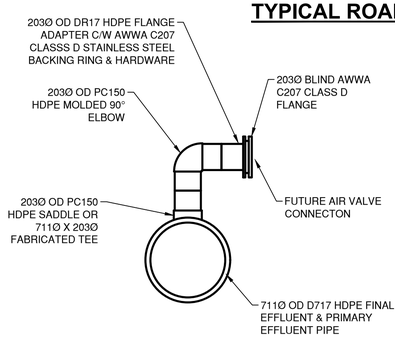


DETAIL 'B'

ASPHALT PAVEMENT SECTION

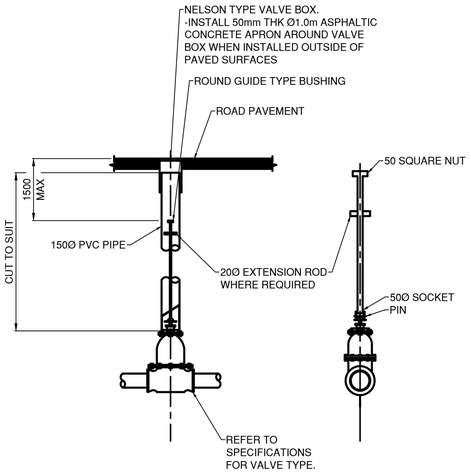
TYPICAL ROADWAY PAVEMENT STRUCTURE DETAILS

NTS



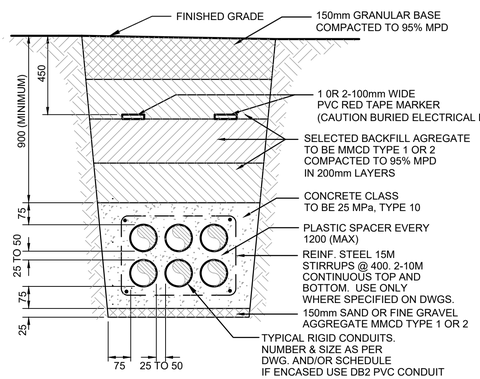
AIR VALVE PIPING DETAIL

NTS



TYPICAL VALVE INSTALLATION DETAIL

NTS

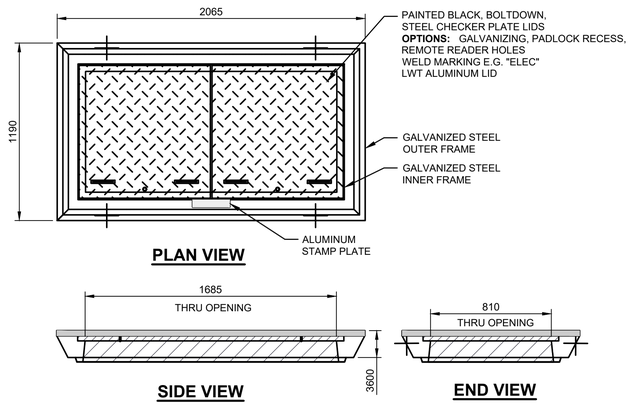


NOTES:

1. IF GROUND BELOW CONDUIT BANK HAS BEEN DISTURBED, IT SHALL BE COMPACTED TO 95% STANDARD PROCTOR TO DUCTBANK INSTALLATION.
2. DIRECT BURIED REQUIRE SAME FILL REQUIREMENTS.

TYPICAL DUCT BANK DETAIL

NTS



PLAN VIEW

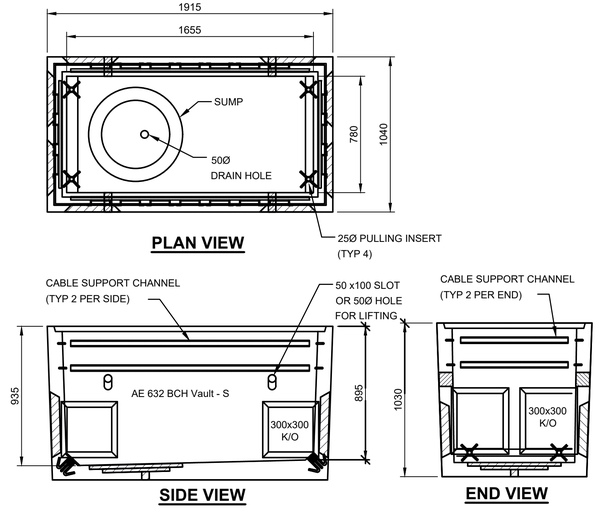
SIDE VIEW END VIEW

GENERAL NOTES:

- PRODUCT MANUFACTURED IN ACCORDANCE WITH CSA A23.4
- LIFT POINTS PROVIDED (SEE SHOP DRAWING FOR QUANTITY & LOCATIONS)
- DESIGNED FOR BOULEVARD (OFF-ROAD) USE - H-20 STATIC LOADING
- STEEL PRODUCTS MANUFACTURED UNDER CSA W47.1 IN ACCORDANCE TO CSA W59

632 BC HYDRO VAULT COVER

SCALE: NTS



PLAN VIEW

SIDE VIEW END VIEW

GENERAL NOTES:

- PRODUCT MANUFACTURED IN ACCORDANCE WITH CSA A23.4
- LIFT POINTS PROVIDED (SEE SHOP DRAWING FOR QUANTITY & LOCATIONS)
- DESIGNED FOR ROADWAY USE - H-20 TRAFFIC LOADING

632 BC HYDRO VAULT

SCALE: NTS

REFERENCE DRAWINGS

DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
-	-	1

REV	YY/MM/DD	DESCRIPTION	DRWN	CHKD	APVD
0	24/04/19	ISSUED FOR RFP	MW	BB	NS

REGIONAL DISTRICT OF NANAIMO

CONSULTANT

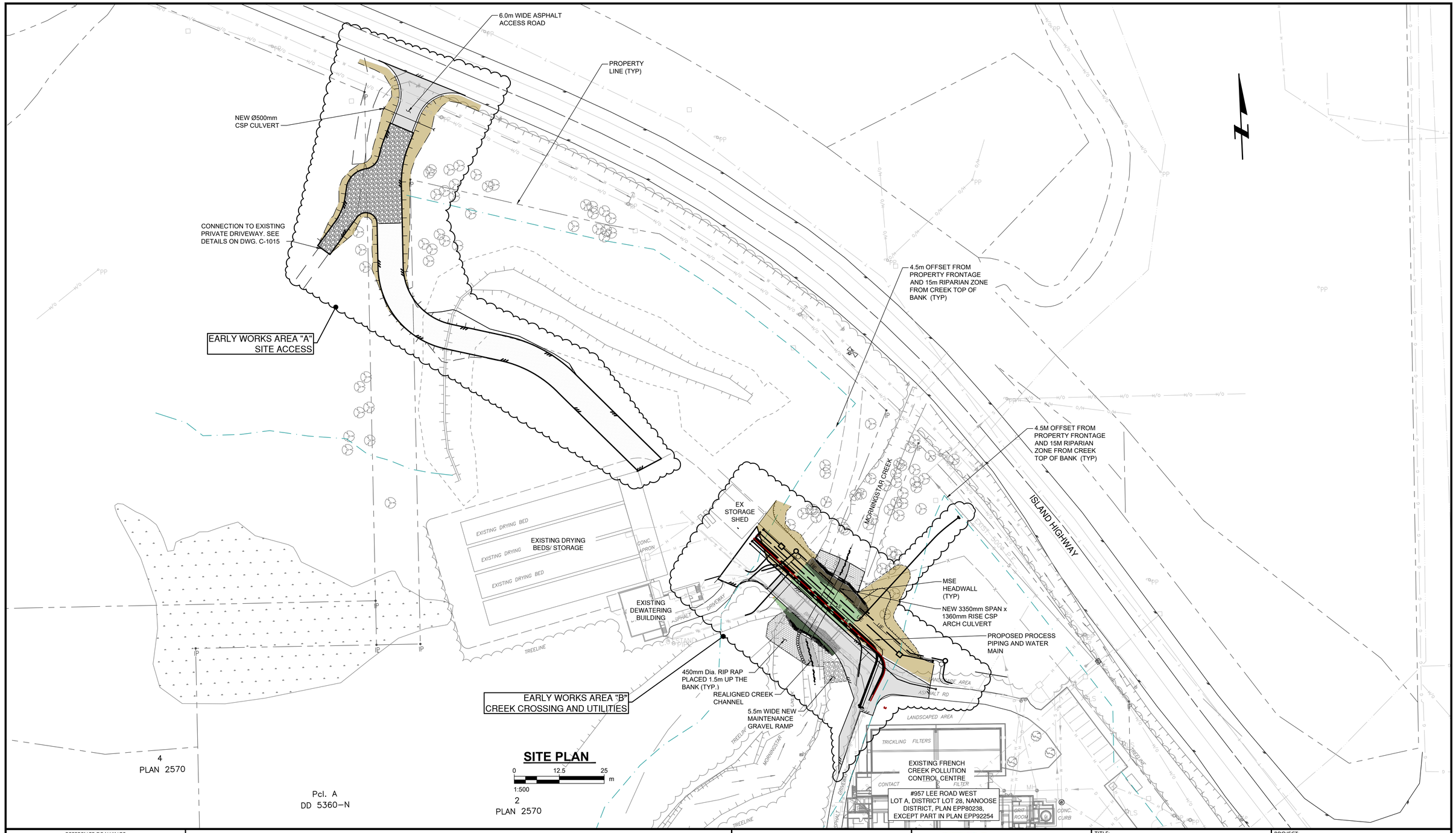
AECOM

TITLE: **STANDARD DETAILS**

PROJECT: **FRENCH CREEK POLLUTION CONTROL CENTRE STAGE 4 EXPANSION - EARLY WORKS**

PROJECT NO:	60714632	DSGN:	MW	DATE:	-
RDN PROJECT NO:	-				
DRAWING SIZE:	ANSI "D"	CHKD:	-	DATE:	-
SCALE:	AS NOTED	APVD:	-	DATE:	-

DWG NO: **FCPCC-SHT-C-003** REV: **0**



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DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
-	-	1

REV	YY/MM/DD	DESCRIPTION	DRWN	CHKD	APVD
0	24/04/19	ISSUED FOR RFP	MW	BB	NS

REGIONAL DISTRICT OF NANAIMO

CONSULTANT

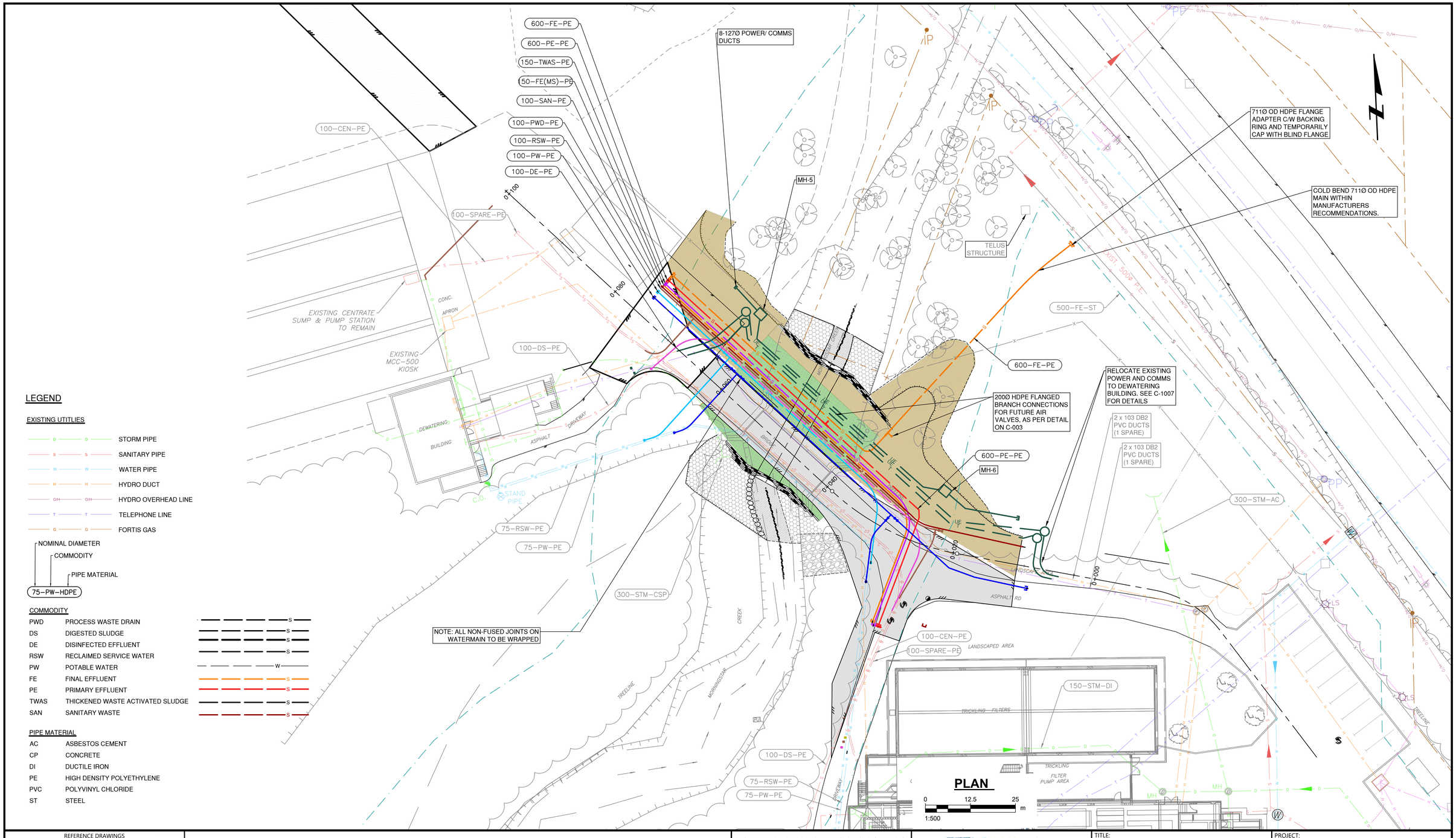
AECOM

TITLE: **OVERALL SITE PLAN**

PROJECT: **FRENCH CREEK POLLUTION CONTROL CENTRE STAGE 4 EXPANSION - EARLY WORKS**

PROJECT NO:	60714632	DSGN:	MW	DATE:	-
RDN PROJECT NO:	-				
DRAWING SIZE:	ANSI "D"	CHKD:	-	DATE:	-
SCALE:	AS NOTED	APVD:	-	DATE:	-

DWG NO: **FCPCC-SHT-C-1000** REV: **0**



LEGEND

EXISTING UTITLIES

- STORM PIPE
- SANITARY PIPE
- WATER PIPE
- HYDRO DUCT
- HYDRO OVERHEAD LINE
- TELEPHONE LINE
- FORTIS GAS

NOMINAL DIAMETER
COMMODITY
PIPE MATERIAL
75–PW–HDPE

COMMODITY

PWD	PROCESS WASTE DRAIN
DS	DIGESTED SLUDGE
DE	DISINFECTED EFFLUENT
RSW	RECLAIMED SERVICE WATER
PW	POTABLE WATER
FE	FINAL EFFLUENT
PE	PRIMARY EFFLUENT
TWAS	THICKENED WASTE ACTIVATED SLUDGE
SAN	SANITARY WASTE

PIPE MATERIAL

AC	ASBESTOS CEMENT
CP	CONCRETE
DI	DUCTILE IRON
PE	HIGH DENSITY POLYETHYLENE
PVC	POLYVINYL CHLORIDE
ST	STEEL

REFERENCE DRAWINGS

DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
-	-	1

REV	YY/MM/DD	DESCRIPTION	DRWN	CHKD	APVD
0	24/04/19	ISSUED FOR RFP	MW	BB	NS

REGIONAL DISTRICT OF NANAIMO

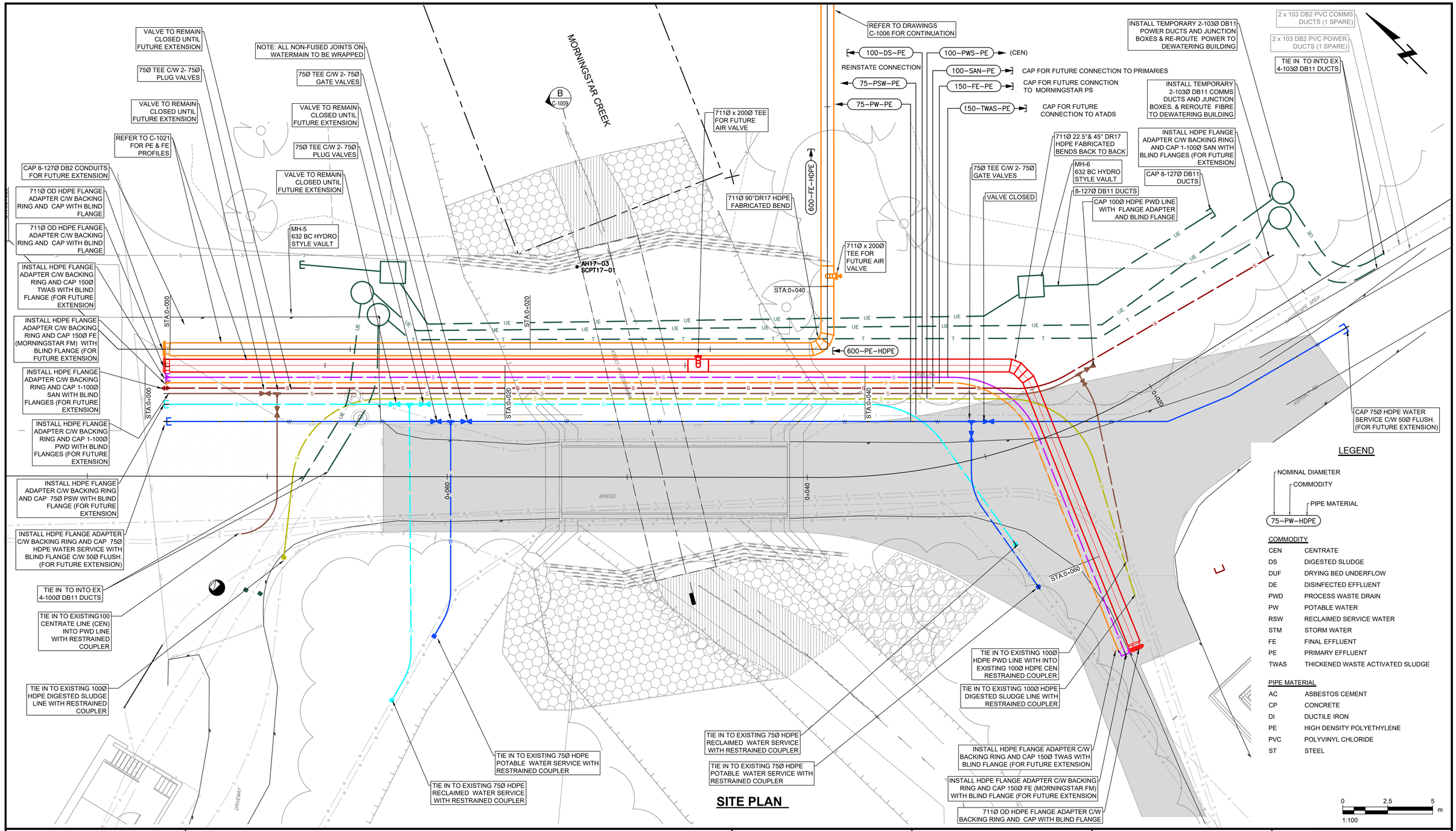
CONSULTANT
AECOM

TITLE:
MORNINGSTAR CREEK SITE CROSSING PLAN

PROJECT NO:	60714632	DSGN: MW	DATE: -
RDN PROJECT NO:	-		
DRAWING SIZE:	ANSI "D"	CHKD: -	DATE: -
SCALE:	AS NOTED	APVD: -	DATE: -

PROJECT:
FRENCH CREEK POLLUTION CONTROL CENTRE STAGE 4 EXPANSION - EARLY WORKS

DWG NO: **FCPCC-SHT-C-1006**
REV: **0**



SITE PLAN

REFERENCE DRAWINGS

DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
-	-	1

REV	YY/MM/DD	DESCRIPTION	DRWN	CHKD	APVD
0	24/04/19	ISSUED FOR RFP	MW	BB	NS

REGIONAL DISTRICT OF NANAIMO

CONSULTANT

AECOM

TITLE: **MORNINGSTAR CREEK UTILITY PLAN**

PROJECT: **FRENCH CREEK POLLUTION CONTROL CENTRE STAGE 4 EXPANSION - EARLY WORKS**

PROJECT NO:	60714632	DSGN:	MW	DATE:	-
RDN PROJECT NO:	-				
DRAWING SIZE:	ANSI "D"	CHKD:	-	DATE:	-
SCALE:	AS NOTED	APVD:	-	DATE:	-

DWG NO: **FCPCC-SHT-C-1007** REV: **0**

SITE PLAN

REFERENCE DRAWINGS		
DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
-	-	1

REV	YY/MM/DD	DESCRIPTION	DRWN	CHKD	APVD
0	24/04/19	ISSUED FOR RFP	MW	BB	NS

REGIONAL DISTRICT OF NANAIMO

CONSULTANT

AECOM

TITLE:

MORNINGSTAR CREEK CULVERT PLAN

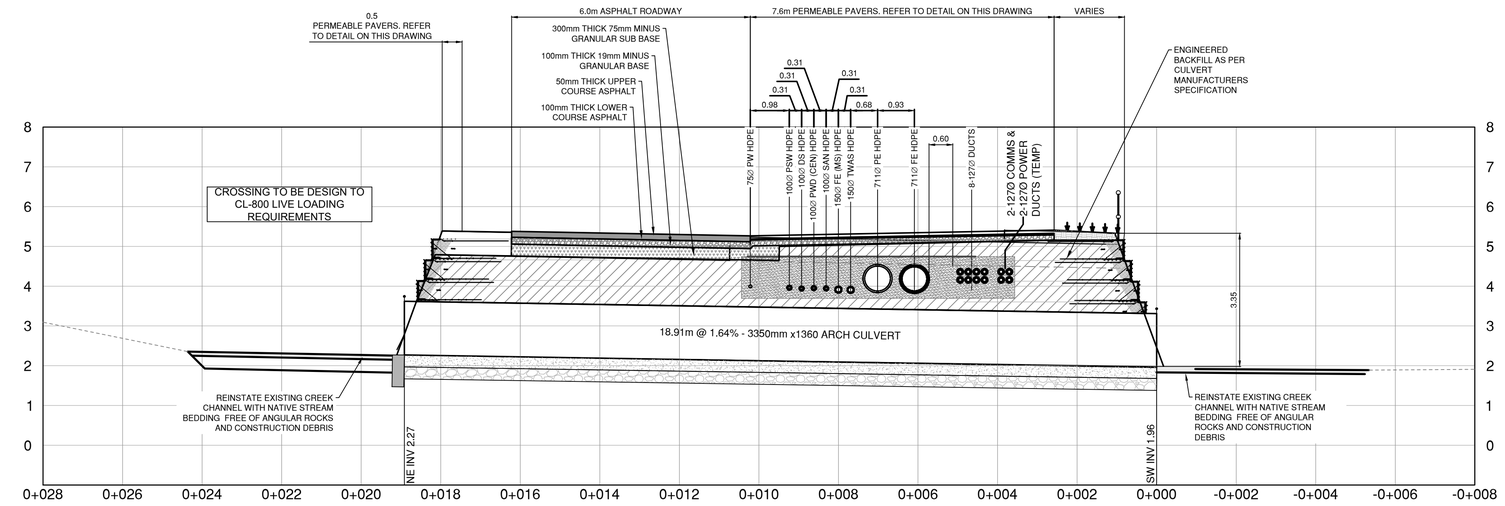
PROJECT NO:	60714632	DSGN:	MW	DATE:	-
RDN PROJECT NO:	-				
DRAWING SIZE:	ANSI "D"	CHKD:	-	DATE:	-
SCALE:	AS NOTED	APVD:	-	DATE:	-

PROJECT:

FRENCH CREEK POLLUTION CONTROL CENTRE STAGE 4 EXPANSION - EARLY WORKS

DWG NO: **FCPCC-SHT-C-1008**

REV: **P1**



PROFILE

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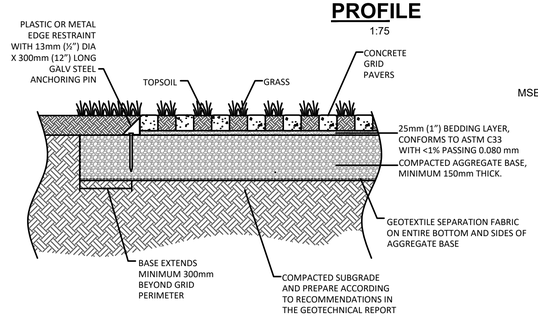
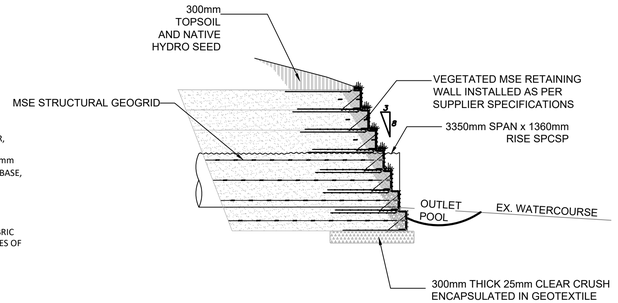


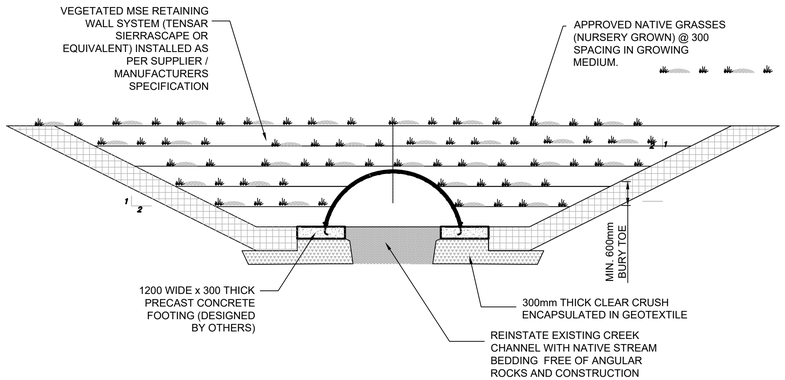
PERMEABLE PAVER DETAIL

N.T.S.



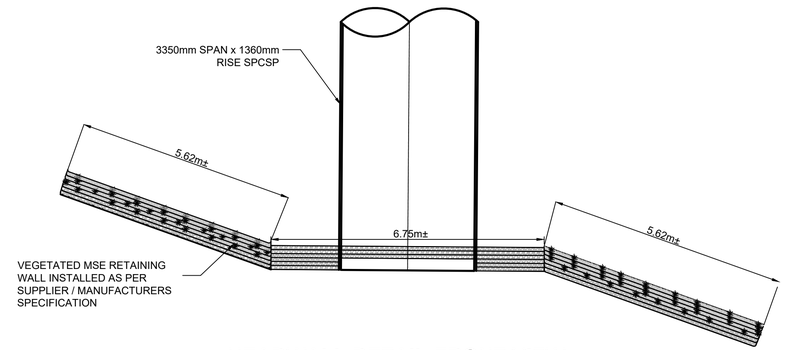
HEADWALL DETAIL-SIDE VIEW

1:75



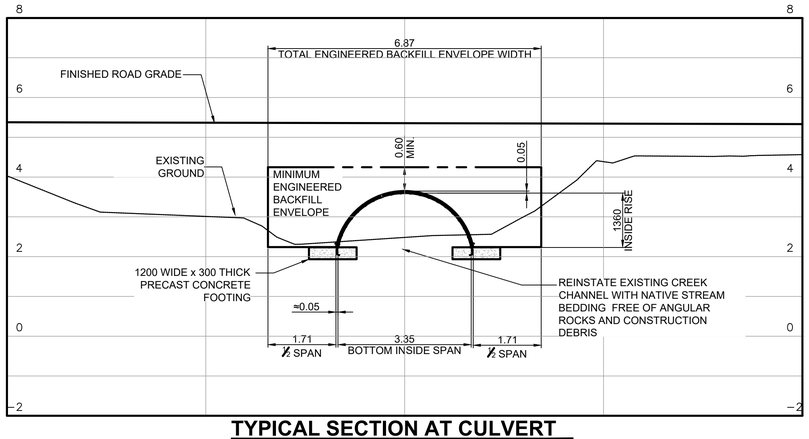
HEADWALL DETAIL-PLAN VIEW

1:75



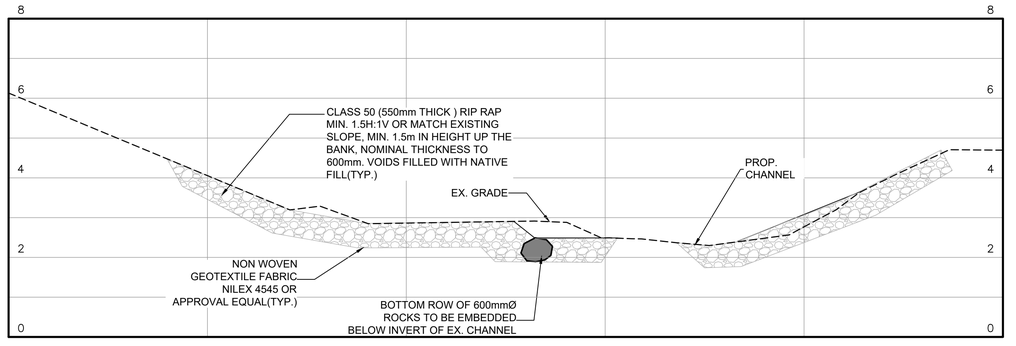
HEADWALL DETAIL-FRONT VIEW

1:75



TYPICAL SECTION AT CULVERT

1:75



SECTION A
1:75
C-1008

NOTE: CULVERT FOOTINGS AND ANCHORS, AND MSE WALL DETAIL FOR INFORMATION ONLY. TO BE DESIGNED BY THE CULVERT SUPPLIER WITH CONSTRUCTION DRAWINGS SEALED BY PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA.

REFERENCE DRAWINGS

DRAWING NO	DRAWING DESCRIPTION/TITLE	REF
-	-	1

REV	YY/MM/DD	DESCRIPTION	DRWN	CHKD	APVD
0	24/04/19	ISSUED FOR RFP	MW	BB	NS

REGIONAL DISTRICT OF NANAIMO

CONSULTANT

AECOM

TITLE: **MORNINGSTAR CREEK CULVERT SECTIONS AND DETAILS**

PROJECT: **FRENCH CREEK POLLUTION CONTROL CENTRE STAGE 4 EXPANSION - EARLY WORKS**

PROJECT NO:	60714632	DSGN:	MW	DATE:	-
RDN PROJECT NO:	-				
DRAWING SIZE:	ANSI "D"	CHKD:	-	DATE:	-
SCALE:	AS NOTED	APVD:	-	DATE:	-

DWG NO: **FCPCC-SHT-C-1009** REV: **P1**

REGIONAL DISTRICT OF NANAIMO

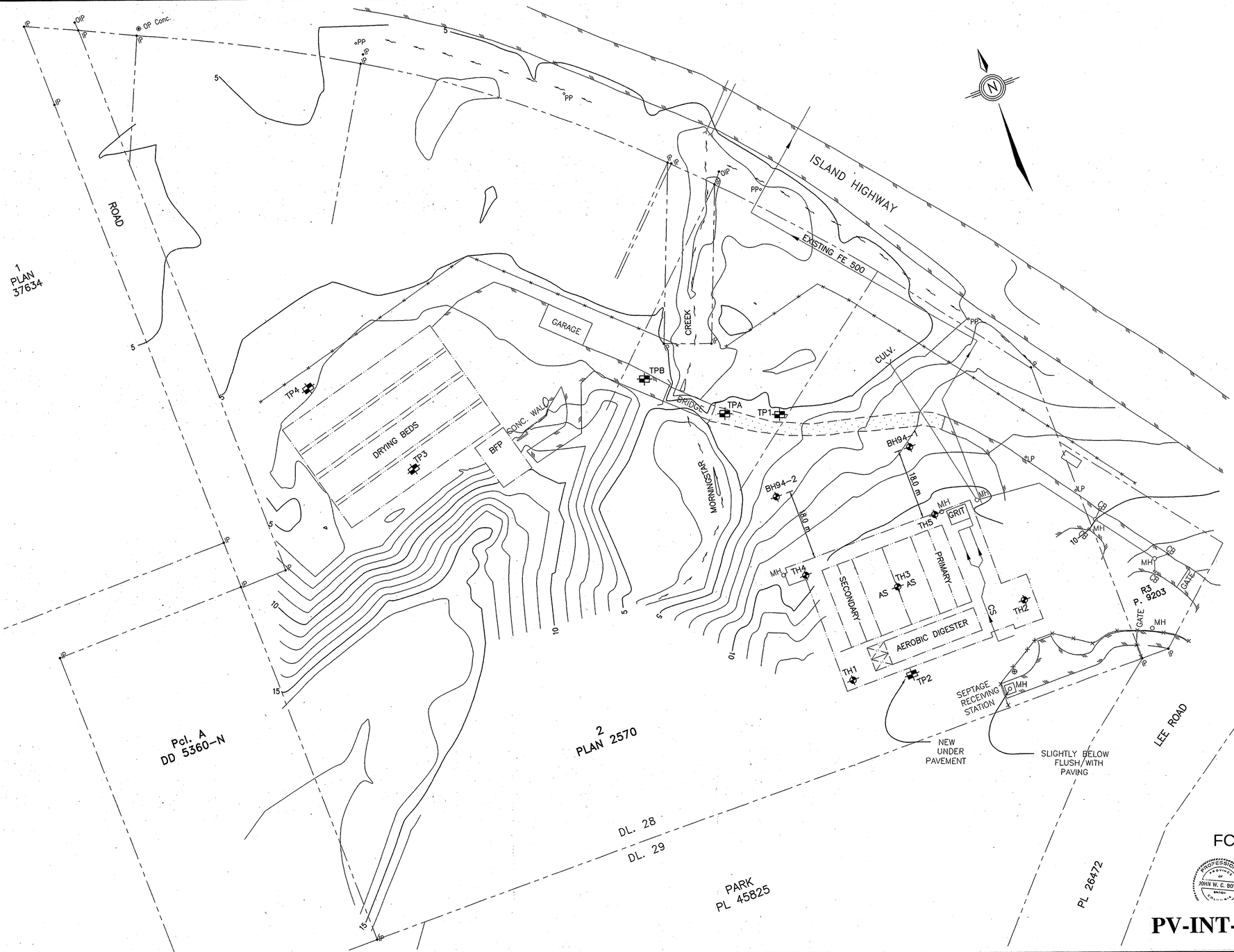
Appendix B
Geotechnical Information

LEGEND

- EXISTING PIPING (CATCH BASIN) (MANHOLE) (CULVERTS) — CB / MH
- EXISTING STRUCTURES
- EXISTING FENCE
- EXISTING DITCH
- EXISTING PAVEMENT
- EXISTING GRAVEL ROAD
- EXISTING PROPERTY LINE
- LP — LAMP POST
- PP — POWER POLE
- 15 — CONTOUR, m , GEODETIC
- TH5 — TEST HOLE AND NUMBER
- TPA — TEST PIT AND NUMBER OR LETTER DESIGNATION
- BH94-1 — BOREHOLE AND NUMBER

NOTES :

1. FOR TEST HOLE AND TEST PIT INFORMATION REFER TO SPECIFICATIONS.



FC-C-1001

PV-INT-226

ACAD DWG. G7 1:500 97-05-26

REVISIONS	ISSUE	DATE	DRAWN	CHK'D	APP'D	DESCRIPTION
	B	MAY/97	BDL	JWB	JWB	RECORD DRAWING

DESIGNED H.K.
DRAWN J.B./L.W.
CHECKED JWB

DAYTON & KNIGHT LTD.
Consulting Engineers
JAN 22 1999

REGIONAL DISTRICT OF NANAIMO
FRENCH CREEK W.P.C.C. STAGE 2 EXPANSION
EXIST. SITE PLAN AND TEST HOLE/BOREHOLE/TEST PIT LOCATIONS

SCALE: 1:500 G7
DRAWING No. 122.78.1
SHEET 7 OF 180 ISSUE B

C:\v13\DRAWINGS\RDN\FRENCH\GEN\g7 Thu Jan 14 09:27:28 1999

PV-INT-106

TEST HOLE # 1

ELEV.

50

47.3 / 0' — SAND & GRAVEL - SOME COBBLES, BROWN.

43.8 / 3.5' — SAND - FINE, SILTY, DENSE, SATURATED BELOW 10' DEPTH.

40

W.L. NOV. 23/76 EL. 35.4

W.L. DEC. 3/76 EL. 32.0

W.L. NOV. 19/76 EL. 29.8

28.3 / 19.0 — CLAY - SILTY, BLUISH GRAY, PLASTIC, SOFT TO FIRM, OCCASIONAL GRAVEL EMBEDDED NEAR BOTTOM

21.3 / 26.0 — SILT - CLAYEY, SOME FINE SAND & FINE GRAVEL - GRAY - VERY STIFF TO HARD. (SILTY TILL)

30

20

INCREASING GRAVEL CONTENT WITH DEPTH

10

MORE SAND BELOW 48 FT. DEPTH.

0

-3.7 / 51.0'

TEST HOLE # 2

43.9 / 0' — SAND & GRAVEL - BROWN WITH ORGANIC MATTER

41.4 / 2.5' — SAND - FINE, SILTY, BROWN, OXIDIZED - SATURATED BELOW 5 FT. DEPTH.

28.9 / 15.0' — CLAY - SILTY, BLUISH GRAY, PLASTIC, FIRM, SENSITIVE, TRACE GRAVEL NEAR BOTTOM.

23.9 / 20.0' — SILT - CLAYEY, SOME FINE SAND, SOME FINE GRAVEL, GRAY, VERY STIFF TO HARD - LAYER OF PLASTIC SILTY CLAY FROM 28 FT. TO 31' DEPTH (SILTY TILL)

HIGHER GRAVEL CONTENT BELOW 42 FT. DEPTH.

-2.6 / 46.5

TEST HOLE # 3

45.0 / 0' — SAND & GRAVEL - SILTY, BROWN, SOME COBBLES & ORGANIC MATTER.

42.0 / 3.0' — W.L. NOV. 23, DEC. 3/76 EL. 40.5

W.L. NOV. 19/76 EL. 40.0

SAND - FINE, SILTY, OXIDIZED BROWN TO GRAY, SATURATED BELOW 10 FT. DEPTH.

W.L. DEC. 3/76 EL. 31.0

25.0 / 20.0 — SILT - SANDY, SOFT, GRAY, TRACE ORGANIC, THIN LAYERS.

22.0 / 23.0 — CLAY - SILTY, GRAY, FIRM, TRACE GRAVEL NEAR BOTTOM.

17.0 / 28.0

INCREASING GRAVEL CONTENT WITH DEPTH

MORE SANDY BELOW 50 FT. DEPTH.

-16.5 / 61.5'

TEST HOLE # 4

35.0 / 0' — SAND & GRAVEL - SILTY, BROWN, SOME COBBLES & ORGANIC MATTER.

31.5 / 3.5' — W.L. NOV. 19 - 23/76 EL. 31.2

SAND - FINE, SILTY, BROWN, OXIDIZED SATURATED BELOW 5 FT. DEPTH.

26.5 / 8.5' — W.L. NOV. 23/76 EL. 25.8

SILT - CLAYEY, GRAY, SOFT.

20.0 / 15.0' — CLAY - SILTY, GRAY, FIRM TO STIFF, SENSITIVE, OCCASIONAL FINE SAND LENSES, TRACE GRAVEL NEAR BOTTOM.

13.0 / 22.0

SILT - CLAYEY, SOME FINE SAND & FINE GRAVEL, OCCASIONAL GRAVEL UP TO 3/4" SIZE, GRAY, VERY STIFF TO HARD. (SILTY TILL)

HIGHER GRAVEL CONTENT WITH DEPTH.

0.4 / 51.5

MORE SANDY BELOW 40 FT. DEPTH.

-6.5 / 41.5'

TEST HOLE # 5

31.9 / 0' — SAND & GRAVEL - SILTY, GRAY, SOME COBBLES & ORGANIC MATTER.

28.4 / 3.5' — SAND - FINE, SILTY, BROWN, OXIDIZED, SATURATED BELOW 5 FT. DEPTH.

W.L. NOV. 19 & DEC. 3/76 EL. 24.8

23.9 / 8.0' — SILT - CLAYEY, GRAY, STIFF, TRACE FINE GRAVEL.

20.9 / 11.0' — CLAY - SILTY, GRAY, SOFT TO FIRM, SENSITIVE, TRACE FINE GRAVEL NEAR BOTTOM.

15.9 / 16.0' — SILT - CLAYEY, SOME FINE SAND & FINE GRAVEL OCCASIONALLY TO 3/4" SIZE, GRAY, VERY STIFF TO HARD. (SILTY TILL)

INCREASING GRAVEL CONTENT WITH DEPTH.

2.5 / 31.5

TEST PIT # 1

10.5 / 0' — TOPSOIL - SAND, SILTY, SOME CLAY WITH ROOTS & ORGANIC MATTER, DARK BROWN.

7.5 / 3.0' — PEAT - AMORPHOUS, DARK BROWN TO BLACK, ROOTS & LARGE PIECES OF DECOMPOSED WOOD.

2.5 / 8.0' — SILT - CLAYEY, GRAY, SOFT, SOME ORGANIC MATTER, SOME FINE SAND LAYERS.

-4.5 / 15.0'

TEST PIT # 2

48.0 / 0' — TOPSOIL - SAND, FINE, BROWN, LOOSE WITH ROOTS & ORGANIC MATTER, LAYER OF COARSE GRAVEL BETWEEN 2.5 FT. & 3.5 FT.

44.5 / 3.5' — SAND - FINE, SILTY, OXIDIZED, BROWN TO GRAY, HIGHER SILT CONTENT BELOW 8 FT. DEPTH, SATURATED BELOW 8 FT. DEPTH.

34.0 / 14.0'

TEST PIT # 3

15.0 / 0' — SAND & GRAVEL - SILTY, BROWN WITH ROOTS & ORGANIC MATTER.

12.0 / 3.0' — SILT - CLAYEY, ORGANIC, LIGHT BROWN.

9.0 / 6.0' — SAND - COARSE, DARK GRAY.

8.0 / 7.0' — CLAY - SILTY, BLUISH GRAY, STIFF.

5.0 / 10.0'

TEST PIT # 4

12.5 / 0' — TOPSOIL - SAND, SILTY, BROWN, WITH ROOTS.

12.0 / 0.5' — SAND - SILTY, BROWN, OXIDIZED.

9.5 / 3.0' — SAND & GRAVEL - SILTY, BROWN, OXIDIZED, COMPACTED.

6.0 / 6.5' — GRAVEL - BLUISH GRAY, SOME SAND, LOOSE OCCASIONAL COBBLES UP TO 6" SIZE.

3.5 / 9.0'

ELEV. 50 40 30 20 10 0

NOTE:

1. TEST HOLES 1 TO 5 AND TEST PITS 1 TO 4 - DUG. NOV. 1-4, 1976 BY KLOHN LEONOFF CONSULTANTS LTD., SEE SOIL REPORT DATED NOV. 29, 1976.
2. TEST PITS A AND B - DUG. DEC. 14, 1976 BY DAYTON & KNIGHT LTD. SOILS CLASSIFICATION BY DAYTON & KNIGHT LTD.; SEE SPECIFICATIONS.

LEGEND

ORGANIC | GRAVEL | SAND | SILT | CLAY

TEST PIT · A

12.0 / 0' — ORGANIC TOPSOIL

10.0 / 2.0' — DARK BROWN COMPACTED CLAY

7.0 / 5.0' — SILT - CLAYEY, BLUE, SOFT, SEEPAGE AT 7 FT. & 9 FT.

-2.0 / 14.0'

-4.0 / 16.0' — FIRM GRAY CLAY

TEST PIT · B

14.3 / 0' — ORGANIC TOPSOIL MIXED WITH SILT

10.8 / 3.5' — BROWN GRAY STIFF CLAY - VERY DRY

6.3 / 8.0' — GRAY CLAY CONTAINING 1" TO 3" ROCKS - DENSE

4.7 / 9.5' — SILTY CLAY - HARD PAN - VERY HARD DIGGING

0.3 / 14.0'

ELEV. 10 0

BRIDGE SITE TEST PITS

PROFESSIONAL ENGINEER PROVINCE OF B.C. E.A. PRATT

FC-C-1002

PV-INT-106

REVISIONS	ISSUE	DATE	DR'N	CH'D	APP'D	DESCRIPTION
	C	MAY/78	I.K.	BW	AH	"AS CONSTRUCTED" Issued for Construction Incorporating Addendum 1 & 2
	B	FEB. '77	ADB	BW	JW	

DESIGNED E.P. | DRAWN D.B.C. | CHECKED E.A. Pratt B.W.

DAYTON & KNIGHT LTD.
CONSULTING ENGINEERS
Jan 7 1977

REGIONAL DISTRICT OF NANAIMO
FRENCH CREEK WATER POLLUTION CONTROL CENTRE
TEST HOLE DATA

SCALE: VERT: 1" = 5'
DRAWING No. 122.41.8
SHEET G-7 OF 17 ISSUE C

September 13, 2023

Laura Locke, P.Eng.
AECOM Canada Ltd.
4th Floor – 3292 Production Way
Burnaby, BC V5A 4R4

via email: laura.locke@aecom.com

Re: VAN-23002846-A0
Geotechnical Assessment Report for New Property
Regional District of Nanaimo
French Creek Pollution Control Centre, Stage 4 Expansion Project
1236 Island Highway West, near Parksville, BC

Dear Laura Locke:

1.0 INTRODUCTION

As requested, EXP Services Inc. (EXP) has completed a geotechnical assessment for the new concept/property proposed for the above referenced project located near Parksville, BC. A previous detailed design report was submitted on April 17, 2019 which consisted of a different layout of the WWTP expansion located on the existing adjacent FCPCC property at 957 Lee Road. The purpose of the assessment was to supplement the geotechnical exploration from the previous detailed design phase specific to the currently proposed project layout, and to provide updated geotechnical recommendations relative to the design and construction for the proposed new Pollution Control Centre expansion facilities in line with current building code requirements.

No sampling or testing of soils retrieved as part of the current exploration program was carried out with respect to environmental issues or soil corrosion.

2.0 SITE CONDITIONS AND PROJECT DESCRIPTION

The Detailed Design for the project was completed in 2021; however, the RDN expressed concerns regarding the cost growth of the project and whether the project was still addressing the challenges with the most appropriate solution. A value engineering study was initiated in 2021 to identify viable alternatives to the proposed design from a planning and optimization perspective.

After completion of the VE study, the RDN requested AECOM to assess the feasibility of a modified approach for the FCPCC Stage 4 Expansion, which includes demolishing the existing trickling filters and upgrading to a full secondary treatment expansion. Additional land is required to fully expand the treatment works, so the neighbouring property was purchased. A conceptual site layout of the upgrades was provided to EXP for reference (60590631-SK-1000_221124.pdf).

The RDN has requested a geotechnical site exploration of the new lands proposed to be used for the additional treatment works at 1236 Island Highway West. Based on AECOM conceptual plans, construction of significance on the new lands would include Bioreactor #3 and #4. There would also be Bioreactor #1 and #2 located at the north end of the site of existing treatment plant at 957 Lee Road. It was understood that the bottom of the tank foundations will be about 3m below grade.

A site plan showing the existing facility and proposed expansion layout is provided in the attached Testhole Location Plan, Figure 1.

3.0 KEY GEOTECHNICAL DESIGN ISSUES

Key geotechnical evaluation and design issues for the project are:

- Excavation and dewatering requirements for the proposed below grade structures and associated piping that may be in the order of 3m deep, considering potential high groundwater conditions, potential loose, saturated granular soils, potential boundary constraints, and potential for on-site and off-site settlement impacts;
- Foundation support for the proposed new structures and associated piping;
- Mitigation of potential impacts on existing structures from adjacent construction;
- Settlement considerations arising from new loads and/or dewatering of excavations considering possible presence of compressible fine-grained soils, including potential settlement influences to adjacent structures and utilities;
- Possible presence of liquefiable soils and/or silt soils susceptible to strain softening and potential consequences;
- Potential hydrostatic uplift impacts for structures constructed below groundwater table; including additional impacts if liquefiable soils are present; and,
- Static and seismic lateral pressures for structures constructed below grade.

4.0 SUBSURFACE CONDITIONS

4.1 Surficial Geology

Based on review of published surficial geology maps, the general site area is mapped as being underlain by Capilano Sediments, Marine Deposits, and Ground Moraine Deposits consisting of mixed sand, gravel and silt deposits, and interbeds of silt and clay. These deposits are mapped as being underlain by Quadra Sediments below depths in the order of about 12m.

4.2 Geotechnical Drilling and Subsurface Exploration

EXP's fieldwork during the preliminary and detailed design stage of the previous development concept was carried out on June 1, 2017 and February 2019, respectively, and included the following:

- Ten (10) solid stem auger holes (designated as AH17-01 through AH17-04 and AH19-01 through AH19-06) drilled to typical depths ranging from about 4.6 to 15.2m by Drillwell Enterprises Ltd. of Duncan, BC. Dynamic Cone Penetration Testing was conducted at each of the 2017 locations except for AH17-02 and AH19-01 through AH19-04.

- One (1) Seismic Cone Penetration Test (designated as SCPT17-01) was advanced to practical refusal at a depth of about 6m, by Schwartz Soil Tech Inc. of Vancouver, BC. Several drill-outs were required to advance the cone due to inability to push the cone in excessively gravelly zones. The results of the SCPT can be found in Appendix C.
- Five (5) test pits (designated as TP19-01 to TP19-05) excavated to depths of about 1 to 2.9m using a tracked excavator by Parksville Heavy Equipment.

The current subsurface exploration program included the following testing:

- Five (5) Sonic boreholes (designated as BH23-01 through BH23-05 drilled to depths ranging from about 15.2m to 23.0m by Drillwell Enterprises Ltd. of Duncan, BC from June 27th to 30th, 2023. All 5 boreholes were terminated in Sandstone bedrock except for BH23-02. Standard Penetration Testing (SPT) was conducted at typical 1.5m intervals within the upper 15m and 3m intervals below 15m.
- Casing was installed in BH23-04 to facilitate downhole shear wave velocity testing completed by Schwartz Soil Tech Inc. of Vancouver, BC. The seismic testing was conducted to obtain shear wave velocity measurements to comply with the NBCC 2020 requiring average shear wave velocity within the upper 30m (Vs30). The shear wave velocity survey report can be found in Appendix B.
- A standpipe piezometer was installed in BH23-02 to facilitate groundwater level measurement.

All field work was carried out under the full-time supervision of a member of EXP geotechnical staff, who located the test holes in the field, examined and logged the subsurface condition encountered, and collected representative soil samples for visual examination and testing in our laboratory. Following completion of drilling, the boreholes were backfilled and sealed according to the regulations of the B.C. Groundwater Protection Act.

The locations of the current and relevant previous testholes are shown on the attached Figure 1 - Testhole Location Plan, and logs of those testholes are presented in Appendix A.

4.3 Laboratory Tests

Laboratory tests were conducted on representative soil samples obtained from the test holes. The tests included natural moisture content tests determination, and sieve analysis on granular soils. The following is a summary of the laboratory tests carried out.

4.3.1 Natural Moisture Content Test

Moisture content determinations were performed on select soil samples obtained from the exploration to assist in identification of soil types and to correlate with engineering design parameters. The tests were done in general accordance with the test procedures in ASTM D-2216. Results of the tests are shown on the auger hole logs, provided in Appendix A.

4.3.2 Sieve Analysis

Sieve analysis was performed on select soil samples obtained from the exploration to determine the grain size distribution of the granular soil. Sieve analysis was conducted on eighteen (18) selected samples, in general accordance with ASTM C-136 and ASTM C-117. The results of the tests are provided in Appendix D.

4.3.3 Atterberg Limits

Atterberg limits tests were performed on select soil samples obtained from the exploration to determine the plastic limit, liquid limit and plasticity index of the fined grained soil. Atterberg limits tests were conducted on three (3) selected samples, in general accordance with ASTM D-4318. The results of the tests are provided in Appendix D.

4.4 Subsoil Conditions

The following section provides a generalized description of subsoil conditions encountered at the current and previous borehole hole and test pits at/near the locations of the proposed bioreactors, in the order of increasing depth.

Bioreactor 1 (BH23-01AH17-02, AH19-01, AH19-03, TP19-01-TP19-05)

UNIT A1 FILL – typically consisting of varying mixtures of sand and gravel, sand and silt and silt, including traces of organics and debris, typically loose to compact/firm, moist, ranging in thickness from about 1.2 to 3m. Blast rock fill was encountered between depths of 1.3 and 2.2m at previous TP19-03. Thin layer of relict topsoil intermittently encountered beneath the fill. Fill not encountered at BH23-03 and BH23-05 and likely not present at proposed Bioreactors 3 and 4 located within native forested area.

UNIT A2 Interlayers of Silty SAND/SAND w/some Silt/SILT AND SAND, GRAVEL AND SAND/Gravelly SAND, Silty CLAY, typically loose to compact/firm, moist, extending to depths of 3 to 4.5m.

UNIT B Gravelly SAND/Sandy GRAVEL/SAND AND GRAVEL, trace silt, occasional cobbly zones, typically compact, wet, extending to depth of about 5 to 9.8m.

UNIT C TILL-LIKE SOIL (some weathered zones in upper portion), compact to very dense, moist, Silty SAND/Sandy SILT/Gravelly Silty SAND/SILT, trace to some clay, trace to some gravel, interbeds of dense sand to gravelly sand, extended to depths ranging from 14.9 to 16.2m. Very dense sand that was logged at depth of 10.7m i at previous auger hole AH19-03 may be weathered sandstone based on the current findings.

UNIT D SANDSTONE, extended to bottom of current boreholes except not encountered within 15.2m depth of BH23-02, 13.7m depth of previous AH17-03, and possibly encountered at 10.7m in previous AH19-03.

4.4 Groundwater Conditions

Groundwater was inferred at depths ranging from about 2.64 to 2.9m at the borehole locations. The inferred groundwater levels may have been an intermittent perched condition on top of the relatively impermeable weather till-like soils.

A monitoring well was installed in BH23-02 and groundwater was measured at a depth of 2.64m at completion of drilling on June 27, 2023. A monitoring well was also installed in previous AH17-04, and groundwater was measured at a depth of about 4.8m in the monitoring well upon completion of drilling on June 2, 2017, and then at a depth of 2.13m on February 21, 2019.

It should be noted that groundwater conditions may vary and fluctuate seasonally and in response to climate conditions, tidal cycles, local land use, and possibly other factors.

5.0 SEISMIC CONSIDERATIONS

5.1 Introduction

For purposes of this study, it was assumed that the criteria of the NBCC 2020 ("Building Code") would be adopted for the seismic assessment of the new structures. In the NBCC 2020, an earthquake motion with a return period of 2475 years is specified. The philosophy for earthquake design in the Building Code is prevention of collapse, but to accept damage to structures. The expectation is that "typical" or "normal" structures will be near collapse and the building may not be repairable following the design earthquake. Implicit within the Building Code is the intent to limit damage during low to moderate level earthquake shaking.

It was assumed that the new structures would need to meet post-disaster facility performance levels, with the implication that major damage would need to be avoided and functionality restored in a relatively short period of time following a major earthquake.

5.2 Seismic Design Parameters

Site-specific interpolated seismic design parameters for this site were obtained from the interactive website maintained by the Geological Survey of Canada (GSC). The "outcropping firm ground" is specified as soils with average shear wave velocity in the range of 360 m/s to 750 m/s. Very dense soils or soft bedrock could be classified as "firm ground".

The design earthquake motions would be damped or amplified as the motion propagates through loose or soft soils. The Building Code has recommended methodology to account for this damping/amplification. The Building Code states that if any soil layer within the top 30m of the ground is susceptible to liquefaction, then the site is to be classified as "Class F". For Class F sites, NBCC 2020 requires a site-specific ground response analysis. However, the Building Code also indicates that if the fundamental period of motion is equal to or less than 0.5s for a structure built on liquefiable soils, Site Class F, the amplification/damping effects can be calculated assumed that the soils are not liquefiable within the upper 30m profile. It was inferred that the Fundamental Period of motion for the proposed facility would be less than 0.5s. Based on the review of shear wave velocities and SPT blow counts the site can be considered as Site Class D for seismic design purposes.

PGA for Site Class D is estimated to be 0.525g at the subject site. For further refinement of the seismic design, a site-specific response analysis could be considered at a later date; however, the benefits may not necessarily be merited for structures of the type proposed.

5.3 Liquefaction Assessment

Liquefaction analyses were carried out using commercially available computer software Cliq v.2.1.6.5 developed by Geologismiki. The analysis was carried out using the SPT blow counts and shear wave velocity profile.

The following methods, settings, and assumptions were used:

Liquefaction factor of safety calculation: Idriss and Boulanger, 2014 method and the following assumptions:

- CSR profile was calculation by Idriss and Boulanger, 2014 for 1:2475-year return periods.
- Earthquake magnitude for this assessment was taken as 7.5 for the 1:2475-year event.).
- Liquefaction settlement based on Zhang et al, 2002 and 2004 method.
- Residual shear strength of granular soil based on Idriss and Boulanger, 2014 using CLiq.
- Strain softening of fine-grained soil for seismic conditions based on the 2007 Greater Vancouver Liquefaction Task Force Report:
  - Plasticity Index (PI) < 7: Assume sand-like residual shear strength.
  - 7 < PI < 12: residual shear strength equal to 80% of undrained shear strength.
  - PI > 12: residual shear strength is equal to the undrained shear strength.

Factor of Safety against liquefaction (FoS) was calculated as the ratio of CRR/CSR. Soil layers with a FoS less than 1 are considered liquefiable for the 2475 year return period earthquake event.

The findings of the analysis indicate that the depth and thickness of liquefiable soils is localized. pproximately 1m thick liquefiable layer present between 3.6m to 4.6m depth at AH19-03 and approximately 1 to 1.5m thick liquefiable layer present between.7m to 8.5m depth at BH23-05. Further it is pointed out that at these locations the sandy soil layer is looser than elsewhere at the site, and therefore, the liquefaction susceptible soils appear to be confined and lenticular in nature.

5.4 Consequences of Liquefaction

Following liquefaction, the soils lose a significant portion of their shear strength and behave like a heavy liquid. Some of the consequences are: liquefaction induced settlement of the ground, lateral spreading of the ground and the overlying structures, flotation, tilting and/or shear failure of the foundations.

5.4.1 Post-liquefaction Settlement

Dissipation of the excess pore water pressure developed during shaking and liquefaction would cause settlement of the ground. As mentioned above granular soils were found to have potential to liquefy with cumulative thickness of about 1m at AH19-03 and from about 1 to 1.5m at BH23-05. Post-liquefaction settlement due to pore pressure buildup within the soil mass was estimated to be in the order of 25 to 50mm at AH19-03 and up to 50 to 100mm at BH23-05 based on the SPT/DCPT and Shear Wave velocity data using the procedure of Zhang et al. (2002).

5.4.2 Lateral Spreading

Under more common ground conditions where liquefiable soil layers occur globally in a particular area, the ground would be prone to lateral spreading resulting in differential horizontal ground movements, and this would be particularly relevant where there is a “free face” condition such as a riverbank or ocean bank a relatively short distance away. In the case of this site where it appears that the granular soil layers found to be susceptible to liquefaction are discontinuous and lenticular in nature and confined by predominantly compact to dense non-liquefiable soils, there should not be significant liquefaction-induced lateral movement. Using the method by Youd, Hansen and Barlett, Proc. ASCE Seminar April 20, 2002, Seattle, WA, lateral spreading assuming continuity of the liquefiable layer is calculated to be in the order of about 200 to 300mm. However, with the apparent discontinuous nature of the liquefiable soil layers, it is estimated that lateral spreading would likely not be more than 50% of the calculated values (ie.100 to 150mm).

The tolerability of the estimated lateral and vertical displacements would need to be evaluated for the proposed structures, commensurate with risk and performance expectations, and any other relevant criteria.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 General

Below ground surface or thin layer of forest debris, the test holes encountered fill soils consisting of varying mixtures of sand, gravel, silt and clay and intermittently containing organics and other debris (typically loose to compact/firm) extending to depths ranging from about 1.5 to 3m, or native silt and sand to sand and gravel mixture and occasional silty clay (typically loose to compact/firm) extending to depths of about 3 to 4.5m. An approximately 0.9m thick layer of blast rock fill was encountered below mineral soil fill in the area of proposed Bioreactor 1. A layer of typically compact sand and gravel soils was encountered directly beneath the fill or upper native soils, followed by compact to very dense till-like typically comprising silty sand to sandy silt with some gravel, and inferred to have weathered zones within the upper portion. The till-like soils were underlain by sandstone below depths of about 14.9 to 16.2m and possibly below about 10.7m at AH19-03.

The groundwater table will fluctuate with a mean level inferred to be at approximately 2m depth and extreme level near ground surface. It was understood that AECOM has assumed that extreme high groundwater case (HHWL) to be at the 200-year flood level with a safety factor of 10% (ie. approximately El. 5.17m).

Excavation depths for the proposed bioreactors is anticipated to range in the order of approximately 3 to 4m below existing grades. The soil conditions expected at subgrade level are considered to be conducive to use of raft slab type foundations for support of the proposed structures. Details on subgrade preparation and foundation design can be found subsequently in the report.

The excavations may extend below the groundwater table depending on the time of year and recent precipitation. In general, carrying out the excavation in the summer would be preferred from the standpoint of temporary groundwater impact. Further, particular attention will need to be given to temporary excavation stability and potential shoring where excavation will occur adjacent to, and below the depth of existing structures.

As discussed above, AH19-03 (within proposed Bioreactor 1 location) was found to have a zone of compact gravelly sand that was found to be susceptible to liquefaction under the design earthquake event. This layer was found to about 1.0m thick, extending from about 3.6 to 4.6m depth. Further, BH23-05 (just east of proposed Bioreactor 4) was also found to have a zone of loose to compact gravelly sand susceptible to liquefaction inferred to be about 1 to 1.5m thick and ranging between depths of about 7 and 8.5m. It is noted that other confined zones of liquefiable soils can be present at depth at other locations across the site. With Bioreactor 1 expected to be about 3m deep putting the foundation close to the top of the liquefiable surface, it is recommended that the liquefiable gravelly sand layer be over-excavated and replaced with structural fill to mitigate risk of punching failure of the foundation in the event of liquefaction during a design seismic event. This would also effectively mitigate liquefaction induced vertical and lateral ground displacements. The other zone of liquefiable gravelly sand is considered to be sufficiently deep to prevent punching failure in the event of liquefaction. The estimated vertical ground settlement of 50 to 100mm and horizontal displacements in the order of 100 to 150mm can likely be tolerated by a raft slab foundation.

6.2 Subgrade Preparation

It appears that the excavation base for the proposed bioreactors/clarifiers would likely encounter the Unit B Sand and Gravel Layer with the exception of Bioreactor 4 near BH23-03 where the sand and gravel deposit was encountered at about 4.5m. Therefore, the Bioreactor 4 location would require over-excavation down to the native sand and gravel soils and replacement with structural fill. The over-excavation should extend laterally beyond the foundation footprint a distance at least equal to the depth of excavation below design foundation subgrade elevation.

As discussed above, AH19-03 in the area of proposed Bioreactor 1 was found to have a zone of compact gravelly sand that was found to be susceptible to liquefaction under the design earthquake event. This layer was found to about 1.m thick, extending from about 3.6 to 4.6m depth. With the structure expected to be about 3m deep in that area putting the foundation close to the top of the liquefiable surface, it is recommended that the liquefiable gravelly sand layer be over-excavated and replaced with structural fill to mitigate risk of punching failure of the foundation in the event of liquefaction during a design seismic event. We recommend that the over-excavation of this potentially liquefiable layer extend at least 2m beyond the foundation footprint. This should also effectively mitigate liquefaction induced vertical and lateral ground displacements. It is recommended that this over-excavation process be completed under the full-time review of a representative from EXP.

The excavated subgrade should be reviewed and approved by EXP prior to reinstating any foundation over-excavation. The excavated subgrade for all foundation subgrade surfaces should be reviewed and approved by EXP to confirm the design allowable bearing pressure.

6.3 Excavation and Dewatering

Based on the test hole logs, it appears that the anticipated excavations for the proposed structures will likely encounter varying depths of existing fill soils, and some of the below grade structures will likely penetrate into native compact sand and gravel soils and encounter groundwater. It should be noted that the excavation for Bioreactor 1 will likely encounter an approximately 0.9m thick layer of large blast rock that the contractor will need to be prepared to remove. It appears that the anticipated excavations could likely be achieved with appropriately sized equipment conventional excavation equipment.

Where groundwater is encountered, dewatering will be required to provide a stable excavation base for proposed structures and associated utilities and to facilitate installation and backfill in the dry. We recommend that dewatering be specified to a depth of at least 1m below proposed excavation base level which should be maintained until the backfilling is complete. Such dewatering should help reduce bottom heave of the excavation base, thereby providing a more stable foundation and reducing post-construction settlements. The type of dewatering will depend on factors such as the groundwater table relative to the depth of excavation at the time of construction and permeability of the soils in a particular area of excavation and could range from simple methods such as sump pumping or more extensive methods such as using vacuum well points. It may be feasible to conduct pipe excavations using trench box type shoring and sump pump type dewatering depending on the actual depths, soil conditions and groundwater table at time of construction.

Appropriate shoring will likely be required for any excavations that will extend adjacent to and below the depth of existing structures to avoid adversely impacting/undermining of such structures.

Where temporary slopes are feasible, they should be planned no steeper than 1H:1V (horizontal:vertical) in drained conditions, and follow WorkSafeBC regulations. Slopes in native till-like soils can be steepened to 3H:4V. Flatter slopes may be required in areas where caving/sloughing soils and/or groundwater seepage is encountered.

It should be recognized that dewatering within loose/ compressible deposits can cause ground settlement due to an increase in the effective stress of the dewatered soils and such ground settlements would extend laterally beyond the immediate area of dewatering. The lateral influence would depend on localized soil stratification, the depth of groundwater drawdown, and the method of dewatering being used, and, therefore, the magnitude and area of influence of dewatering-induced ground settlements are difficult to accurately predict. We recommend that the contractor assess the likely impact of dewatering, and use methods which will reduce such impacts, where appropriate. A pre-construction survey documenting the condition of adjacent settlement sensitive structures and other elements should be completed.

Ultimately, the means and methods of shoring and dewatering to achieve short-term and long-term performance objectives will need to be determined by the contractor. As such, the design, operation and maintenance of dewatering and shoring systems should be the responsibility of the contractor taking the various factors discussed above into consideration.

6.4 Structural Fill and Backfill

In general, structural fill for increase or reinstatement of grades, or backfill for buried structures and trenches should consist of free draining granular soil such as Sechelt sand or 75mm minus pit run sand and gravel. Free draining granular soil should generally have no more than 5% passing the 0.075mm sieve size. The structural fill and backfill should be placed in maximum 300mm loose lifts and compacted to achieve at least 95% Modified Proctor maximum dry density (ASTM D-1557). A lesser degree of compaction to 90% Modified Proctor Density would likely be acceptable for backfill of structures where settlement would not be a concern (ie. landscape areas only).

Note that the existing silty/clayey site soils are not suitable for trench backfill. The existing granular soils could possibly be re-used as backfill subject to the review and approval of the Geotechnical Engineer at time of construction.

6.5 Foundation Design

It is assumed that the typical installation procedure for underground structures would be to excavate to depths required, place a layer of granular bedding, pour a relatively thick concrete slab to resist buoyancy, and backfill the excavation.

Raft slab type foundations would be suitable for the proposed bioreactor structures following the subgrade preparation recommendations outlined in Section 6.2 above. In accordance with the subgrade preparation requirements, the foundations would either need to be founded directly on at least compact Unit B Sand and Gravel soils, or structural fill placed thereon. In order to provide a stable base for construction of the concrete raft slab/anti-flotation slab, it is recommended that the slab for underground structure be constructed on a minimum 150mm thick bedding layer of compacted 19mm clear crushed rock placed on top of approved subgrade soils.

A raft slab type foundation for the proposed new bioreactor structures supported on subgrade prepared as recommended above may be designed on the basis of a Serviceability Limit State (SLS) bearing pressure of 100 kPa for average contact area. A Factored Ultimate bearing resistance of 150 kPa (ULS) may be used when considering seismic loading. A modulus of subgrade reaction of 15,000 kN/m^3 can be used for raft slab design.

Vs is estimated to be 561 m/s assuming that the last measured shear wave velocity of 906 m/s at 22.3m will remain constant to a depth of 30.3m.

Static settlement of the proposed bioreactor structures supported in the manner recommended is estimated to be less than 25mm total. Half the total settlement may occur differentially across the width of a structure. Refer to Section 5.4 above for estimated post-liquefaction vertical and horizontal displacements accounting for random localized zones of liquefiable soils at depth.

Flexible pipe joints and connections with provision to accommodate the estimated liquefaction induced horizontal and vertical ground displacements are recommended.

6.6 Design to Prevent Flotation of Buried Structures

The groundwater table will fluctuate with a mean level inferred to be at approximately 2m depth and extreme level near ground surface. It was understood that AECOM has assumed that extreme high groundwater case (HHWL) to be at the 200-year flood level with a safety factor of 10% (i.e. approximately El. 5.17m) for static buoyancy design. For seismic design, the groundwater level can be taken at 2m below ground surface.

The dead load of the structure and the mass of soil column engaged by the perimeter area of the foundation slab can be used to check the resistance to buoyancy Further consultation between the Structural and Geotechnical Engineers may be required for this assessment.

6.7 Lateral Earth Pressures for Below Grade Wall Design

Lateral earth pressures for design of foundation walls have been evaluated. Recommended design lateral earth pressures are presented in the attached Figures 2 and 3. In providing the pressure diagram for active pressure (yielding) conditions (Figure 2), it is assumed that the walls can rotate in the order of 0.005H to 0.01H to mobilize active earth pressure condition, where H is the height of the wall below grade. If the walls are “rigid” without the freedom to rotate as indicated above, then the at-rest pressure (non-yielding) condition should be used as shown in Figure 3. The seismic component was calculated based on the 2,475-year return period earthquake according to NBCC 2020. Note that the hydrostatic component could be eliminated if a suitably designed sub-drainage system is incorporated that would maintain the groundwater table below the structure foundation on a permanent basis.

6.8 Pavement Structure for New Access Roads

New access roads are expected to accommodate heavy truck traffic that will be predominantly using the access road during Stage 4 construction and also for routine deliveries to and from the FCPCC.

The subgrade for access road pavement structure should generally consist of native compact to dense soils or structural fill placed thereon, prepared as recommended in Section 6.2. However, where existing fill soils extend to significant depths, over-excavation and replacement with structural fill can be limited to 1m below the recommended pavement structure provided that organic materials are removed.

Based on the assumptions outlined above, the following minimum pavement structure thickness is recommended for proposed access road:

- Hot Mix Asphalt: 150mm (50mm UC #1 over 100mm LC#1)
- 19mm Minus Granular Base: 150mm
- 75mm Minus Select Granular Subbase: 300mm

The materials, placement and compaction should be in general accordance with the latest edition of the Master Municipal Construction Documents.

6.9 Subgrade Review and Testing

Engineering review of foundation and access road subgrade preparation, structural fill and backfill, and excavation stability should be carried out by the Geotechnical Engineer during the progress of the work. Further, it is recommended that EXP carry out a full-time review of the over-excavation of potentially liquefiable soils where required. Monitoring and testing of structural fill backfill should be carried out by a qualified testing agency. This will allow for geotechnical aspects of the project to be verified for compliance with the geotechnical recommendations and allow for design changes during construction, as appropriate.

7.0 CLOSURE

Please be advised that the contents of this report are based on the information and drawings provided to us by AECOM and our understanding of the project as described in this report.

This report was prepared for the exclusive use of AECOM Canada Ltd., the Regional District of Nanaimo, and their designated consultants/agents and may not be used by other parties without written consent of EXP Services Inc. The attached "Interpretation & Use of Study and Report" forms an integral part of this report and must be included with any copies of this report.

We appreciate this opportunity to be of service to you. If you have any questions regarding the contents of this report, or if we can be of further assistance to you on this project, please call the undersigned.

Sincerely,

Ben Weiss, P.Eng.
Senior Geotechnical Engineer

Reviewed by:

Ujjal Chakraborty, P.Eng.
Geotechnical Technical Lead

Enclosures: Interpretation & Use of Study and Report
Figure
– Testhole Location Plan
– Lateral Earth Pressure on Yielding Walls, 2475 EQ
– Lateral Earth Pressure on Non-Yielding Walls, 2475 EQ
Appendix A – EXP Test Hole Logs (BH23-01 through -05, AH19-03, AH17-02 & -03, TP19-01 through -03)
Appendix B – Downhole Shear Wave Velocity Survey Report
Appendix C – SCPT Plot & Interpretation (SCPT17-01)
Appendix D – Sieve Analysis Reports (No. 1 to 18); Atterberg Limits Reports (No. 1 to 3)

INTERPRETATION & USE OF STUDY AND REPORT

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering consulting practices in this area. No other warranty, expressed or implied, is made. Engineering studies and reports do not include environmental consulting unless specifically stated in the engineering report.

2. COMPLETE REPORT

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

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

3. BASIS OF THE REPORT

The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorized use of the Report.

5. INTERPRETATION OF THE REPORT

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

b. Reliance on Provided information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons providing information.

c. To avoid misunderstandings, EXP Services Inc. (EXP) should be retained to work with the other design professionals to explain relevant engineering findings and to review their plans, drawings, and specifications relative to engineering issues pertaining to consulting services provided by EXP. Further, EXP should be retained to provide field reviews during the construction, consistent with building codes guidelines and generally accepted practices. Where applicable, the field services recommended for the project are the minimum necessary to ascertain that the Contractor's work is being carried out in general conformity with EXP's recommendations. Any reduction from the level of services normally recommended will result in EXP providing qualified opinions regarding adequacy of the work.

6.0 ALTERNATE REPORT FORMAT

When EXP submits both electronic file and hard copies of reports, drawings and other documents and deliverables (EXP's instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by EXP shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancy, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by EXP shall be deemed to be the overall original for the Project.

The Client agrees that both electronic file and hard copy versions of EXP's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EXP. The Client warrants that EXP's instruments of professional service will be used only and exactly as submitted by EXP.

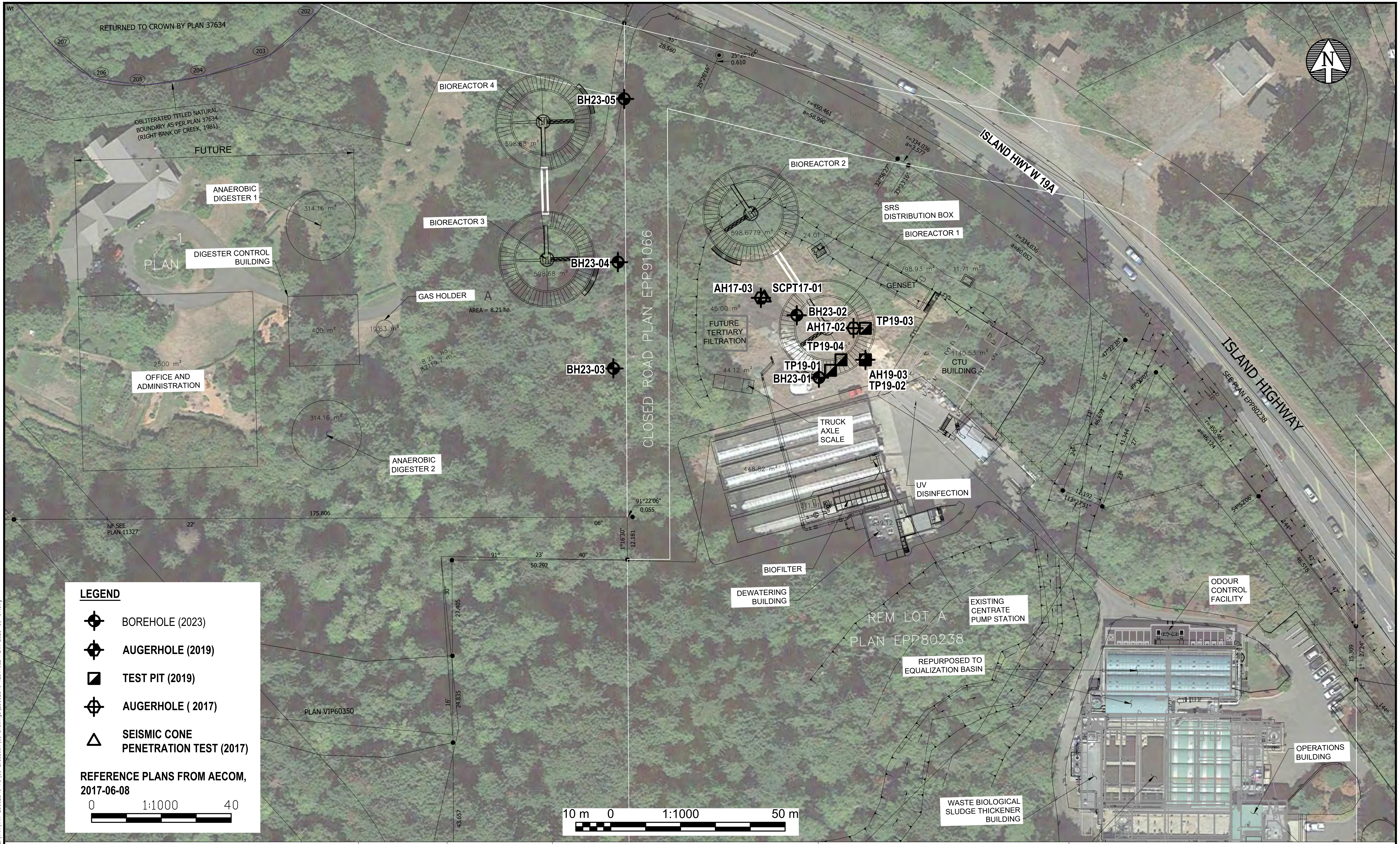
The Client recognizes and agrees that electronic files submitted by EXP have been prepared and submitted using specific software and hardware systems. EXP makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

Figures –

Testhole Location Plan
Figure 1

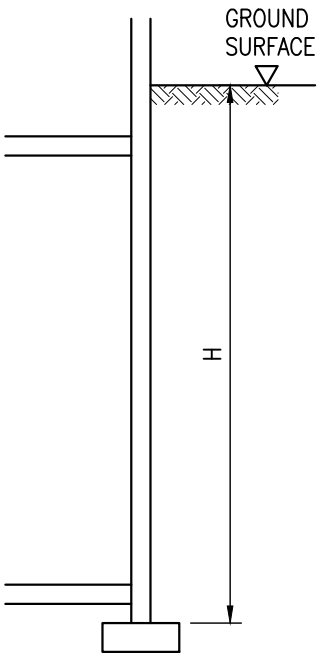
Lateral Earth Pressure on Yielding Walls, 2475 EQ
Figure 2

Lateral Earth Pressure on Non-Yielding Walls, 2475 EQ
Figure 3

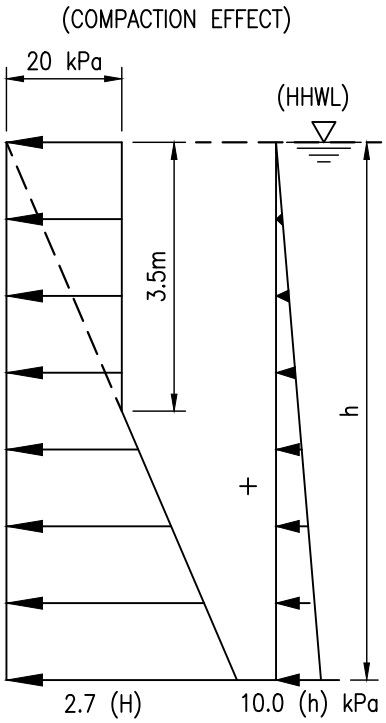

RETURNED TO CROWN BY PLAN 37634
OBLITERATED TITLED NATURAL BOUNDARY AS PER PLAN 37634 (RIGHT BANK OF CREEK, 1981)
FUTURE
PLAN
BIOREACTOR 4
BH23-05
BIOREACTOR 3
BH23-04
BH23-03
ANAEROBIC DIGESTER 1
DIGESTER CONTROL BUILDING
GAS HOLDER
AREA = 8.21 ha.
OFFICE AND ADMINISTRATION
ANAEROBIC DIGESTER 2
CLOSED ROAD PLAN EPP91066
ISLAND HWY W 19A
ISLAND HIGHWAY
SEE PLAN EPP80238
BIOREACTOR 2
SRS DISTRIBUTION BOX
BIOREACTOR 1
GENSET
AH17-03
SCPT17-01
BH23-02
AH17-02
TP19-03
TP19-04
TP19-01
BH23-01
AH19-03
TP19-02
FUTURE TERTIARY FILTRATION
CTU BUILDING
TRUCK AXLE SCALE
UV DISINFECTION
BIOFILTER
DEWATERING BUILDING
EXISTING CENTRATE PUMP STATION
REM LOT A
PLAN EPP80238
REPURPOSED TO EQUALIZATION BASIN
ODOUR CONTROL FACILITY
OPERATIONS BUILDING
WASTE BIOLOGICAL SLUDGE THICKENER BUILDING
PLAN VIP60350
LEGEND
BOREHOLE (2023)
AUGERHOLE (2019)
TEST PIT (2019)
AUGERHOLE (2017)
SEISMIC CONE PENETRATION TEST (2017)
REFERENCE PLANS FROM AECOM, 2017-06-08
0 1:1000 40
10 m 0 1:1000 50 m

EXP Services Inc. 275–3001 Wayburne Drive Burnaby, British Columbia V5G 4W3 Telephone: 604–874–1245 Fax: 604–874–2358 exp.com	DFTR. PDL DSGN. AN CHK. BW	ISSUE/REVISION (No. / DESCRIPTION / DATE)	CLIENT: AECOM PROJECT: French Creek Pollution Control Centre, 957 Lee Road, Parksville, BC PROJECT NO. VAN-23002846-A0
TITLE: Testhole Location Plan	DATE: 2023-09-07	SCALE: 1:1000	DWG NO. Figure 1

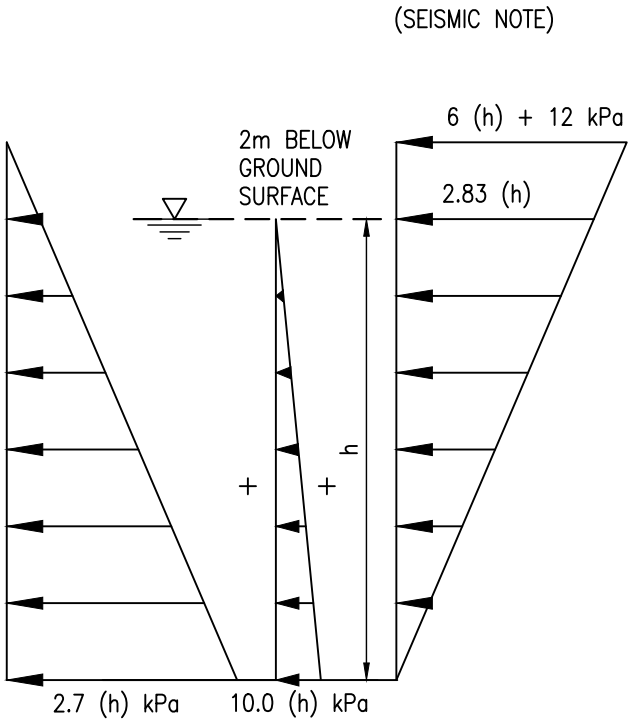
E:\VAN\VAN-23002846-A0\60 Execution\65 Drawings\23002846 TESTHOLE PLAN 2023-09-07.dwg
Sep 12, 2023 - 6:35pm



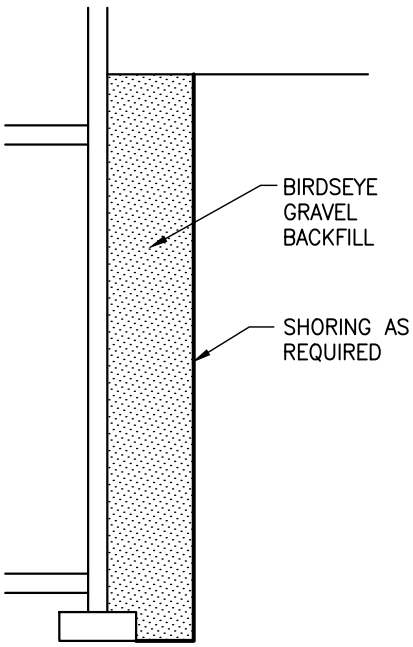
TYPICAL FOUNDATION WALL



STATIC + WATER PRESSURE



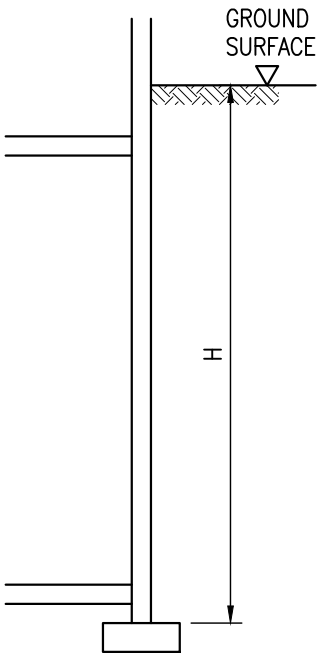
STATIC + WATER PRESSURE + SEISMIC



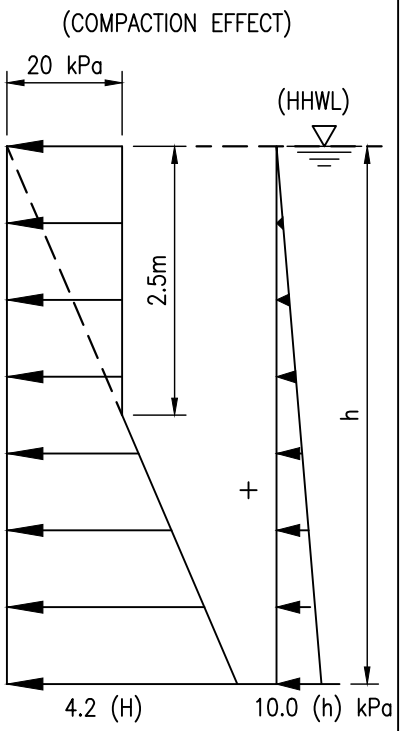
NOTES:

- ALL METRIC UNITS IN (m) AND (kPa)
- ACTIVE PRESSURE IS CALCULATED BASED ON ø=33 DEGREE AND γ =19kN/m3
- ACTIVE PRESSURE COEFFICIENT Ka = 0.30
- THE PRESSURES GIVEN IN THIS DIAGRAM ARE UNFACTORED. USE APPROXIMATE LOAD FACTORS.
- SEISMIC COMPONENT BASED ON:
  Kh = ¾XPGA =¾x0.525= 0.393

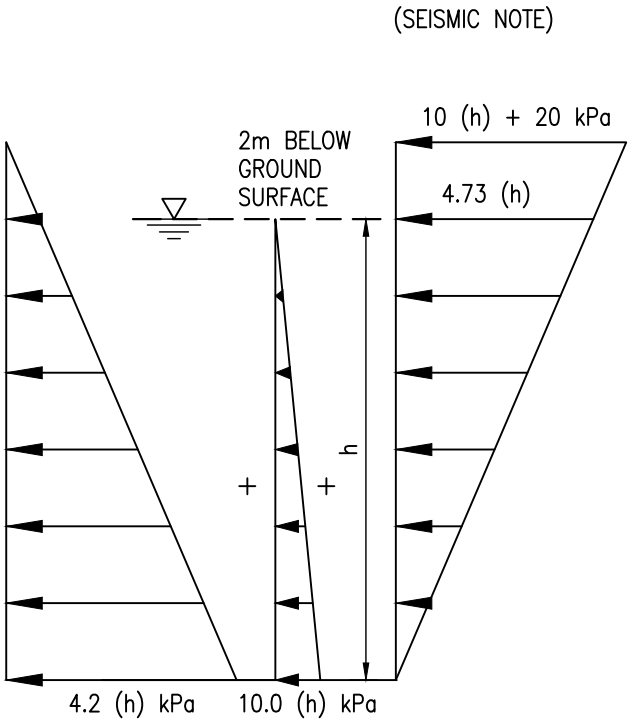
CLIENT: AECOM				TITLE: Lateral Earth Pressure on Yielding Walls, 2475 EQ		
PROJECT: French Creek Pollution Control Centre, 957 Lee Road, Parksville, BC						
PROJECT NO. VAN-23002846-A0	DFTR. MG	DSGN. UC	CHK. BW	DATE 2023-09-12	SCALE: NTS	DWG NO. FIGURE 2



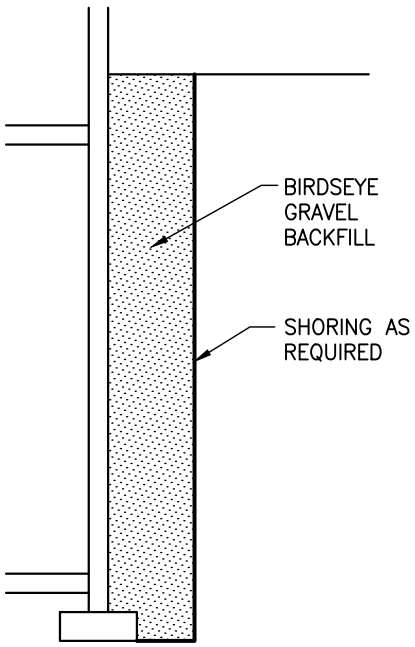
TYPICAL FOUNDATION WALL



STATIC + WATER PRESSURE



STATIC + WATER PRESSURE + SEISMIC



NOTES:

- ALL METRIC UNITS IN (m) AND (kPa)
- ACTIVE PRESSURE IS CALCULATED BASED ON ϕ=33 DEGREE AND γ =19kN/m3
- EARTH PRESSURE AT REST COEFFICIENT Ko = 0.46
- THE PRESSURES GIVEN IN THIS DIAGRAM ARE UNFACTORED. USE APPROXIMATE LOAD FACTORS.
- SEISMIC COMPONENT BASED ON:
  Kh = PGA = 0.525

CLIENT: AECOM				TITLE: Lateral Earth Pressure on Non-Yielding Walls, 2475 EQ		
PROJECT: French Creek Pollution Control Centre, 957 Lee Road, Parksville, BC						
PROJECT NO. VAN-23002846-A0	DFTR. MG	DSGN. UC	CHK. BW	DATE 2023-09-12	SCALE: NTS	DWG NO. FIGURE 3

Appendix A –
Test Hole Logs

BH23-01 to BH23-05

AH17-02 and AH17-03

AH19-03

TP19-01 to TP19-03

RECORD OF BOREHOLE : BH23-01

EXP

PROJECT NUMBER VAN-23002846-A0
PROJECT NAME French Creek Pollution Control Centre
DRILLING DATE 2023-06-27 to 2023-06-27
DRILLING CONTRACTOR Drillwell Enterprises Ltd.
DRILLING METHOD Sonic Core
EQUIPMENT TYPE Boart LS250 Track Mounted Sonic Drill
LOGGED BY AN **CHECKED BY** BW

CLIENT AECOM Canada Ltd.
PROJECT LOCATION 1236 Island Highway West, Parksville, BC
BOREHOLE LOCATION
ELEVATION
GROUND WATER DEPTHS: **AT TIME OF DRILLING** ---
AT END OF DRILLING 2.74m
AFTER DRILLING ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m / DYNAMIC CONE BLOWS/0.3m	POCKET PEN. (kPa) / FIELD VANE SHEAR (kPa) Peak Remold	FINES CONTENT (%) / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL
		SANDY SILT and ORGANICS, trace gravel, dark grey-brown, moist, very loose [FILL].							
		NO RECOVERY	0.2	GR1	SC	100			8
1									
		SAND and SILT, trace clay, trace gravel, brown-grey, moist, loose [FILL].	1.5	S1	SS	75	6 (1, 3, 3, 5)		8 23 45 41
2									
		GRAVEL and SAND, trace silt, grey-brown, wet, compact.	2.5	S2	SS	75	24 (9, 13, 11, 17)		
3									
				GR2	SC	100			9 3
4		- cobbles between 4.60m to 5.20m			SS	0	30 (7, 16, 14, 14)		
5									
6				S3	SS	50	23 (3, 11, 12, 10)		
		SAND and SILT, some gravel, trace clay, grey, moist, compact to dense [Weathered TILL-LIKE].	6.4	GR3	SC	100			11 36
7									
					SS	0	19 (5, 9, 10, 10)		
8									

(Continued Next Page)

RECORD OF BOREHOLE : BH23-01

EXP

PROJECT NUMBER VAN-23002846-A0 **CLIENT** AECOM Canada Ltd.

PROJECT NAME French Creek Pollution Control Centre **PROJECT LOCATION** 1236 Island Highway West, Parksville, BC

DRILLING DATE 2023-06-27 to 2023-06-27 **BOREHOLE LOCATION**

DRILLING CONTRACTOR Drillwell Enterprises Ltd. **ELEVATION**

DRILLING METHOD Sonic Core **GROUND WATER DEPTHS:** ▽ **AT TIME OF DRILLING** ---

EQUIPMENT TYPE Boart LS250 Track Mounted Sonic Drill ▼ **AT END OF DRILLING** 2.74m

LOGGED BY AN **CHECKED BY** BW ▼ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
9		SAND and SILT, some gravel, trace clay, grey, moist, compact to dense [Weathered TILL-LIKE]. *(continued)*							
					SS	0	59 ▲ (21, 34, 25, 25)		
10		- some cobbles		GR4	SC	100			11 ⬠
				GR5	SC	100			9 ⬠
11		SILTY SAND, some gravel, trace clay, dark grey, very dense [TILL-LIKE].	10.4		SS	0	(50, 103, refusal)		
12					SS		63 ▲ (17, 28, 35, 38)		
13		GRAVELLY SAND, trace silt, light grey, dense.	12.5	S4	SS	100			
14				GR6	SC	100			10 ⬠ □ 2
15		SILTY SAND, trace gravel, grey-brown, moist, dense/hard [TILL-LIKE].	14.6	GR7	SC	100			11 ⬠
		SILT and SAND, trace gravel, grey, moist, very dense/hard [TILL-LIKE].	15.2	GR8	SC	100			11 ⬠
16		SANDSTONE	15.8						

(Continued Next Page)

RECORD OF BOREHOLE : BH23-01

EXP

PROJECT NUMBER VAN-23002846-A0
CLIENT AECOM Canada Ltd.
PROJECT NAME French Creek Pollution Control Centre
PROJECT LOCATION 1236 Island Highway West, Parksville, BC
DRILLING DATE 2023-06-27 to 2023-06-27
BOREHOLE LOCATION
DRILLING CONTRACTOR Drillwell Enterprises Ltd.
ELEVATION
DRILLING METHOD Sonic Core
GROUND WATER DEPTHS: ▽ **AT TIME OF DRILLING** ---
EQUIPMENT TYPE Boart LS250 Track Mounted Sonic Drill
▼ **AT END OF DRILLING** 2.74m
LOGGED BY AN **CHECKED BY** BW
▽ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
17		SANDSTONE *(continued)*							
18									

Bottom of hole at 18.9m.

RECORD OF BOREHOLE : BH23-02

EXP

PROJECT NUMBER VAN-23002846-A0
CLIENT AECOM Canada Ltd.
PROJECT NAME French Creek Pollution Control Centre
PROJECT LOCATION 1236 Island Highway West, Parksville, BC
DRILLING DATE 2023-06-27 to 2023-06-27
BOREHOLE LOCATION
DRILLING CONTRACTOR Drillwell Enterprises Ltd.
ELEVATION
DRILLING METHOD Sonic Core
GROUND WATER DEPTHS: ▽ **AT TIME OF DRILLING** ---
EQUIPMENT TYPE Boart LS250 Track Mounted Sonic Drill
▼ **AT END OF DRILLING** 2.64m
LOGGED BY AN **CHECKED BY** BW
▼ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m / DYNAMIC CONE BLOWS/0.3m	POCKET PEN. (kPa) / FIELD VANE SHEAR (kPa) Peak, Remold	FINES CONTENT (%) / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL	WELL DIAGRAM Casing Type:
0		GRAVELLY SAND, trace to some silt, brown-grey, compact [FILL].								
				GR1	SC	100			5, 10	
1										
		SILT, some clay, grey, moist, firm [FILL].	1.2	GR2	SC	100			10	Bentonite
			1.4	GR3	SC	100				
		SAND, some silt, trace clay, trace gravel, grey, moist, compact [FILL].	1.5							
		SANDY GRAVEL, trace silt, frequent layers of cobble, grey-brown, wet, compact to dense.		S1	SS	50	57 (16, 28, 29, 29)			
2										
				GR4	SC	100			5, 7	Sand
3				S2	SS	50	27 (9, 13, 14, 17)			
4										
				S3	SS	38	23 (4, 12, 11, 8)			Screen
5										
				GR5	SC	100			9	
6										
				S4	SS	50	85 (6, 50, 35, 25)			
		SAND and GRAVEL, trace silt, light grey to grey, moist, dense to compact [TILL-LIKE].	6.4							
7				GR6	SC	100			10, 8	
8				S5	SS	100	20 (3, 8, 12, 12)			

(Continued Next Page)

RECORD OF BOREHOLE : BH23-02

EXP

PROJECT NUMBER VAN-23002846-A0
CLIENT AECOM Canada Ltd.
PROJECT NAME French Creek Pollution Control Centre
PROJECT LOCATION 1236 Island Highway West, Parksville, BC
DRILLING DATE 2023-06-27 to 2023-06-27
BOREHOLE LOCATION
DRILLING CONTRACTOR Drillwell Enterprises Ltd.
ELEVATION
DRILLING METHOD Sonic Core
GROUND WATER DEPTHS: **AT TIME OF DRILLING** ---
EQUIPMENT TYPE Boart LS250 Track Mounted Sonic Drill
AT END OF DRILLING 2.64m
LOGGED BY AN **CHECKED BY** BW
AFTER DRILLING ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m / DYNAMIC CONE BLOWS/0.3m	POCKET PEN. (kPa) / FIELD VANE SHEAR (kPa) Peak Remold	FINES CONTENT (%) / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL	WELL DIAGRAM Casing Type:
9		SAND and GRAVEL, trace silt, light grey to grey, moist, dense to compact [TILL-LIKE]. *(continued)*								
				S6	SS	50	21 (7, 8, 13, 16)		10	
10		SANDY SILT, trace gravel, grey, moist, compact to dense [TILL-LIKE].	9.4	GR7	SC	100			61	
				S7	SS	63	82 (35, 38, 44, 83)			- Bentonite
11		SILTY SAND, fine to medium, grey, moist, very dense [TILL-LIKE].	11.1	GR8	SC	100			10	
12		SAND, medium to coarse, some gravel, trace to some silt, grey, moist, dense.	11.7	GR9	SC	100			10	
		- gravelly between 12.5m to 13.1m.		S8	SS	100	89 (12, 43, 46, 55)			
13				GR10	SC	100			14	
14		- gravelly between 13.7m to 14.6m.								
15		SILTY SAND, fine to medium, trace gravel, grey, moist, dense [TILL-LIKE].	14.6	GR11	SC	100			14	

Bottom of hole at 15.2m.

RECORD OF BOREHOLE : BH23-03

EXP

PROJECT NUMBER VAN-23002846-A0
PROJECT NAME French Creek Pollution Control Centre
DRILLING DATE 2023-06-29 to 2023-06-29
DRILLING CONTRACTOR Drillwell Enterprises Ltd.
DRILLING METHOD Sonic Core
EQUIPMENT TYPE Boart LS250 Track Mounted Sonic Drill
LOGGED BY AN **CHECKED BY** BW

CLIENT AECOM Canada Ltd.
PROJECT LOCATION 1236 Island Highway West, Parksville, BC
BOREHOLE LOCATION
ELEVATION
GROUND WATER DEPTHS: ▽ **AT TIME OF DRILLING** ---
▼ **AT END OF DRILLING** 2.74m
▼ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
		SILT and ORGANICS, some wood, dark brown, moist, very loose [FILL].		GR1	SC	100			47
		SILTY SAND, some clay, trace gravel, trace organic, trace roots, orange-brown-grey, moist, loose.	0.3						
1									
2				S1	SS	100	5 ▲ (2, 2, 3, 5)		
3		▼							
		GRAVEL and SAND, trace silt, dark grey, moist, compact.	2.9	GR2	SS SC	50 100	13 ▲ (13, 7, 6, 5)		8 2
4		SILTY CLAY, trace sand, trace organic, grey, moist, firm.	3.9	GR3	SC	100			30 16 28
		GRAVELLY SAND, trace silt, grey to dark gray, wet, compact.	4.5		SS	50	24 ▲ (7, 18, 6, 4)		
5				GR4	SC	100			10 4
6									
					SS	0	14 ▲ (6, 6, 8, 7)		
7									
		SILTY SAND, some gravel, trace cobbles, trace clay, moist, compact to dense [TILL-LIKE].	7.6		SS	0	46 ▲ (8, 38, 8, 10)		
8				GR5	SC	100			11

(Continued Next Page)

RECORD OF BOREHOLE : BH23-03

EXP

PROJECT NUMBER VAN-23002846-A0 **CLIENT** AECOM Canada Ltd.

PROJECT NAME French Creek Pollution Control Centre **PROJECT LOCATION** 1236 Island Highway West, Parksville, BC

DRILLING DATE 2023-06-29 to 2023-06-29 **BOREHOLE LOCATION**

DRILLING CONTRACTOR Drillwell Enterprises Ltd. **ELEVATION**

DRILLING METHOD Sonic Core **GROUND WATER DEPTHS:** ▽ **AT TIME OF DRILLING** ---

EQUIPMENT TYPE Boart LS250 Track Mounted Sonic Drill ▼ **AT END OF DRILLING** 2.74m

LOGGED BY AN **CHECKED BY** BW ▼ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
9		SILTY SAND, some gravel, trace cobbles, trace clay, moist, compact to dense [TILL-LIKE]. *(continued)*							
				S2	SS	100	22 ▲ (6, 11, 11, 12)		
10									
				GR6	SC	100			7 ⬠
11				S3	SS	100	80 ▲ (33, 39, 41, 58)		
		SAND, fine to medium, some silt, trace gravel, trace clay, brown, dense.	11.4	GR7	SC	100			12 ⬠
12		GRAVELLY SAND, trace silt, brown, wet, compact to dense.	11.9						
13				GR8	SS	100			13 ⬠
14		- cobbles between 14.00 m to 14.35m.							
		SANDY SILT, trace gravel, brown-grey, dense [TILL-LIKE].	14.5	GR9	SC	100			10 ⬠
15		SANDSTONE	14.9						

Bottom of hole at 15.5m.

RECORD OF BOREHOLE : BH23-04

EXP

PROJECT NUMBER VAN-23002846-A0
CLIENT AECOM Canada Ltd.
PROJECT NAME French Creek Pollution Control Centre
PROJECT LOCATION 1236 Island Highway West, Parksville, BC
DRILLING DATE 2023-06-30 to 2023-06-30
BOREHOLE LOCATION
DRILLING CONTRACTOR Drillwell Enterprises Ltd.
ELEVATION
DRILLING METHOD Sonic Core
GROUND WATER DEPTHS: ▽ **AT TIME OF DRILLING** ---
▼ **AT END OF DRILLING** 2.90m
EQUIPMENT TYPE Boart LS250 Track Mounted Sonic Drill
▼ **AFTER DRILLING** ---
LOGGED BY AN **CHECKED BY** BW

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL ⬠ MC LL 20 40 60 80	DOWNHOLE SEISMIC CASING DIAGRAM Casing Type:
0		SILT and ORGANICS, trace sand, fine, trace roots, damp, loose [FILL].		GR1	SC	100			25	
		SAND and SILT trace organics, trace roots, damp, orangish brown-brown, damp, loose to compact [FILL].	0.3	GR2	SC	100			17 / 47	
1										
					SS	0	18 (8, 9, 9, 5)			
2		Gravel and Cobbles, some sand, trace debris, grey to dark grey, moist, comapct [FILL].	2.0	S1	SS	100				
				GR3	SC	100			9	
3	▼									
		SAND and GRAVEL, trace silt, layers of cobbles, grey, wet to saturated, compact.	3.0		SS	0	15 (4, 7, 8, 7)			
4										
					SS	0	30 (18, 14, 16, 12)			
5				S2	SS	100				
		-silty between 5.8m to 7.0m.		GR4	SC	100			16 / 21	
6					SS	0	24 (9, 14, 10, 8)			
7				GR5	SC	100			7	
					SS	0	28 (3, 16, 12, 11)			
8										

(Continued Next Page)

RECORD OF BOREHOLE : BH23-04

EXP

PROJECT NUMBER VAN-23002846-A0 **CLIENT** AECOM Canada Ltd.

PROJECT NAME French Creek Pollution Control Centre **PROJECT LOCATION** 1236 Island Highway West, Parksville, BC

DRILLING DATE 2023-06-30 to 2023-06-30 **BOREHOLE LOCATION**

DRILLING CONTRACTOR Drillwell Enterprises Ltd. **ELEVATION**

DRILLING METHOD Sonic Core **GROUND WATER DEPTHS:** ▽ **AT TIME OF DRILLING** ---

EQUIPMENT TYPE Boart LS250 Track Mounted Sonic Drill ▼ **AT END OF DRILLING** 2.90m

LOGGED BY AN **CHECKED BY** BW ▼ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL ⬠ MC LL 8 20 40 60 80	DOWNHOLE SEISMIC CASING DIAGRAM Casing Type:
		SILTY SAND, some gravel, grey-brown, moist, dense/hard [TILL-LIKE]. *(continued)*	8.2	GR6	SC	100			⬠ 11	
9		GRAVELLY SILTY SAND, grey, moist, dense [TILL-LIKE].	8.7	GR7	SC	100			⬠ □ 26	
				S3	SS	100	37 ▲ (5, 11, 26, 31)			
10		SILTY SAND, some gravel ro gravelly, grey-brown, moist, dense [TILL-LIKE].	9.9	GR8	SC	100			⬠ 7	
11		SANDY SILT, some gravel, grey, moist, very dense/hard [TILL-LIKE].	10.7	S4	SS	100				
12										
		SAND, trace to some silt, trace gravel, grey, moist, dense.	12.3	S5	SS	100	44 ▲ (22, 21, 23, 23)			
13										
14				GR9	SC	100			⬠ 11 10	
15										
		SILT and SAND, fine, trace gravel, grey, moist, very dense [TILL-LIKE].	15.2	S6	SS	100	▲ (89, 110, refusal)			
16										
		SANDSTONE	16.2	GR10	SS	100				

(Continued Next Page)

RECORD OF BOREHOLE : BH23-04

EXP

PROJECT NUMBER VAN-23002846-A0 **CLIENT** AECOM Canada Ltd.

PROJECT NAME French Creek Pollution Control Centre **PROJECT LOCATION** 1236 Island Highway West, Parksville, BC

DRILLING DATE 2023-06-30 to 2023-06-30 **BOREHOLE LOCATION**

DRILLING CONTRACTOR Drillwell Enterprises Ltd. **ELEVATION**

DRILLING METHOD Sonic Core **GROUND WATER DEPTHS:** ▽ **AT TIME OF DRILLING** ---

EQUIPMENT TYPE Boart LS250 Track Mounted Sonic Drill ▼ **AT END OF DRILLING** 2.90m

LOGGED BY AN **CHECKED BY** BW ▼ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80	DOWNHOLE SEISMIC CASING DIAGRAM Casing Type:
17		SANDSTONE *(continued)*								
18										
19										
20										
21										
22										

Bottom of hole at 23.0m.

RECORD OF BOREHOLE : BH23-05

EXP

PROJECT NUMBER VAN-23002846-A0
PROJECT NAME French Creek Pollution Control Centre
DRILLING DATE 2023-06-29 to 2023-06-29
DRILLING CONTRACTOR Drillwell Enterprises Ltd.
DRILLING METHOD Sonic Core
EQUIPMENT TYPE Boart LS250 Track Mounted Sonic Drill
LOGGED BY AN **CHECKED BY** BW

CLIENT AECOM Canada Ltd.
PROJECT LOCATION 1236 Island Highway West, Parksville, BC
BOREHOLE LOCATION
ELEVATION
GROUND WATER DEPTHS: ▽ **AT TIME OF DRILLING** ---
▼ **AT END OF DRILLING** 2.74m
▼ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
		FOREST DETRITUS							
		SAND, some silt, trace gravel, orangish brown, loose, dry.	0.3						
1		SILT and SAND, trace clay, orange-brown-grey, compact, moist.	0.7	GR1	SC	100			16 ⬠ 62 □
		GRAVELLY SAND, some silt, brown/grey, compact, moist.	1.3						
2				S1	SS	50	14 ▲ (8, 7, 7, 9)		
		SILTY CLAY, some organic, trace roots, firm, moist.	2.1	GR2	SC	100			18 11 ⊖ 24 □ 50
3		▼ SILTY SAND, fine to medium, trace to some gravel, brown, compact to dense, moist.	2.6	GR3	SC	100			10 ⬠
		SANDY GRAVEL, trace silt, layers of cobbles, grey, wet to saturated, compact.	3.0		SS	0	18 ▲ (5, 9, 9, 15)		
4				GR4	SC	100			7 ◫ 1
5					SS	20	30 ▲ (19, 19, 11, 11)		
6					SS	0	16 ▲ (7, 8, 8, 6)		
7									
8					SS	0	10 ▲ (4, 5, 5, 8)		

(Continued Next Page)

RECORD OF BOREHOLE : BH23-05

EXP

PROJECT NUMBER VAN-23002846-A0
PROJECT NAME French Creek Pollution Control Centre
DRILLING DATE 2023-06-29 to 2023-06-29
DRILLING CONTRACTOR Drillwell Enterprises Ltd.
DRILLING METHOD Sonic Core
EQUIPMENT TYPE Boart LS250 Track Mounted Sonic Drill
LOGGED BY AN **CHECKED BY** BW

CLIENT AECOM Canada Ltd.
PROJECT LOCATION 1236 Island Highway West, Parksville, BC
BOREHOLE LOCATION
ELEVATION
GROUND WATER DEPTHS: **AT TIME OF DRILLING** ---
AT END OF DRILLING 2.74m
AFTER DRILLING ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m / DYNAMIC CONE BLOWS/0.3m	POCKET PEN. (kPa) / FIELD VANE SHEAR (kPa) Peak Remold	FINES CONTENT (%) / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL
9		SANDY GRAVEL, trace silt, layers of cobbles, grey, wet to saturated, compact. *(continued)*							
					SS	0	23 (8, 8, 15, 17)		
10		SANDY SILT, trace to some gravel, layers of cobbles, grey to dark grey, moist, dense [TILL-LIKE].	9.8						
				GR5	SC	100			11
11									
12									
		SILTY SAND, fine, trace gravel, grey, moist, dense to very dense [TILL-LIKE].	12.2	S2	SS	100	59 (21, 33, 26, 39)		
13									
14									
		SILT, trace sand, trace gravel, dark brown/grey, moist, dense [TILL-LIKE].	14.8	GR6	SC	100			16
15		SAND, fine to medium, some gravel, gery to dark grey, moist, dense.	14.9	GR7	SC	100			8
		SANDSTONE	15.4						
16									

Bottom of hole at 16.2m.

RECORD OF AUGERHOLE : AH17-01

EXP Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3

PROJECT NUMBER VAN-00240098-A0
PROJECT NAME French Creek Pollution Control Centre
DRILLING DATE 2017-06-01
DRILLING CONTRACTOR Drillwell Enterprises Ltd.
DRILLING METHOD Solid Stem Auger
EQUIPMENT TYPE Track Mounted Auger Drill
LOGGED BY DGS **CHECKED BY** BW

CLIENT AECOM Canada Ltd.
PROJECT LOCATION 957 Lee Road, Parksville, BC
AUGERHOLE LOCATION N: 5466833 E: 401125
ELEVATION
GROUND WATER DEPTHS: ▽ **AT TIME OF DRILLING** 1.8m inferred
▼ **AT END OF DRILLING** ---
▼ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
		SOD	0.1						
		SAND, trace silt, yellow, damp, (loose) fine grained (FILL)	0.2						
		SAND, some gravel, trace silt, frequent rootlets, orangish brown, damp, (compact) medium grained (FILL)	0.3						
1		SILTY SAND, some gravel, grey, moist, (compact to dense) fine grained (FILL)		S1	AU		11, 37, 31		
		GRAVELLY SAND, trace silt, yellowish brown, dry, (dense to very dense) sand was fine to medium grained	1.1	S2	AU		70, 100+		
2		SAND, grey, wet, (dense) medium grained	1.8						
		GRAVELLY SAND, trace silt, yellowish brown, damp, (dense to very dense) sand was fine to medium grained	2.1	S3	AU				
3		SILTY CLAY, trace sand, trace gravel, bluish grey, moist, (firm)	2.9	S10	AU				
4		-drilling becomes hard		S4	AU				
5		SILTY SANDY GRAVEL to SILTY SAND, some gravel, some clay, grey, moist, (compact to very dense) gravel was angular to sub-angular and fine grained (TILL-LIKE)	4.9						
6				S5	AU				
7		-clay content fluctuates with depth		S6	AU				
8									

(Continued Next Page)

EXP Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3

RECORD OF AUGERHOLE : AH17-01

PROJECT NUMBER VAN-00240098-A0
CLIENT AECOM Canada Ltd.
PROJECT NAME French Creek Pollution Control Centre
PROJECT LOCATION 957 Lee Road, Parksville, BC
DRILLING DATE 2017-06-01
AUGERHOLE LOCATION N: 5466833 E: 401125
DRILLING CONTRACTOR Drillwell Enterprises Ltd.
ELEVATION
DRILLING METHOD Solid Stem Auger
GROUND WATER DEPTHS: ▽ **AT TIME OF DRILLING** 1.8m inferred
EQUIPMENT TYPE Track Mounted Auger Drill
▼ **AT END OF DRILLING** ---
LOGGED BY DGS **CHECKED BY** BW
▼ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
9		SILTY SANDY GRAVEL to SILTY SAND, some gravel, some clay, grey, moist, (compact to very dense) gravel was angular to sub-angular and fine grained (TILL-LIKE) *(continued)*		S7	AU				
10				S8	AU				
11									
12		-becomes sandier, poor recovery below 12m		S9	AU				
13									
14		SAND, trace silt, trace gravel and cobbles, grey, moist, (dense) fine grained -drilling becomes easier, less gravel/cobbles	13.4						
15									

Bottom of hole at 15.2m.

RECORD OF AUGERHOLE : AH17-02

EXP Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3

PROJECT NUMBER VAN-00240098-A0
CLIENT AECOM Canada Ltd.
PROJECT NAME French Creek Pollution Control Centre
PROJECT LOCATION 957 Lee Road, Parksville, BC
DRILLING DATE 2017-06-01
AUGERHOLE LOCATION N: 5466932 E: 401014
DRILLING CONTRACTOR Drillwell Enterprises Ltd.
ELEVATION
DRILLING METHOD Solid Stem Auger
GROUND WATER DEPTHS: ▽ **AT TIME OF DRILLING** ---
EQUIPMENT TYPE Track Mounted Auger Drill
▼ **AT END OF DRILLING** ---
LOGGED BY DGS **CHECKED BY** BW
▽ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
		SOD/TOPSOIL	0.1						
		GRAVELLY SAND, some silt, pockets of black organic silt, orangish brown, damp, (compact) (FILL)		S11	AU				
		SAND, some gravel, trace silt, grey, wet, (compact) well-graded (FILL)	0.6						
1		CLAY, some silt, some sand, some gravel, grey with rust pockets, moist, (stiff) (FILL)	0.8						
		SAND, some gravel, some sand, frequent pieces of wood debris, reddish brown with occasional grey pockets, moist, (loose to compact) fine grained (FILL)	0.9	S12	AU				
				S32	AU				

Refusal at 1.8m.

NOTES: Repeated attempts made in a 12m radius all encountered refusal at 1.5 to 1.8m on hard surface. Unable to penetrate further.

RECORD OF AUGERHOLE : AH17-03

EXP Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3

PROJECT NUMBER VAN-00240098-A0
PROJECT NAME French Creek Pollution Control Centre
DRILLING DATE 2017-06-01
DRILLING CONTRACTOR Drillwell Enterprises Ltd.
DRILLING METHOD Solid Stem Auger
EQUIPMENT TYPE Track Mounted Auger Drill
LOGGED BY DGS **CHECKED BY** BW

CLIENT AECOM Canada Ltd.
PROJECT LOCATION 957 Lee Road, Parksville, BC
AUGERHOLE LOCATION N: 5466942 E: 400988
ELEVATION
GROUND WATER DEPTHS: ▽ **AT TIME OF DRILLING** 2.6m inferred
▼ **AT END OF DRILLING** ---
▼ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
		SOD	0.1						
		SILT, SAND & GRAVEL, frequent organics, mottled dark brown-grey-rust, damp, (loose to compact) (FILL)		S13	AU		9, 15, 5		
		SAND, some gravel, some silt, orangish brown, damp, (loose to compact) fine grained (FILL)	0.5						
1		CLAY, some silt, some gravel, grey, moist, (firm) (FILL)	0.8						
		SILTY SAND, some gravel, frequent organics, layers of sand, layers of silt, grey-rust-brown,moist, (loose) (FILL)	0.9	S14	AU		3, 4		
		DECOMPOSING WOOD & ORGANIC REMNANTS	1.5	S15	AU		20		
2		SAND, trace silt, occasional pieces of wood, bluish grey, damp, (compact) fine grained	1.7	S16	AU		15		
		CLAYEY SILT, frequent sand seams, greyish blue with rust seams, damp, (stiff)	2.1	S17	AU		10, 8		
		▽ SAND, some gravel to gravelly, some silt, brown, wet, (compact) medium to coarse grained	2.6				28		
3				S18	AU		42, 29, 25		
		SANDY GRAVEL, trace silt, grey, wet, (compact) sand was coarse grained, gravel was sub-angular to rounded	3.7						
4				S19	AU		25, 35, 38		
		-poor recovery below 4.6m; appears to grade to sand, some gravel							
5							24, 19		
				S20	AU		15, 25		
6							13, 19, 22		
7							27, 23		
8							Drilled Out, 17		

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EXP Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3

RECORD OF AUGERHOLE : AH19-02

PROJECT NUMBER VAN-00240098-A0
CLIENT AECOM Canada Ltd.
PROJECT NAME French Creek Pollution Control Centre
PROJECT LOCATION 957 Lee Road, Parksville, BC
DRILLING DATE 2019-02-22
AUGERHOLE LOCATION N: 5466835 E: 401142
DRILLING CONTRACTOR Southland Drilling Co. Ltd.
ELEVATION
DRILLING METHOD Solid Stem Auger
GROUND WATER DEPTHS: ▽ **AT TIME OF DRILLING** ---
EQUIPMENT TYPE MST 1100 Track Mounted Drill
▼ **AT END OF DRILLING** ---
LOGGED BY DGS **CHECKED BY** BW
▼ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
9		SILTY SAND, some gravel, grey, moist, (very dense) (TILL-LIKE) *(continued)*	8.2	S17	AU				
10									

Bottom of hole at 10.7m.

RECORD OF AUGERHOLE : AH19-03

EXP Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3

PROJECT NUMBER VAN-00240098-A0
PROJECT NAME French Creek Pollution Control Centre
DRILLING DATE 2019-02-22
DRILLING CONTRACTOR Southland Drilling Co. Ltd.
DRILLING METHOD Solid Stem Auger
EQUIPMENT TYPE MST 1100 Track Mounted Drill
LOGGED BY DGS **CHECKED BY** BW

CLIENT AECOM Canada Ltd.
PROJECT LOCATION 957 Lee Road, Parksville, BC
AUGERHOLE LOCATION N: 5466923 E: 401017
ELEVATION
GROUND WATER DEPTHS: ▽ **AT TIME OF DRILLING** 2.7m inferred
▼ **AT END OF DRILLING** ---
▼ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
1		SEE TESTPIT TP19-02							
2									
3		▽ GRAVELLY SAND, trace to some silt, grey, wet, (compact) medium to coarse grained	2.7				DRILLOUT 29		
4				S19	AU		20 20 11		
5							15 17 16		9
6		SILTY SAND, some clay, some gravel, grey, moist, (compact to very dense) sand is fine to medium grained, gravel is sub-rounded to sub-angular (TILL-LIKE)	5.0	S20	AU		32 29 27 31		14
7							56 39 38		
8				S21	AU		43 42 58 56		13

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RECORD OF AUGERHOLE : AH19-03

EXP Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3

PROJECT NUMBER VAN-00240098-A0
PROJECT NAME French Creek Pollution Control Centre
DRILLING DATE 2019-02-22
DRILLING CONTRACTOR Southland Drilling Co. Ltd.
DRILLING METHOD Solid Stem Auger
EQUIPMENT TYPE MST 1100 Track Mounted Drill
LOGGED BY DGS **CHECKED BY** BW

CLIENT AECOM Canada Ltd.
PROJECT LOCATION 957 Lee Road, Parksville, BC
AUGERHOLE LOCATION N: 5466923 E: 401017
ELEVATION
GROUND WATER DEPTHS: ▽ **AT TIME OF DRILLING** 2.7m inferred
▼ **AT END OF DRILLING** ---
▼ **AFTER DRILLING** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
9		SILTY SAND, some clay, some gravel, grey, moist, (compact to very dense) sand is fine to medium grained, gravel is sub-rounded to sub-angular (TILL-LIKE) *(continued)*		S22	AU		52 51 50 61 100+		13
10		SANDY SILT, some clay, some gravel, grey, moist, (dense to very dense) sand is fine to coarse grained, gravel is rounded (TILL-LIKE)	9.4	S23	AU				12
11		SAND, some gravel, trace to some silt, brown, damp, (very dense) sand is fine to medium grained, gravel is fine grained and rounded	10.7						
12				S24	AU				13

Bottom of hole at 12.2m.

RECORD OF TEST PIT : TP19-01

EXP Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3

PROJECT NUMBER VAN-00240098-A0
PROJECT NAME French Creek Pollution Control Centre
EXCAVATION DATE 2019-02-21
EXCAVATION CONTRACTOR Parksville Heavy Equipment
EXCAVATION METHOD Test Pit
EQUIPMENT TYPE Excavator
LOGGED BY DGS **CHECKED BY** BW

CLIENT AECOM Canada Ltd.
PROJECT LOCATION 957 Lee Road, Parksville, BC
TEST PIT LOCATION N: 5466920 E: 401007
ELEVATION
GROUND WATER DEPTHS: ▽ **AT TIME OF EXCAVATION** 1.2m seepage
▼ **AT END OF EXCAVATION** ---
▼ **AFTER EXCAVATION** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
1		SILT, wood, metal pipes, sand, grey and yellow, (firm) (FILL)							
		ROOTMAT	1.1						
		SAND, trace to some silt, grey, wet, (compact) fine grained	1.2	S1	GB				17
2									

Bottom of test pit at 2.1m.

RECORD OF TEST PIT : TP19-02

EXP Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3

PROJECT NUMBER VAN-00240098-A0
PROJECT NAME French Creek Pollution Control Centre
EXCAVATION DATE 2019-02-21
EXCAVATION CONTRACTOR Parksville Heavy Equipment
EXCAVATION METHOD Test Pit
EQUIPMENT TYPE Excavator
LOGGED BY DGS **CHECKED BY** BW

CLIENT AECOM Canada Ltd.
PROJECT LOCATION 957 Lee Road, Parksville, BC
TEST PIT LOCATION N: 5466923 E: 401017
ELEVATION
GROUND WATER DEPTHS: ▽ **AT TIME OF EXCAVATION** ---
▼ **AT END OF EXCAVATION** ---
▼ **AFTER EXCAVATION** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
		SAND, some silt to silty, some gravel, grey and brown, frequent plastic , wood waste, steel, moist, (compact) (FILL)							
		TOPSOIL	0.4						
1		SILTY SAND, some gravel, some rootlets, chainlink fence, electrical wires, grey, (compact) (FILL)	0.5	S2	GB				

Bottom of test pit at 1.0m.

NOTES: Holed terminated due to exposure of wires and conduit; FCPCC staff believed it was refuse but did not proceed due to safety concerns.

RECORD OF TEST PIT : TP19-03

EXP Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3

PROJECT NUMBER VAN-00240098-A0
PROJECT NAME French Creek Pollution Control Centre
EXCAVATION DATE 2019-02-21
EXCAVATION CONTRACTOR Parksville Heavy Equipment
EXCAVATION METHOD Test Pit
EQUIPMENT TYPE Excavator
LOGGED BY DGS **CHECKED BY** BW

CLIENT AECOM Canada Ltd.
PROJECT LOCATION 957 Lee Road, Parksville, BC
TEST PIT LOCATION N: 5466932 E: 401017
ELEVATION
GROUND WATER DEPTHS: ▽ **AT TIME OF EXCAVATION** ---
▼ **AT END OF EXCAVATION** ---
▼ **AFTER EXCAVATION** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
		SOD							
		SILTY SAND, some gravel, some rootlets, grey, (compact) (FILL)	0.1						
		ROOTMAT/BLACK WOODWASTE	0.8						
1		SILTY SAND, some gravel, some rootlets, grey, (compact) (FILL)	0.9						
		0.9m MINUS BLAST ROCK (FILL)	1.3						
2									
		SAND, trace silt, grey and brown, moist, (compact) medium grained	2.2						

Bottom of test pit at 2.3m.

RECORD OF TEST PIT : TP19-04

EXP Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3

PROJECT NUMBER VAN-00240098-A0
PROJECT NAME French Creek Pollution Control Centre
EXCAVATION DATE 2019-02-21
EXCAVATION CONTRACTOR Parksville Heavy Equipment
EXCAVATION METHOD Test Pit
EQUIPMENT TYPE Excavator
LOGGED BY DGS **CHECKED BY** BW

CLIENT AECOM Canada Ltd.
PROJECT LOCATION 957 Lee Road, Parksville, BC
TEST PIT LOCATION N: 5466923 E: 401010
ELEVATION
GROUND WATER DEPTHS: ▽ **AT TIME OF EXCAVATION** 2.1m inferred
▼ **AT END OF EXCAVATION** ---
▼ **AFTER EXCAVATION** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
1		SILT, SAND, WOOD, grey and yellow, (firm) (FILL)							
		0.9m MINUS BLAST ROCK (FILL)	1.3						
2		▽ SAND, trace to some silt, grey, wet, (compact) fine grained	2.1	S3	GB				

Bottom of test pit at 2.9m.

RECORD OF TEST PIT : TP19-05

EXP Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3

PROJECT NUMBER VAN-00240098-A0
PROJECT NAME French Creek Pollution Control Centre
EXCAVATION DATE 2019-02-21
EXCAVATION CONTRACTOR Parksville Heavy Equipment
EXCAVATION METHOD Test Pit
EQUIPMENT TYPE Excavator
LOGGED BY DGS **CHECKED BY** BW

CLIENT AECOM Canada Ltd.
PROJECT LOCATION 957 Lee Road, Parksville, BC
TEST PIT LOCATION N: 5466926 E: 401024
ELEVATION
GROUND WATER DEPTHS: ▽ **AT TIME OF EXCAVATION** ---
▼ **AT END OF EXCAVATION** ---
▼ **AFTER EXCAVATION** ---

DEPTH (m)	STRATA	SOIL DESCRIPTION	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY %	SPT N VALUE BLOWS/0.3m ▲ 20 40 60 80 / DYNAMIC CONE BLOWS/0.3m ▨ 20 40 60 80	POCKET PEN. (kPa) ⊙ 100 200 300 400 / FIELD VANE SHEAR (kPa) Peak ● Remold ○ 40 80 120 160	FINES CONTENT (%) □ 20 40 60 80 / PLASTIC & LIQUID LIMIT MOISTURE CONTENT PL MC LL 20 40 60 80
1		SILT, SAND, WOOD, grey and yellow, (firm) (FILL)							
		0.9m MINUS BLAST ROCK (FILL)	1.3						
2		SAND, some silt, grey, moist, (compact) fine grained	2.1						

Bottom of test pit at 2.4m.

Appendix B –
Downhole Shear Wave Velocity Survey Report

Schwartz
SOIL TECH
598 West 24 Avenue, Vancouver, B.C. V5Z 2B4 Tel: (604) 418-1072
billschwartzcpt@telus.net

Exp
#275 - 3001 Wayburne Drive
Burnaby, BC
V5G 4W3

May 7, 2023

Attn: Ben Wise, P.Eng

Re: Down-hole Vs survey
French Creek Pollution Control Centre
1236 Island Highway West
Parksville, BC

1. Introduction

As requested, Schwartz Soil Technical conducted a down-hole shear wave testing survey at the above noted project site on July 13, 2023. The down-hole Vs survey which we performed is labelled DHS23-04 and was conducted in the cased borehole identified as BH23-04.

Upon our arrival at the site, we observed that the PVC casing which was grouted into the earth was protected inside a stick-up protector. The casing and protector were undamaged when we arrived at the site. The inside of the casing was clean and free of soil and grout. Our measurements on site indicate the casing at DHS23-04 was open to a depth of approximately 22.5 meters below adjacent site grade.

The plastic casing cap was screwed back in to place and the lid of the stick-up protector was closed after the survey was completed. A lock was not in use on the stick-up casing protector.

We understand the casing was grouted into place before July 6th, 2023.

2. Vs testing equipment and procedures

At the project site steel impact plates were placed on the ground surface in order to act as a source for the Vs testing program. The site was covered in a layer of topsoil and forest debris. Some shoveling was necessary in order to smooth the test area. To ensure that the impact plates had a strong contact with ground surface we positioned our ¾ ton truck directly on top of them.

The combination of the impact plates and the weighted truck enabled us to accurately record shear wave measurement on this site.

Our borehole geophone unit is specially designed with a wall lock clamp, a servo-motor and a triple geophone assembly. When the clamp mechanism is activated, it pushes the entire unit laterally against the inside of the casing. This ensures that the geophone in the down-hole tool has good contact with casing wall. The servomotor contains a flux-gate compass that enables the geophone assembly to maintain a constant alignment. The compass driven motor keeps the geophone assembly at the same orientation at each successive testing depth.

The geophone assembly is comprised of 3 OYO Geospace geophones. The geophones are mounted in a vertically, horizontally and transverse orientation within the down-hole tool. The servomotor and compass constantly keep one of the geophones oriented parallel to the source beam. This configuration allows us to record optimal shear wave data. The geophones have a 15 Hz natural frequency and a 2400-ohm coil.

Shear wave testing was performed on 1-meter intervals on this site from the ground surface down to a depth of 22.3 meters.

At each testing depth a minimum of 3 and a maximum of 6 strikes from each side of the beam were conducted. The wave traces from the strikes were then “stacked”. Stacking the Vs data increases the amplitude of the shear wave trace profiles while reducing the noise. As the data was collected on site a preliminary analysis of the wave forms was conducted in order to ensure validity and quality. The data was then transferred to our office computer for further analysis.

During the analysis of the data in our office a mild, high frequency filter was applied to the data. This filter helps to reduce the naturally occurring vibrations that occur in the earth.

External noise and vibration monitoring instruments that we were operating on site indicated that large, low frequency noise was not occurring on the day of the field investigation. Heavy construction activities and large trucks can sometimes cause low frequency noise.

The vibrations and related vehicular noise from the traffic on the island highway was minimal.

Figures 1 and 2 on the following page shows our truck positioned on the impact plate sources and a profile view of the site.

Figure 1.
Truck positioned on the source impact plates at DHS23-04

Figure 2.
Profile view of our service truck positioned at test location.

3. Recorded Data

As previously discussed, the shear waves were generated by striking the steel impact plates with an instrumented sledgehammer. The hammer impact on the plates produces a polarized shear wave. Striking the plate from the opposite side produces a similar shear wave with a reversed polarity.

The impact plates were centered under the rear tires of our support truck in order to hold them firmly against the ground surface.

Our geophysical controller for recording the Vs waves is wired into a timing circuit that is in turn connected to our data acquisition system and computer. The exact moment when the hammer strikes the source a timing circuit is opened by the switch which is attached to the sledgehammer.

The timing circuit is then used to record the length of time it takes for the wave to travel from the beam source at the ground surface down to the triaxial geophone unit.

The horizontal distance from the geophone unit to the source was measured on site, as this distance and the testing depth are necessary for calculating the length of the inclined shear wave travel path.

The following formula shows the method by which the interval shear wave velocities were calculated.

$$\text{Interval Vs} = \frac{\text{Change in the geophone depth (meters)}}{\text{Change in the arrival time of the Vs wave (seconds)}}$$

A noticeable increase in the Vs velocity occurred near 16 meters in depth.

Appendix 1 shows the Vs data that we recorded. A plot of the Vs values versus depth and table are supplied.

Figure 3 on the following page shows a waterfall style plot of the shear waves traces in the frequency time domain.

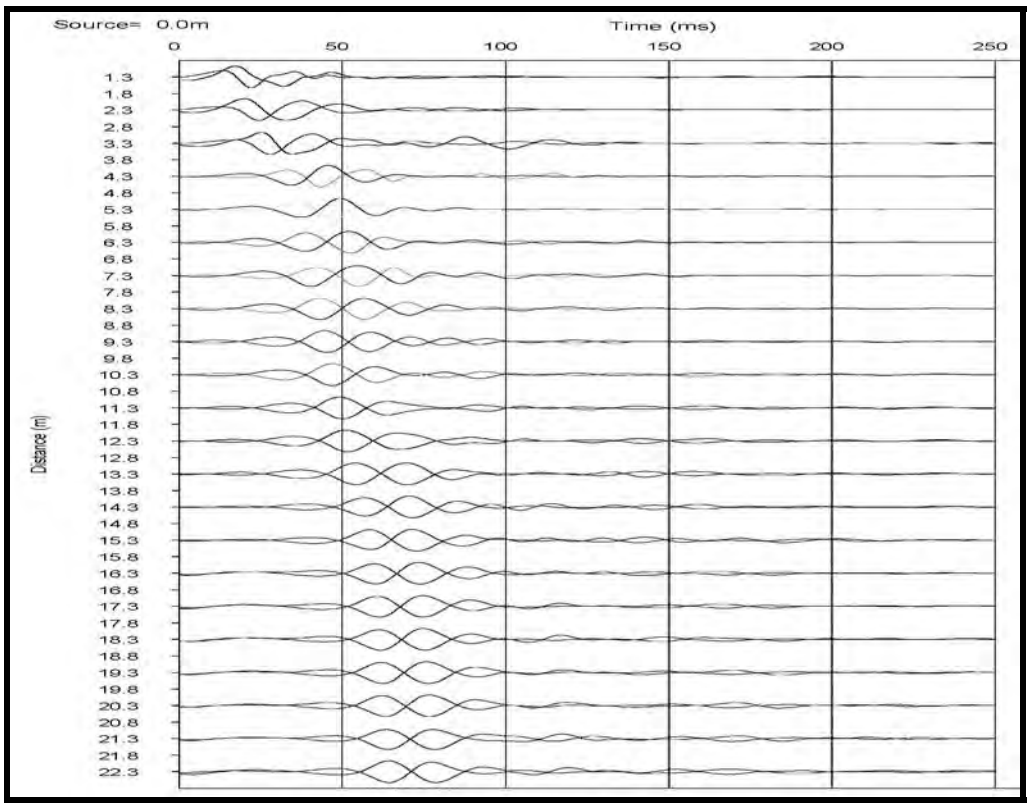


Figure 3.
Shear waves traces viewed in the frequency time domain

4. Closure

If you have any questions regarding the enclosed data please feel free to contact us at (604) 418-1072. We look forward to working with you in the near future.

Respectfully,

Bill Schwartz, P.Eng
In-situ Testing Services
Schwartz Soil Technical Inc.

References

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

APPENDIX 1

Vs DATA PLOTTED VERSUS DEPTH

AND

TABLE OF RECORDED Vs VALUES

Schwartz
SOIL TECH

DATA TABLE
DOWN HOLE SHEAR WAVE VELOCITY

Client: EXP		**Date:**	July 13, 2023
Test: DHS23 - 04 at BH23 - 04		**Tool:**	Downhole
Site: French Creek		**Source offset:**	1.77 m
Parkville, BC		**Source:**	Impact plates

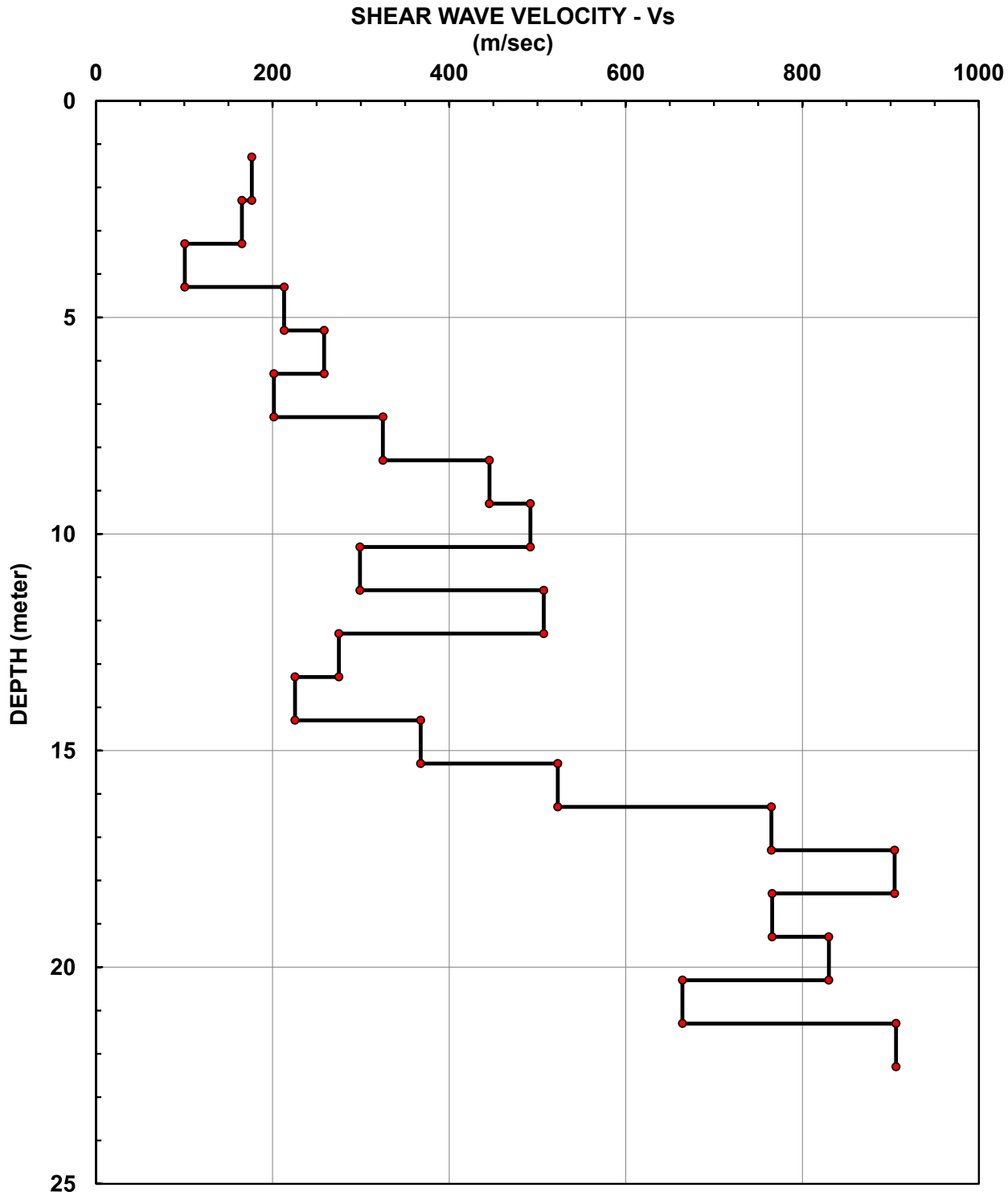
Geophone Depth (m)	Wave Path Length (m)	Change in Wave Path (m)	Wave Travel Time interval (ms)	Interval Vs Velocity (m/sec)
1.30	2.20			
		0.71	4.00	177
2.30	2.90			
		0.84	5.10	165
3.30	3.74			
		0.91	9.00	101
4.30	4.65			
		0.94	4.40	213
5.30	5.59			
		0.96	3.70	258
6.30	6.54			
		0.97	4.80	202
7.30	7.51			
		0.98	3.00	325
8.30	8.49			
		0.98	2.20	446
9.30	9.47			
		0.98	2.00	492
10.30	10.45			
		0.99	3.30	299
11.30	11.44			
		0.99	1.95	507
12.30	12.43			
		0.99	3.60	275
13.30	13.42			
		0.99	4.40	225
14.30	14.41			
		0.99	2.70	368
15.30	15.40			
		0.99	1.90	523
16.30	16.40			
		0.99	1.30	765
17.30	17.39			
		1.00	1.10	905
18.30	18.39			
		1.00	1.30	766
19.30	19.38			
		1.00	1.20	830
20.30	20.38			
		1.00	1.50	664
21.30	21.37			
		1.00	1.10	906
22.30	22.37			

Schwartz SOIL TECH

DOWN HOLE SHEAR WAVE TESTING

VELOCITY PROFILE

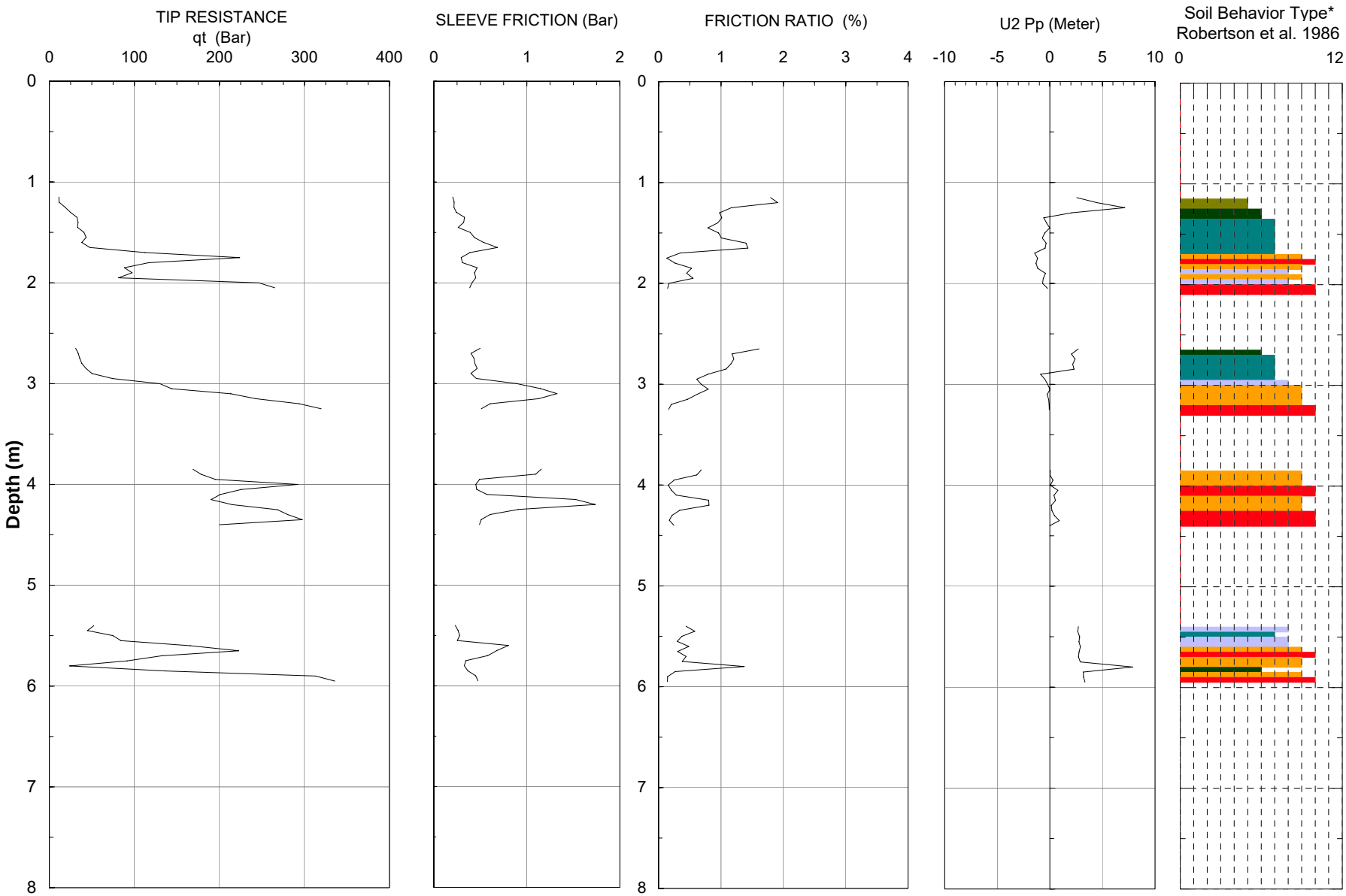
Client:	EXP	Date:	July 13, 2023
Test:	DHS23 - 04 at BH23 - 04	Tool:	Downhole
Site:	French Creek Parksville, BC	Source offset: Source:	1.77 m Impact Plates



Appendix C –
SCPT Plot & Interpretation

exp.	Operator: Schwartz Soil Technical Sounding: CPT17 - 01 Cone Id: DPG1236	Date: June 2, 2017 Site: FCPCC, Parksville Exp Project Number: 240098

Schwartz SOIL TECH



Maximum Depth = 5.95 meters

Depth Increment = 0.05 meters

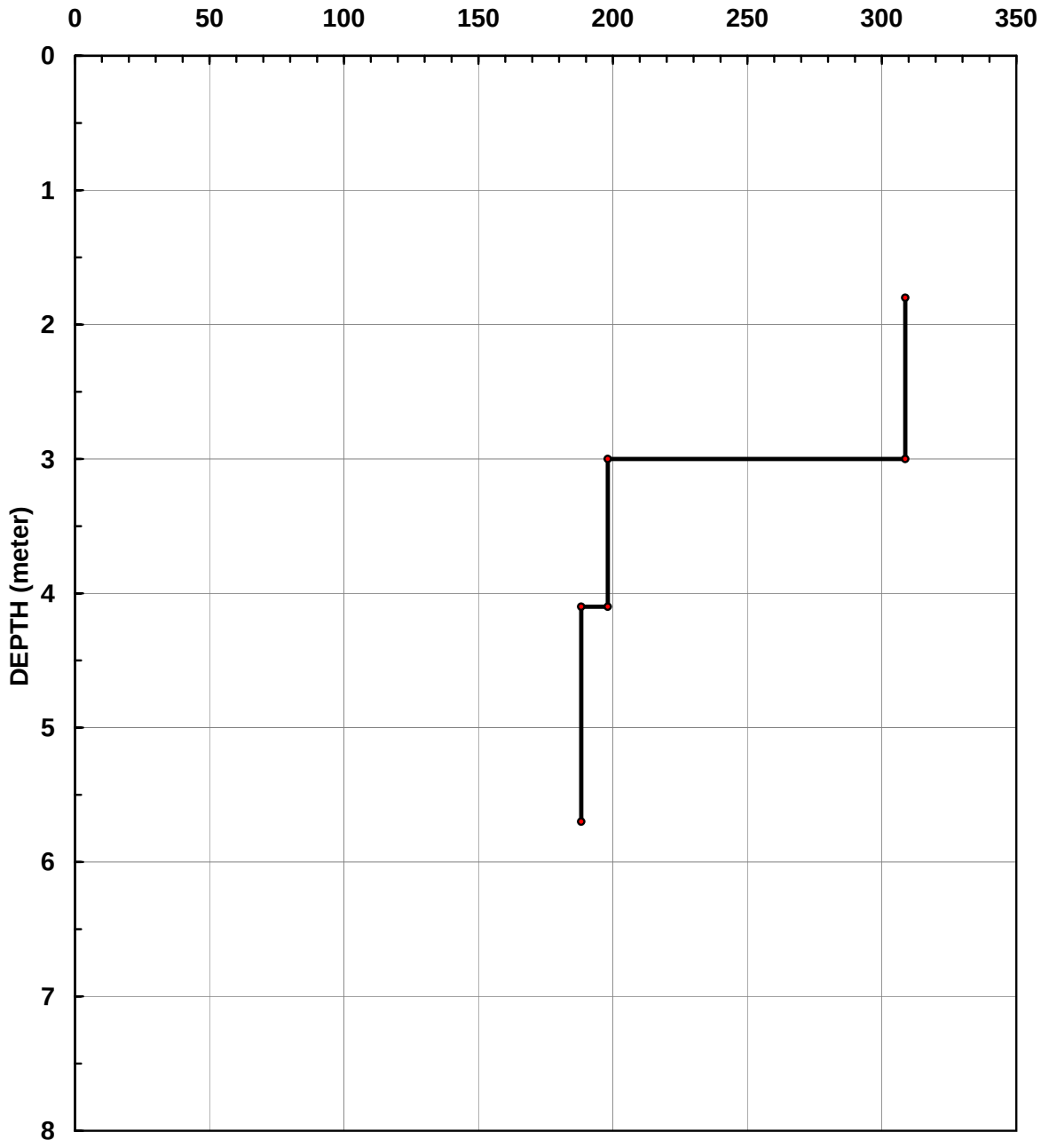
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

Schwartz SOIL TECH

SHEAR WAVE VELOCITY PROFILE

Client:	**Exp**	**Date:**	**June 2, 2017**
Test:	**CPT17 - 01**	**Cone ID:**	**DPG1236**
Site:	**FCPCC**	**Source offset:**	**0.75 m**
	Parksville, B.C.	**Source:**	**Beam**

SHEAR WAVE VELOCITY - Vs
(m/sec)



Schwartz SOIL TECH

SHEAR WAVE VELOCITY DATA

Client: Exp
Test: CPT17 - 01
Site: FCPCC
Parksville, B.C.

Date: June 2, 2017
Cone ID: DPG1236
Source offset: 0.75 m
Source: Beam

CONE TIP DEPTH (m)	GEOPHONE DEPTH (m)	INTERVAL VELOCITY (m/sec)
2.05	1.80	
		309
3.25	3.00	
		198
4.35	4.10	
		188
5.95	5.70	

Appendix D –
Sieve Analysis Reports
Nos. 1 to 18

Atterberg Limits Reports
Nos.1 to 3

SIEVE ANALYSIS
ASTM C136/C117

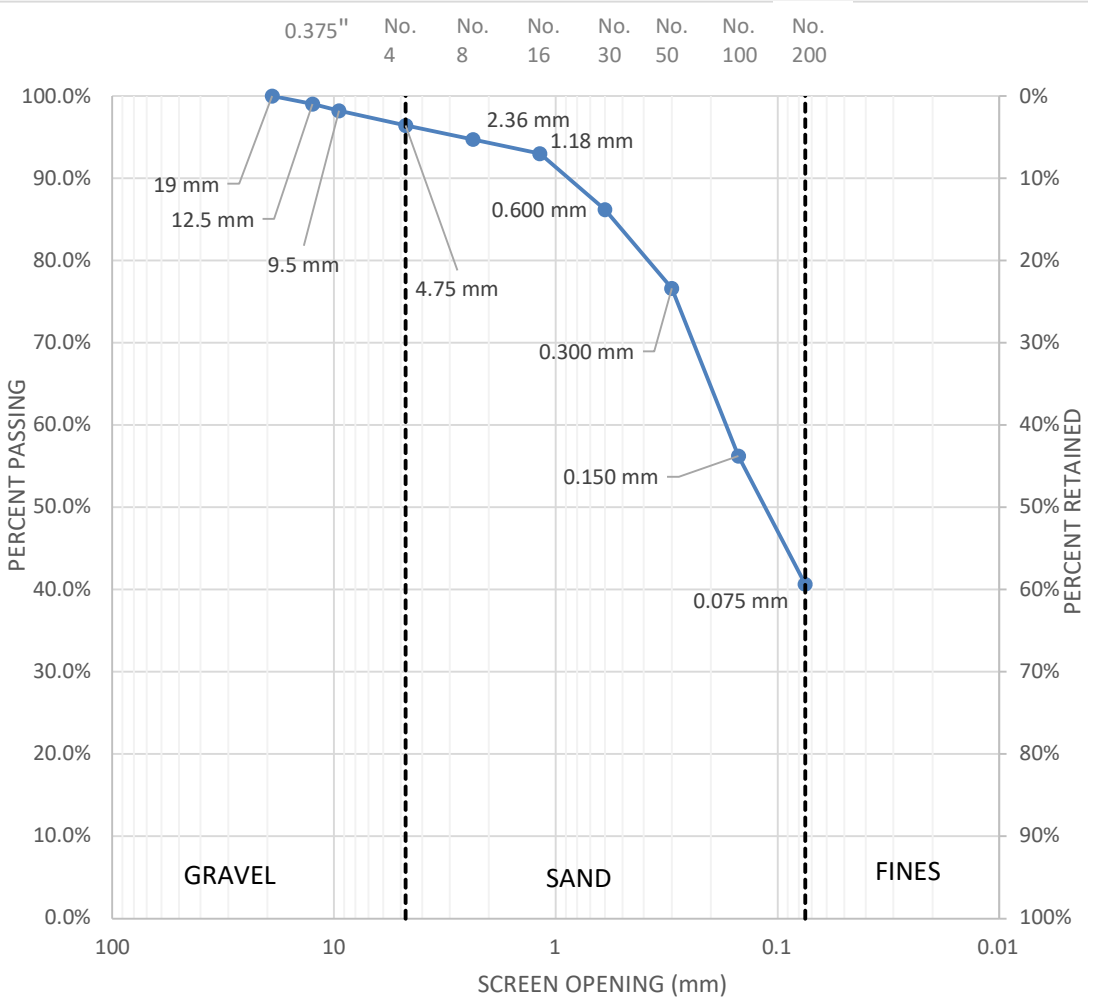
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SAND AND SILT, TRACE GRAVEL	METHOD	WASHED
IN-SITU MOISTURE	8.0%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-01, S-1	REPORT NO.	01

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	
37.5 mm	1.5"	
25.0 mm	1"	
19.0 mm	0.75"	100.0%
16.0 mm	0.63"	
12.5 mm	0.5"	99.0%
9.5 mm	0.375"	98.2%
4.75 mm	No. 4	96.4%
2.36 mm	No. 8	94.7%
2.00 mm	No. 10	
1.18 mm	No. 16	93.0%
850 µm	No. 20	
600 µm	No. 30	86.2%
425 µm	No. 40	
300 µm	No. 50	76.6%
180 µm	No. 80	
150 µm	No. 100	56.2%
75 µm	No. 200	40.6%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	3.6%	55.8%	40.6%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

SIEVE ANALYSIS
ASTM C136/C117

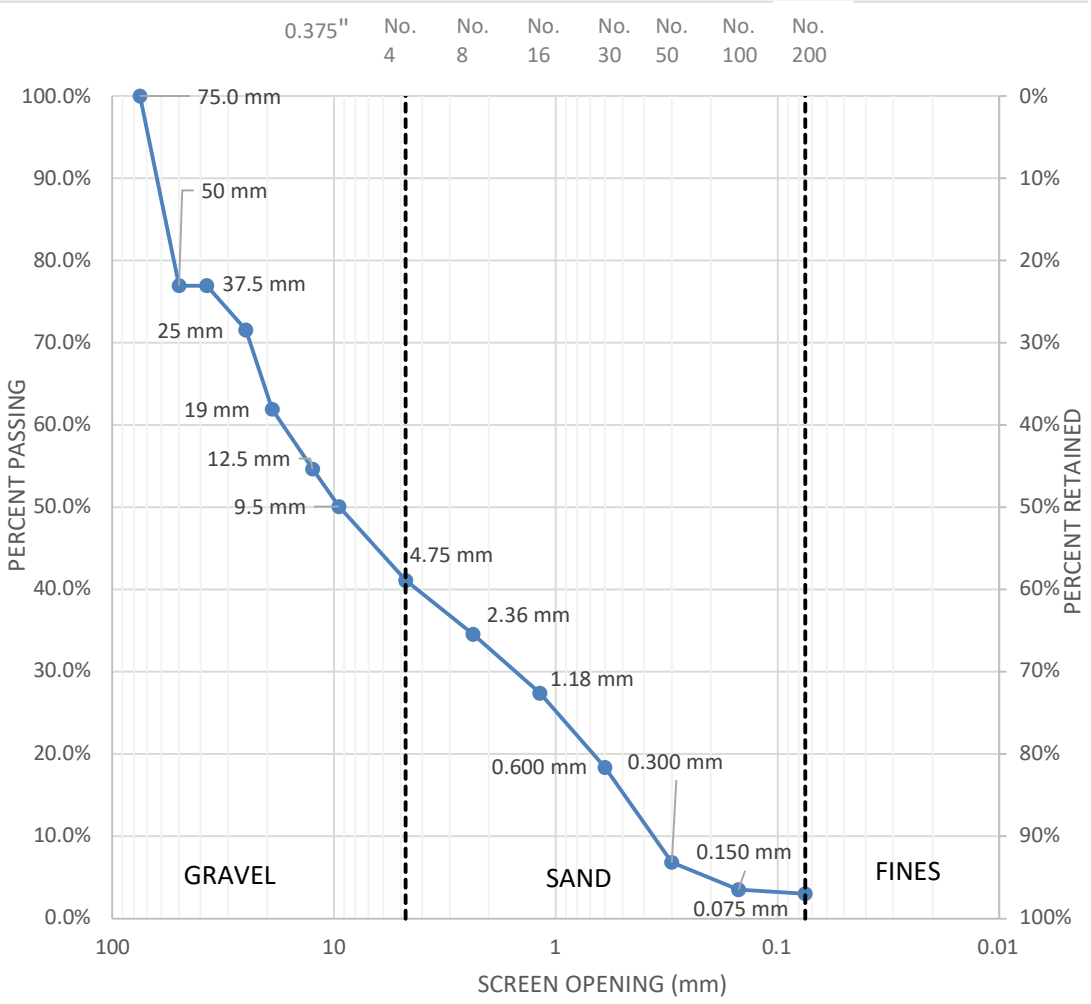
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	GRAVEL AND SAND, TRACE SILT	METHOD	WASHED
IN-SITU MOISTURE	9.3%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-01, GR-2 @13'-15'	REPORT NO.	02

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	100.0%
50.0mm	2"	76.9%
37.5 mm	1.5"	76.9%
25.0 mm	1"	71.6%
19.0 mm	0.75"	61.9%
16.0 mm	0.63"	
12.5 mm	0.5"	54.6%
9.5 mm	0.375"	50.1%
4.75 mm	No. 4	41.1%
2.36 mm	No. 8	34.6%
2.00 mm	No. 10	
1.18 mm	No. 16	27.4%
850 µm	No. 20	
600 µm	No. 30	18.4%
425 µm	No. 40	
300 µm	No. 50	6.8%
180 µm	No. 80	
150 µm	No. 100	3.5%
75 µm	No. 200	3.0%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	58.9%	38.1%	3.0%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

SIEVE ANALYSIS
ASTM C136/C117

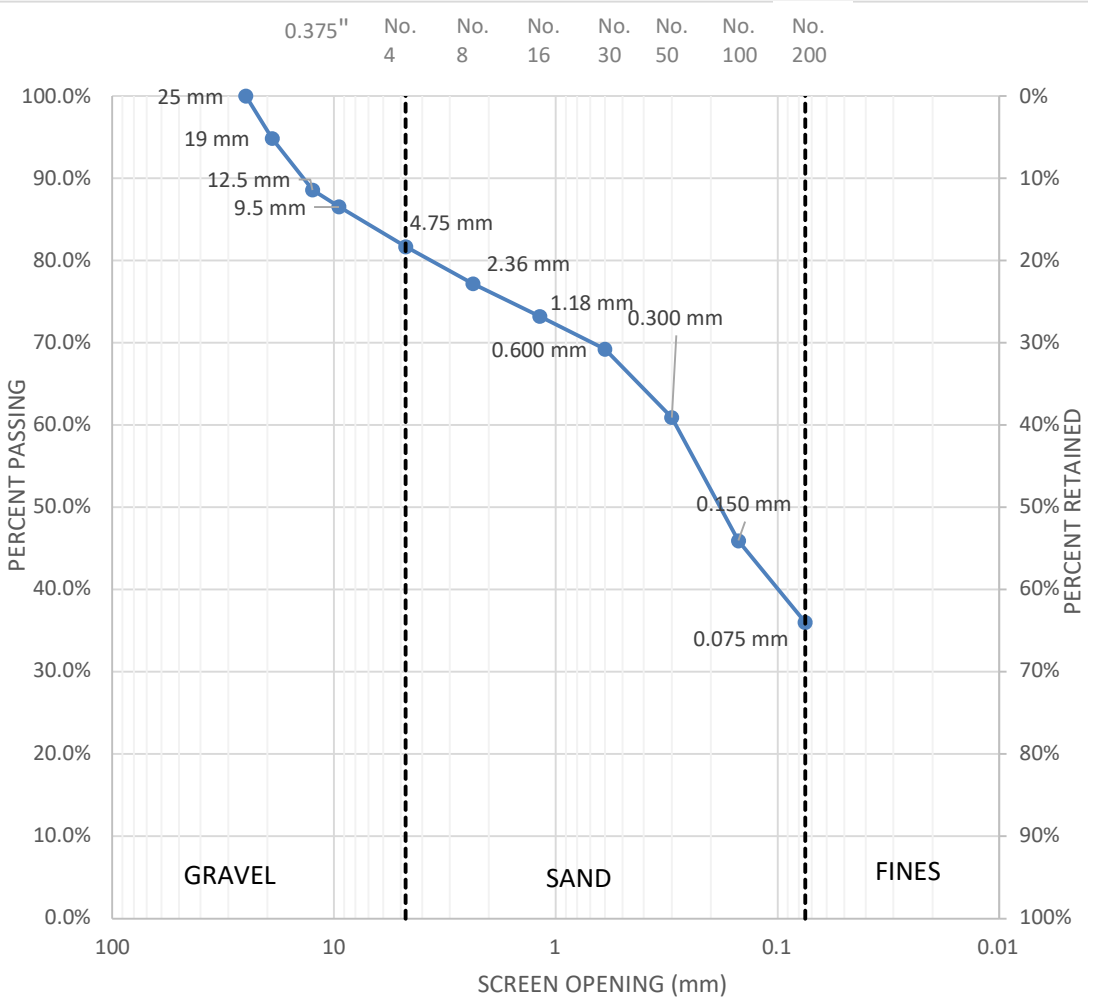
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SAND AND SILT, SOME GRAVEL	METHOD	WASHED
IN-SITU MOISTURE	11.4%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-01, GR-3 @22'-24'	REPORT NO.	03

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	
37.5 mm	1.5"	
25.0 mm	1"	100.0%
19.0 mm	0.75"	94.8%
16.0 mm	0.63"	
12.5 mm	0.5"	88.6%
9.5 mm	0.375"	86.5%
4.75 mm	No. 4	81.7%
2.36 mm	No. 8	77.2%
2.00 mm	No. 10	
1.18 mm	No. 16	73.2%
850 µm	No. 20	
600 µm	No. 30	69.2%
425 µm	No. 40	
300 µm	No. 50	60.9%
180 µm	No. 80	
150 µm	No. 100	45.9%
75 µm	No. 200	36.0%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	18.3%	45.7%	36.0%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

SIEVE ANALYSIS
ASTM C136/C117

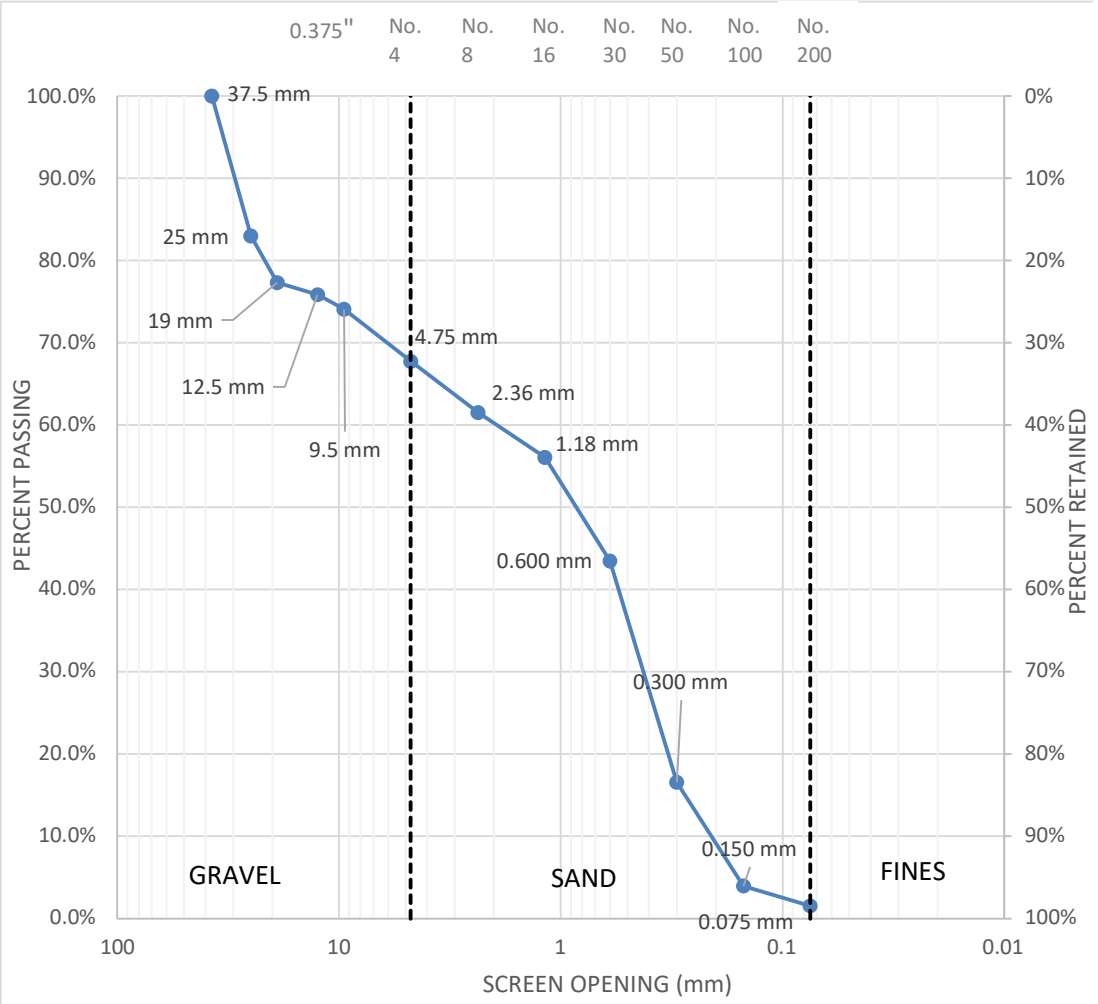
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SAND, GRAVELLY, TRACE SILT	METHOD	WASHED
IN-SITU MOISTURE	10.3%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-01, GR-6 @46'-48'	REPORT NO.	04

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	
37.5 mm	1.5"	100.0%
25.0 mm	1"	83.0%
19.0 mm	0.75"	77.3%
16.0 mm	0.63"	
12.5 mm	0.5"	75.9%
9.5 mm	0.375"	74.1%
4.75 mm	No. 4	67.7%
2.36 mm	No. 8	61.5%
2.00 mm	No. 10	
1.18 mm	No. 16	56.1%
850 µm	No. 20	
600 µm	No. 30	43.5%
425 µm	No. 40	
300 µm	No. 50	16.6%
180 µm	No. 80	
150 µm	No. 100	4.0%
75 µm	No. 200	1.6%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	32.3%	66.2%	1.6%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

SIEVE ANALYSIS
ASTM C136/C117

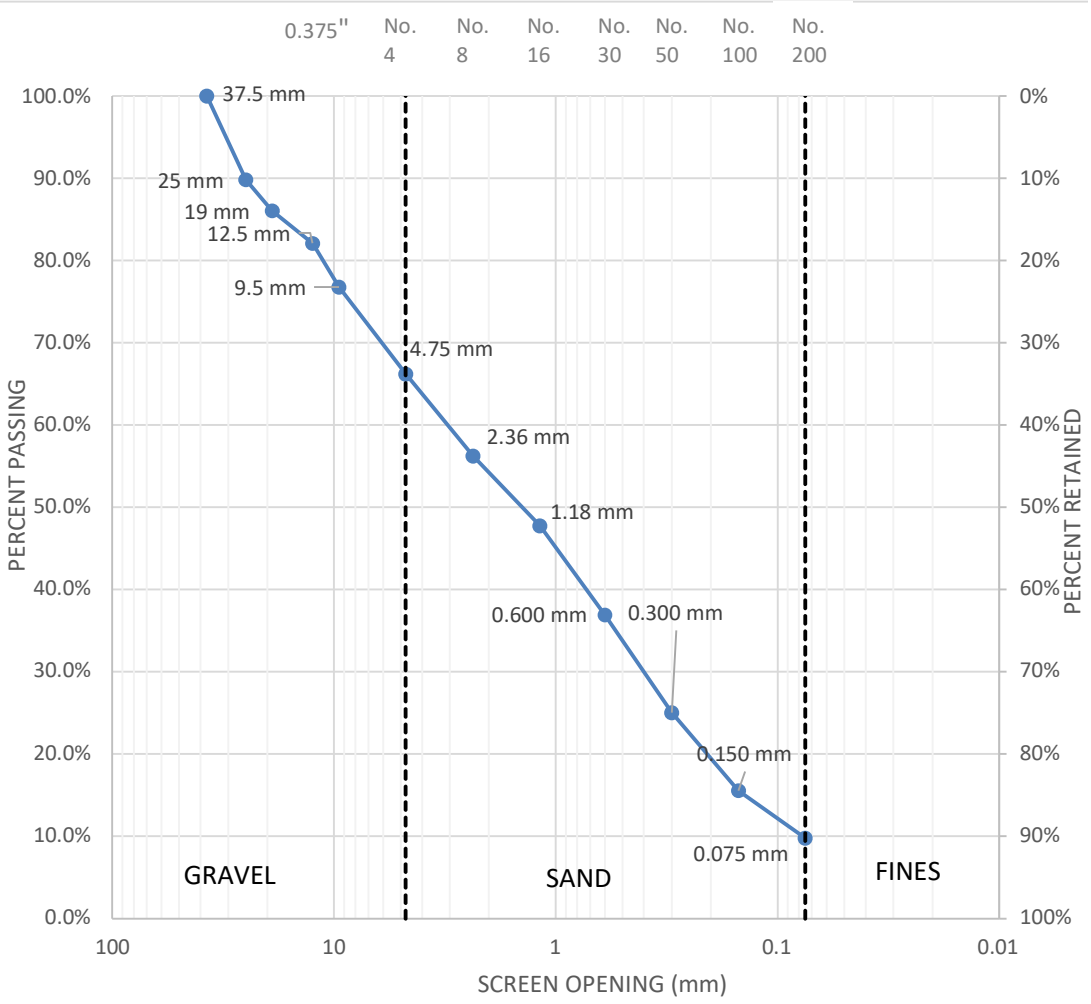
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SAND, GRAVELLY, TRACE SILT	METHOD	WASHED
IN-SITU MOISTURE	4.8%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-02, GR-1 @1'-5'	REPORT NO.	05

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	
37.5 mm	1.5"	100.0%
25.0 mm	1"	89.8%
19.0 mm	0.75"	86.0%
16.0 mm	0.63"	
12.5 mm	0.5"	82.1%
9.5 mm	0.375"	76.8%
4.75 mm	No. 4	66.2%
2.36 mm	No. 8	56.2%
2.00 mm	No. 10	
1.18 mm	No. 16	47.8%
850 µm	No. 20	
600 µm	No. 30	36.9%
425 µm	No. 40	
300 µm	No. 50	25.0%
180 µm	No. 80	
150 µm	No. 100	15.6%
75 µm	No. 200	9.8%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	33.8%	56.4%	9.8%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

SIEVE ANALYSIS
ASTM C136/C117

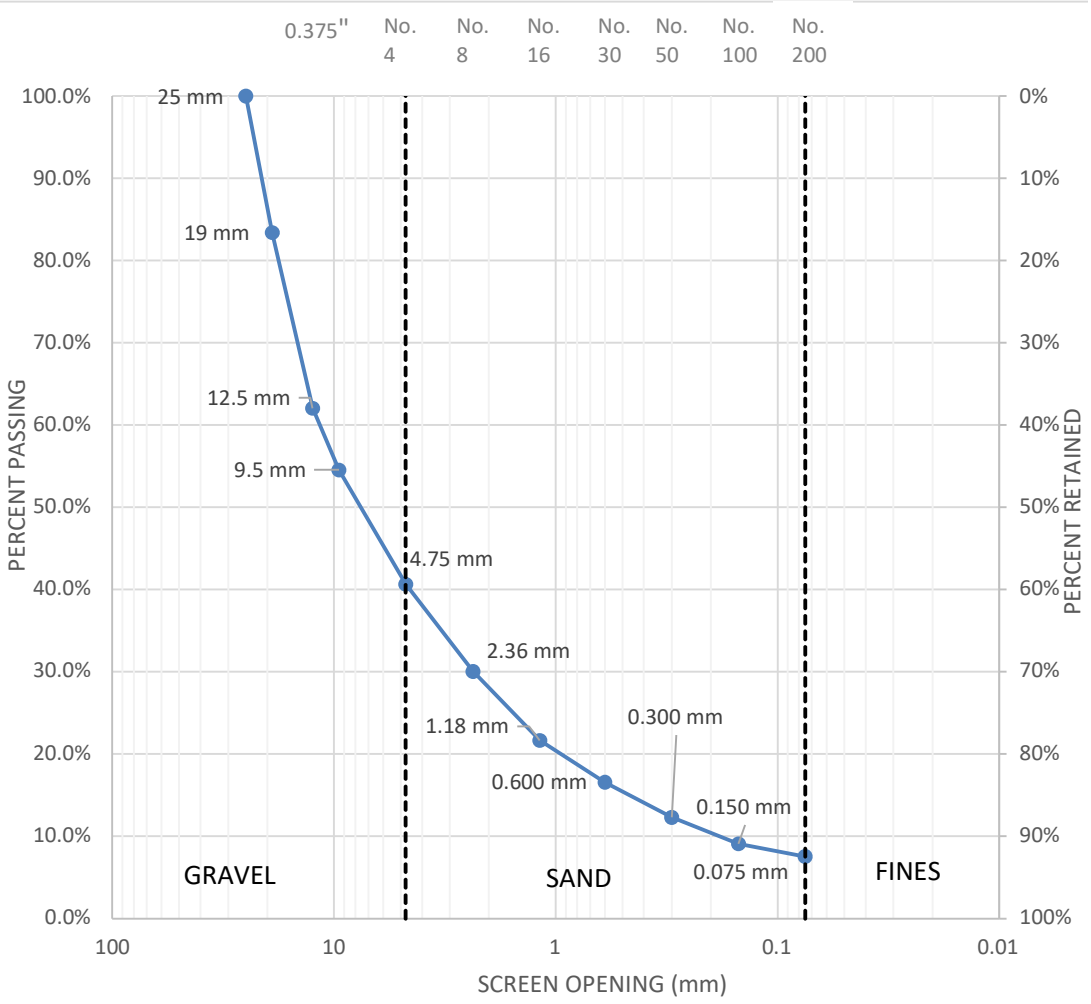
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	GRAVEL, SANDY, TRACE SILT	METHOD	WASHED
IN-SITU MOISTURE	4.7%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-02, GR-4 @8'-10'	REPORT NO.	06

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	
37.5 mm	1.5"	
25.0 mm	1"	100.0%
19.0 mm	0.75"	83.4%
16.0 mm	0.63"	
12.5 mm	0.5"	62.0%
9.5 mm	0.375"	54.5%
4.75 mm	No. 4	40.6%
2.36 mm	No. 8	30.1%
2.00 mm	No. 10	
1.18 mm	No. 16	21.7%
850 µm	No. 20	
600 µm	No. 30	16.6%
425 µm	No. 40	
300 µm	No. 50	12.3%
180 µm	No. 80	
150 µm	No. 100	9.1%
75 µm	No. 200	7.5%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	59.4%	33.1%	7.5%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

SIEVE ANALYSIS
ASTM C136/C117

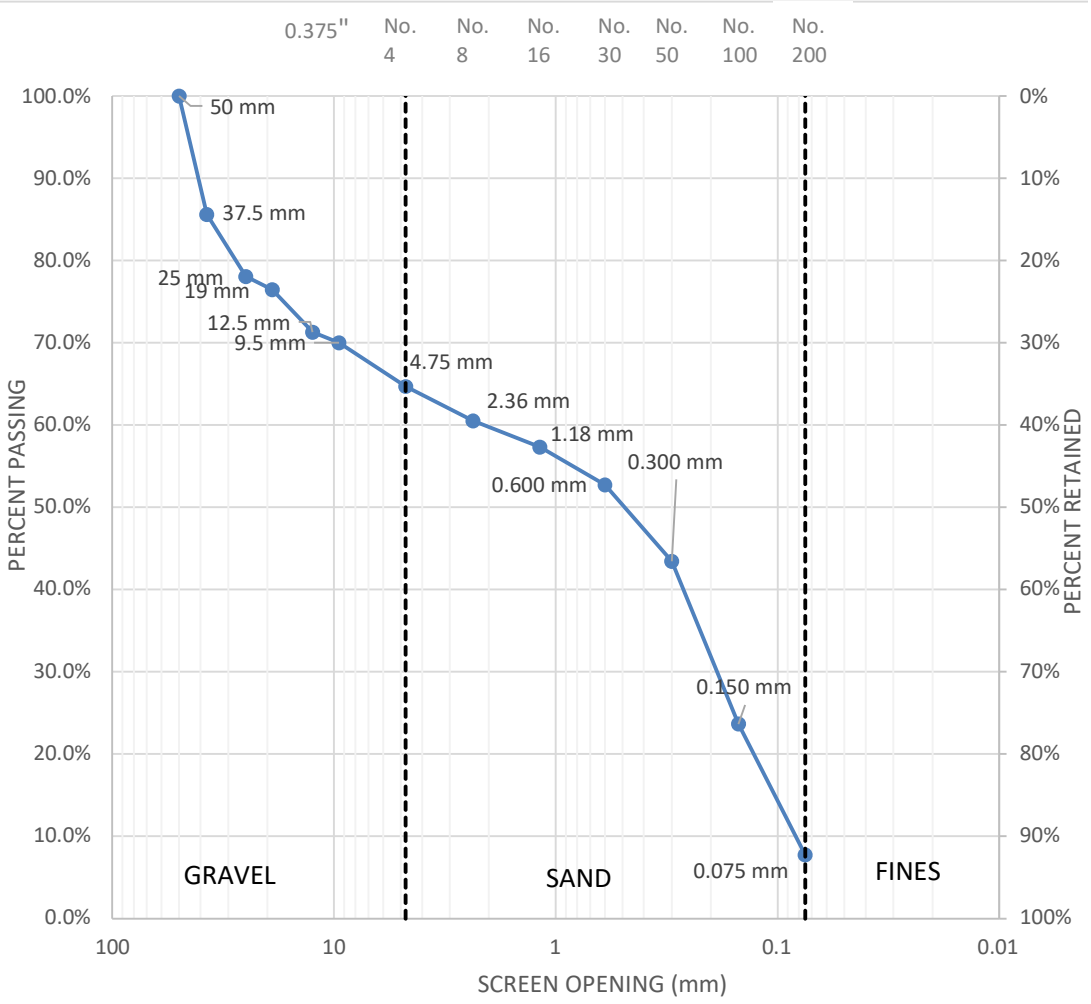
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SAND AND GRAVEL, TRACE SILT	METHOD	WASHED
IN-SITU MOISTURE	10.3%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-02, GR-6 @22'-24'	REPORT NO.	07

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	100.0%
37.5 mm	1.5"	85.6%
25.0 mm	1"	78.0%
19.0 mm	0.75"	76.4%
16.0 mm	0.63"	
12.5 mm	0.5"	71.3%
9.5 mm	0.375"	70.0%
4.75 mm	No. 4	64.7%
2.36 mm	No. 8	60.5%
2.00 mm	No. 10	
1.18 mm	No. 16	57.3%
850 µm	No. 20	
600 µm	No. 30	52.7%
425 µm	No. 40	
300 µm	No. 50	43.4%
180 µm	No. 80	
150 µm	No. 100	23.7%
75 µm	No. 200	7.7%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	35.3%	56.9%	7.7%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

SIEVE ANALYSIS
ASTM C136/C117

EXP Services Inc.
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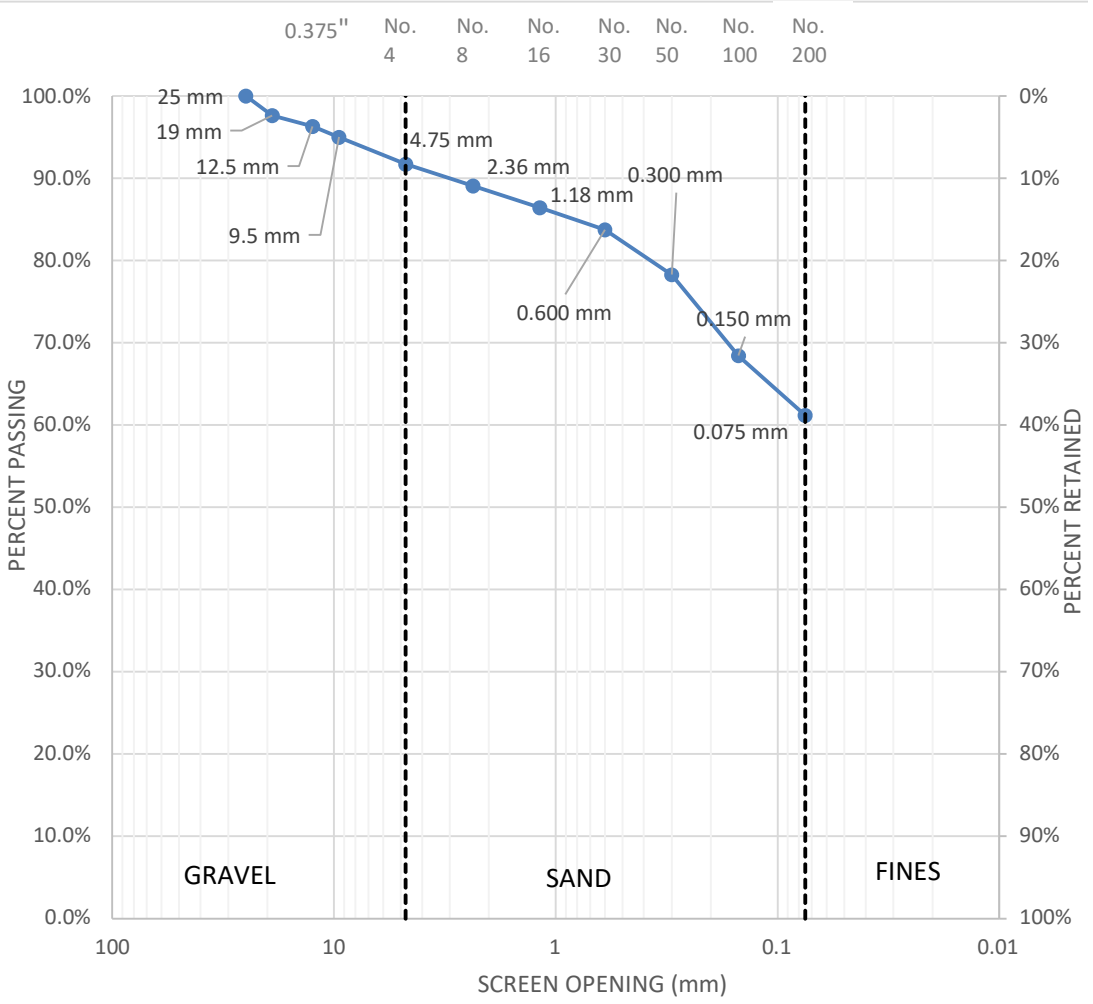
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SILT, SANDY, TRACE GRAVEL	METHOD	WASHED
IN-SITU MOISTURE	9.7%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-02, GR-7 @31'-33'	REPORT NO.	08

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	
37.5 mm	1.5"	
25.0 mm	1"	100.0%
19.0 mm	0.75"	97.6%
16.0 mm	0.63"	
12.5 mm	0.5"	96.3%
9.5 mm	0.375"	95.0%
4.75 mm	No. 4	91.7%
2.36 mm	No. 8	89.0%
2.00 mm	No. 10	
1.18 mm	No. 16	86.4%
850 µm	No. 20	
600 µm	No. 30	83.8%
425 µm	No. 40	
300 µm	No. 50	78.3%
180 µm	No. 80	
150 µm	No. 100	68.4%
75 µm	No. 200	61.2%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	8.3%	30.5%	61.2%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

GRADATION ANALYSIS
ASTM C136/C117 & AASHTO T88

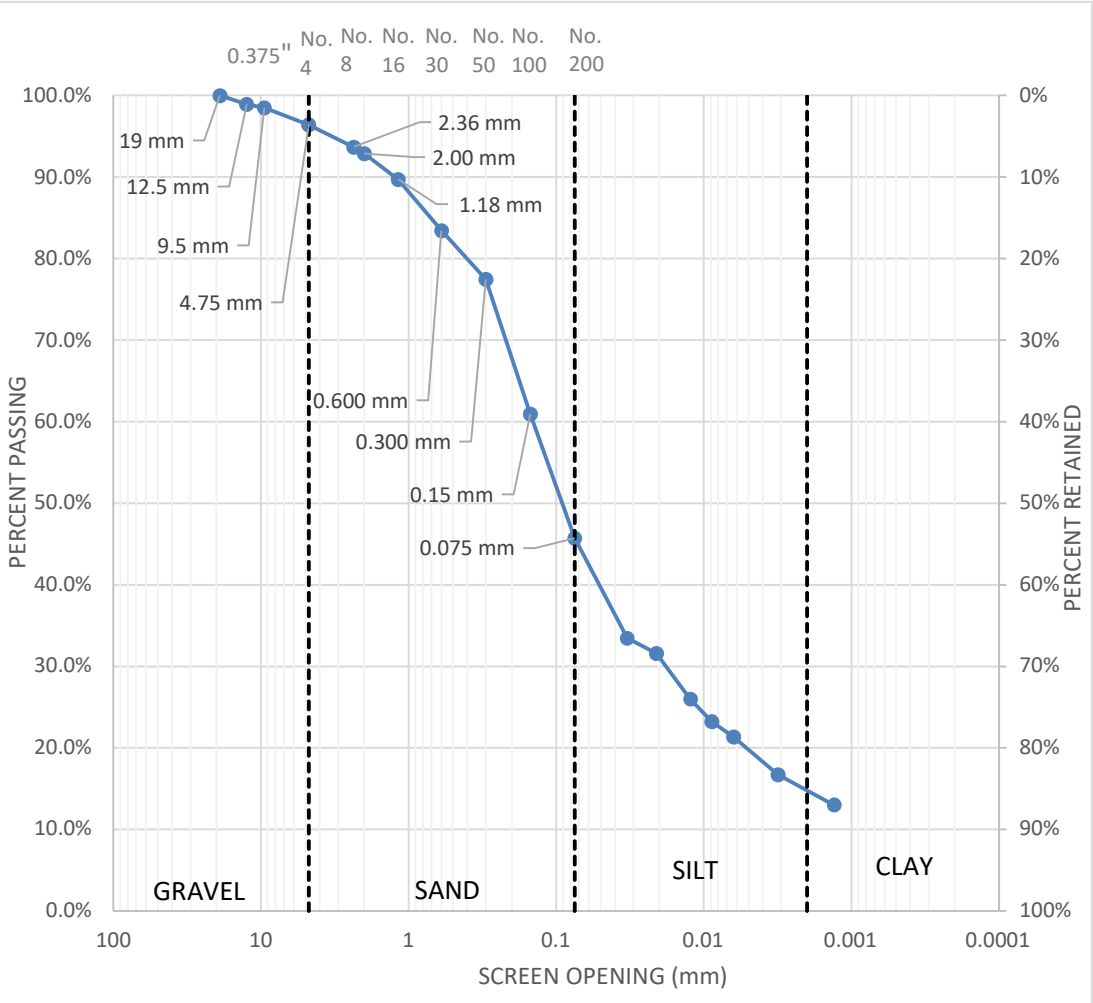
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-27

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SAND, SILTY, SOME CLAY, TRACE GRAVEL	METHOD	WASHED
IN-SITU MOISTURE	21.5%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	ER
SAMPLE LOCATION	BH23-03, S-1	REPORT NO.	09

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	
37.5 mm	1.5"	
25.0 mm	1"	
19.0 mm	0.75"	100.0%
16.0 mm	0.63"	
12.5 mm	0.5"	98.9%
9.5 mm	0.375"	98.5%
4.75 mm	No. 4	96.4%
2.36 mm	No. 8	93.7%
2.00 mm	No. 10	92.9%
1.18 mm	No. 16	89.7%
850 µm	No. 20	
600 µm	No. 30	83.4%
425 µm	No. 40	
300 µm	No. 50	77.5%
180 µm	No. 80	
150 µm	No. 100	60.9%
75 µm	No. 200	45.7%



HYDROMETER	SIZE (MM)	0.0330	0.0210	0.0123	0.0088	0.0063	0.0032	0.0013
	SIZE (IN)	0.0013	0.0008	0.0005	0.0003	0.0002	0.0001	5.17E-05
	% PASSING	33.4%	31.6%	26.0%	23.2%	21.4%	16.7%	13.0%

CONSTITUENT PERCENTAGES	GRAVEL	SAND	SILT	CLAY
	3.6%	50.7%	30.7%	15%

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

WORK ORDER NO: 2023-274

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

SIEVE ANALYSIS
ASTM C136/C117

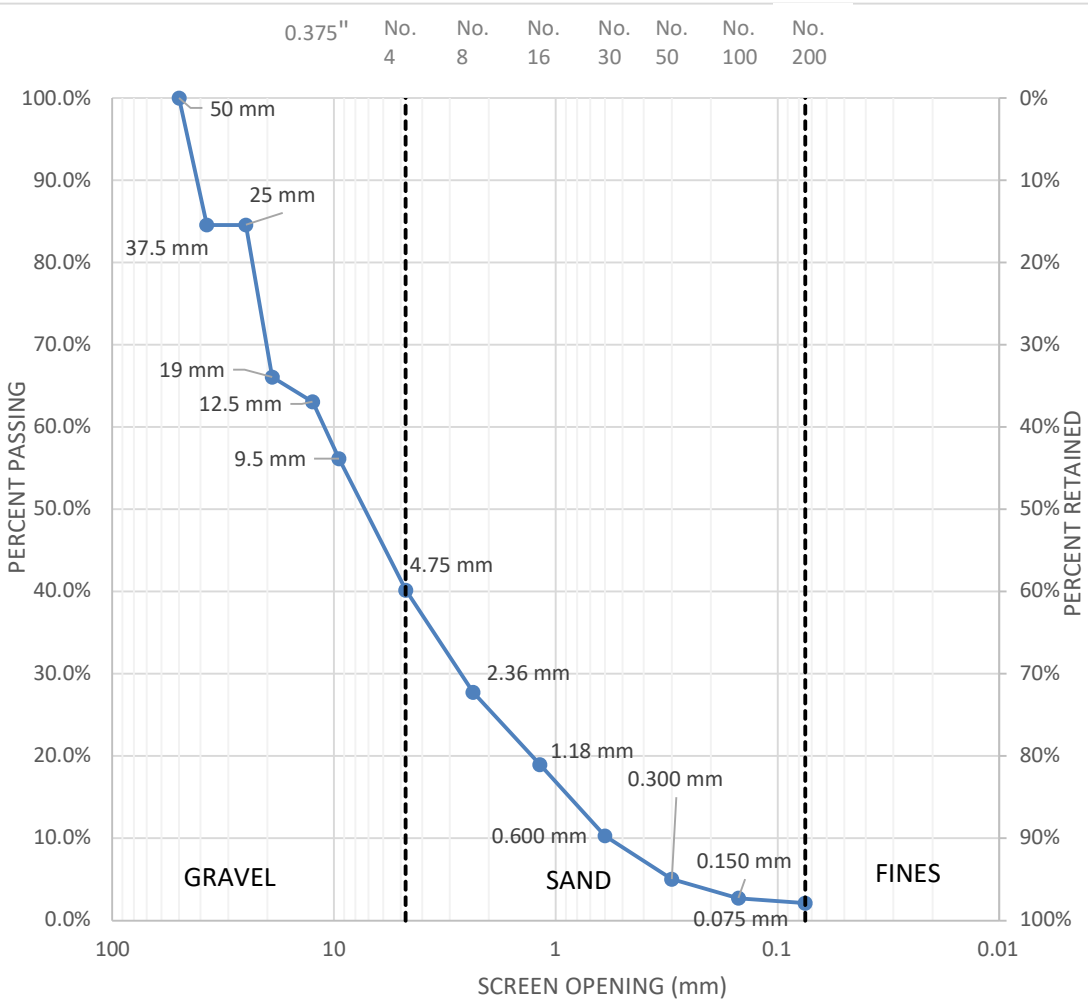
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	GRAVEL AND SAND, TRACE SILT	METHOD	WASHED
IN-SITU MOISTURE	7.5%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-03 ,GR-2 @9'8"-12'9"	REPORT NO.	10

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	100.0%
37.5 mm	1.5"	84.6%
25.0 mm	1"	84.6%
19.0 mm	0.75"	66.1%
16.0 mm	0.63"	
12.5 mm	0.5"	63.1%
9.5 mm	0.375"	56.2%
4.75 mm	No. 4	40.2%
2.36 mm	No. 8	27.7%
2.00 mm	No. 10	
1.18 mm	No. 16	18.9%
850 µm	No. 20	
600 µm	No. 30	10.3%
425 µm	No. 40	
300 µm	No. 50	5.0%
180 µm	No. 80	
150 µm	No. 100	2.7%
75 µm	No. 200	2.1%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	59.8%	38.1%	2.1%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

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SIEVE ANALYSIS
ASTM C136/C117

EXP Services Inc.
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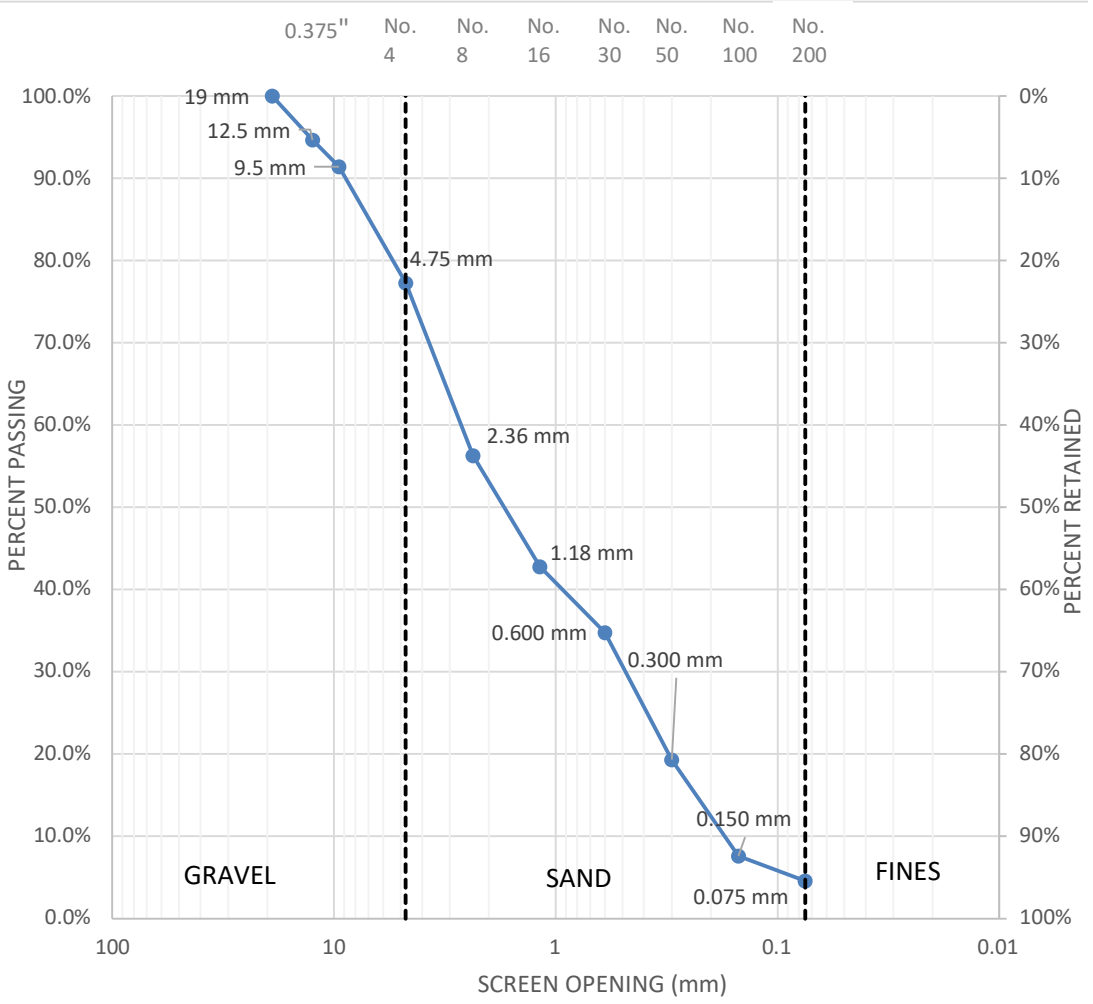
CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SAND, GRAVELLY, TRACE SILT	METHOD	WASHED
IN-SITU MOISTURE	9.1%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-03, GR-4 @16'-18'	REPORT NO.	11

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	
37.5 mm	1.5"	
25.0 mm	1"	
19.0 mm	0.75"	100.0%
16.0 mm	0.63"	
12.5 mm	0.5"	94.6%
9.5 mm	0.375"	91.4%
4.75 mm	No. 4	77.3%
2.36 mm	No. 8	56.3%
2.00 mm	No. 10	
1.18 mm	No. 16	42.7%
850 µm	No. 20	
600 µm	No. 30	34.8%
425 µm	No. 40	
300 µm	No. 50	19.3%
180 µm	No. 80	
150 µm	No. 100	7.6%
75 µm	No. 200	4.6%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	22.7%	72.7%	4.6%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
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Reviewed by:

James Burrows, EIT
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SIEVE ANALYSIS
ASTM C136/C117

EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
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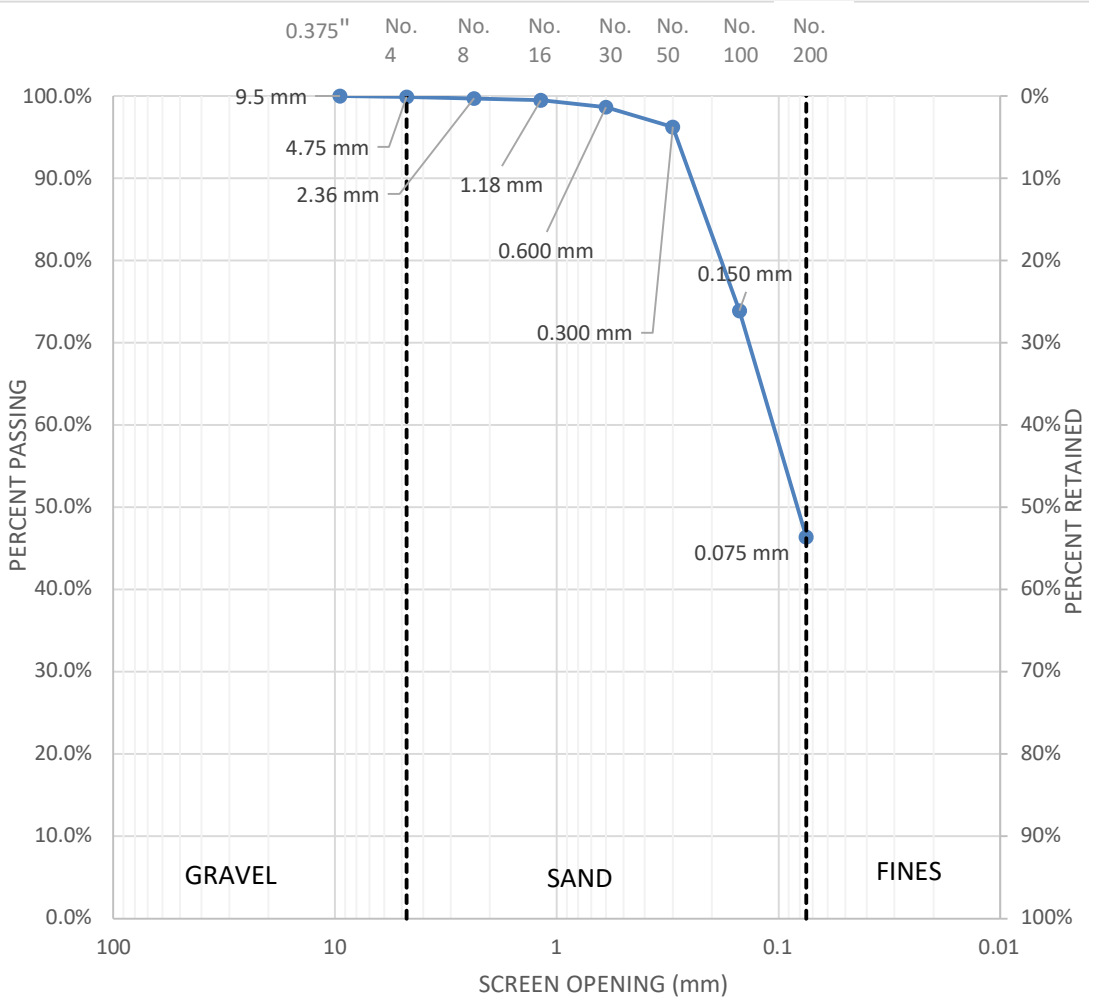
CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SAND AND SILT, TRACE GRAVEL	METHOD	WASHED
IN-SITU MOISTURE	16.8%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-04, GR-2 @1'-3'	REPORT NO.	12

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	
37.5 mm	1.5"	
25.0 mm	1"	
19.0 mm	0.75"	
16.0 mm	0.63"	
12.5 mm	0.5"	
9.5 mm	0.375"	100.0%
4.75 mm	No. 4	99.9%
2.36 mm	No. 8	99.7%
2.00 mm	No. 10	
1.18 mm	No. 16	99.5%
850 µm	No. 20	
600 µm	No. 30	98.7%
425 µm	No. 40	
300 µm	No. 50	96.2%
180 µm	No. 80	
150 µm	No. 100	73.9%
75 µm	No. 200	46.4%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	0.1%	53.5%	46.4%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

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ASTM C136/C117

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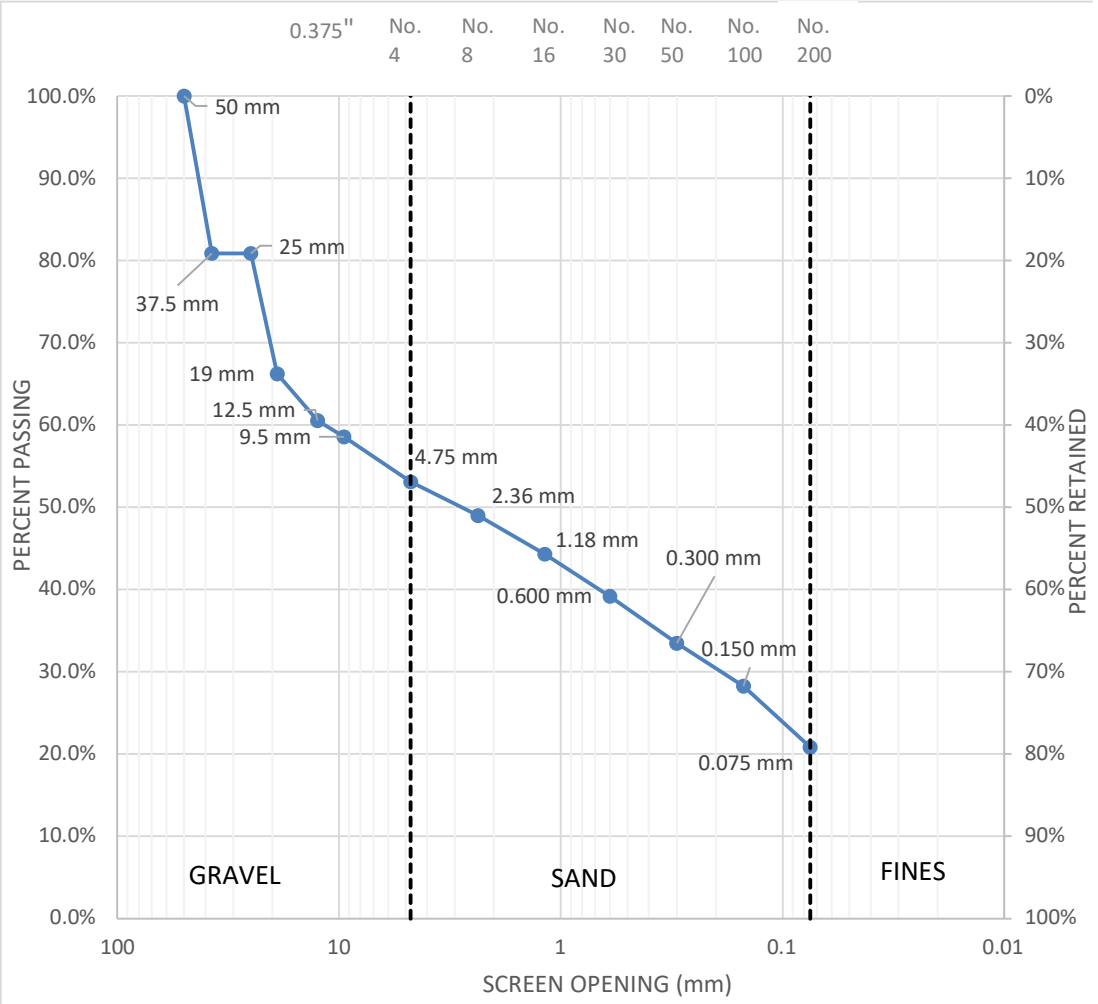
CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	GRAVEL, SANDY, SILTY	METHOD	WASHED
IN-SITU MOISTURE	16.3%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-04, GR-4 @19'-20'	REPORT NO.	13

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	100.0%
37.5 mm	1.5"	80.9%
25.0 mm	1"	80.9%
19.0 mm	0.75"	66.2%
16.0 mm	0.63"	
12.5 mm	0.5"	60.5%
9.5 mm	0.375"	58.6%
4.75 mm	No. 4	53.1%
2.36 mm	No. 8	49.0%
2.00 mm	No. 10	
1.18 mm	No. 16	44.3%
850 µm	No. 20	
600 µm	No. 30	39.2%
425 µm	No. 40	
300 µm	No. 50	33.5%
180 µm	No. 80	
150 µm	No. 100	28.3%
75 µm	No. 200	20.8%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	46.9%	32.3%	20.8%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

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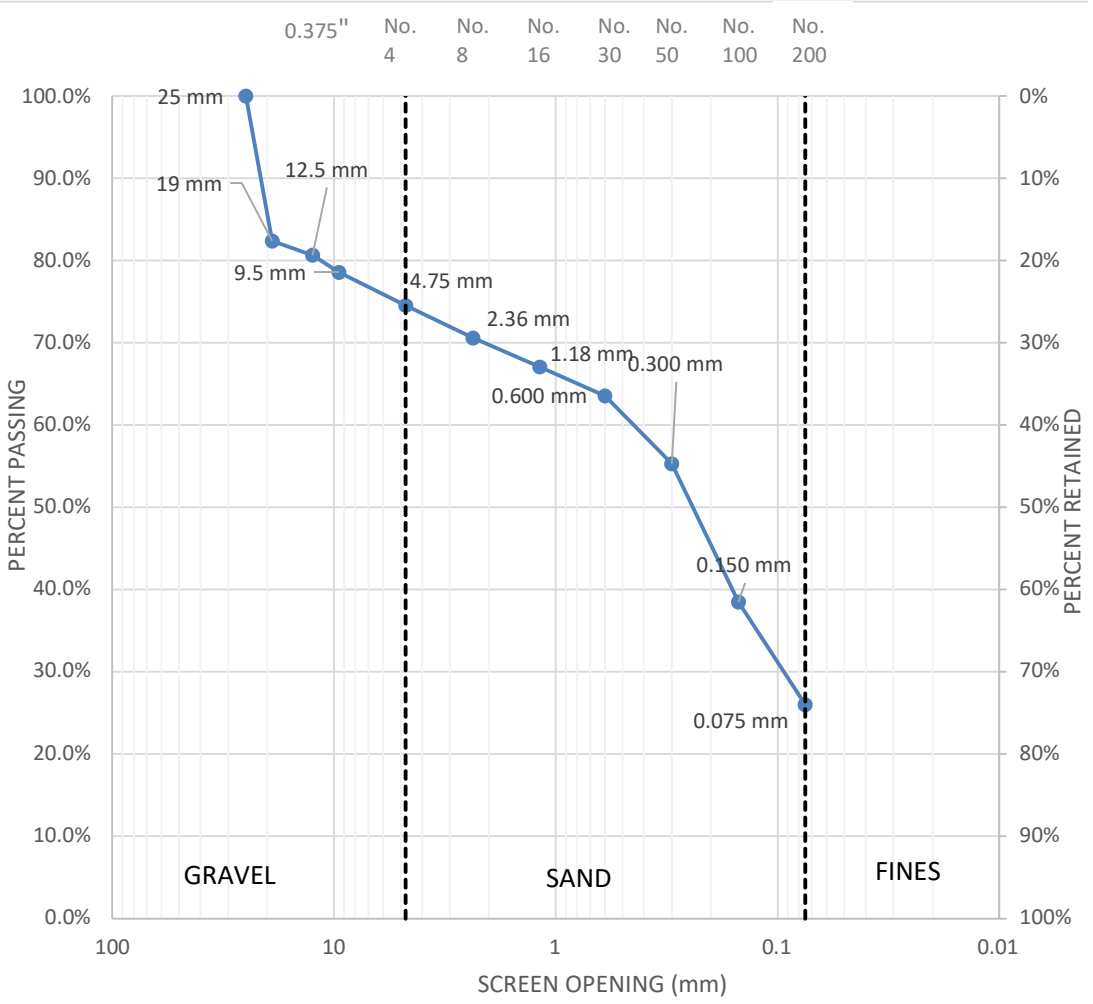
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SAND, GRAVELLY, SILTY	METHOD	WASHED
IN-SITU MOISTURE	11.1%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-04, GR-7 @28.5'-30'	REPORT NO.	14

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	
37.5 mm	1.5"	
25.0 mm	1"	100.0%
19.0 mm	0.75"	82.4%
16.0 mm	0.63"	
12.5 mm	0.5"	80.6%
9.5 mm	0.375"	78.6%
4.75 mm	No. 4	74.5%
2.36 mm	No. 8	70.6%
2.00 mm	No. 10	
1.18 mm	No. 16	67.1%
850 µm	No. 20	
600 µm	No. 30	63.5%
425 µm	No. 40	
300 µm	No. 50	55.3%
180 µm	No. 80	
150 µm	No. 100	38.5%
75 µm	No. 200	26.0%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	25.5%	48.5%	26.0%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

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SIEVE ANALYSIS
ASTM C136/C117

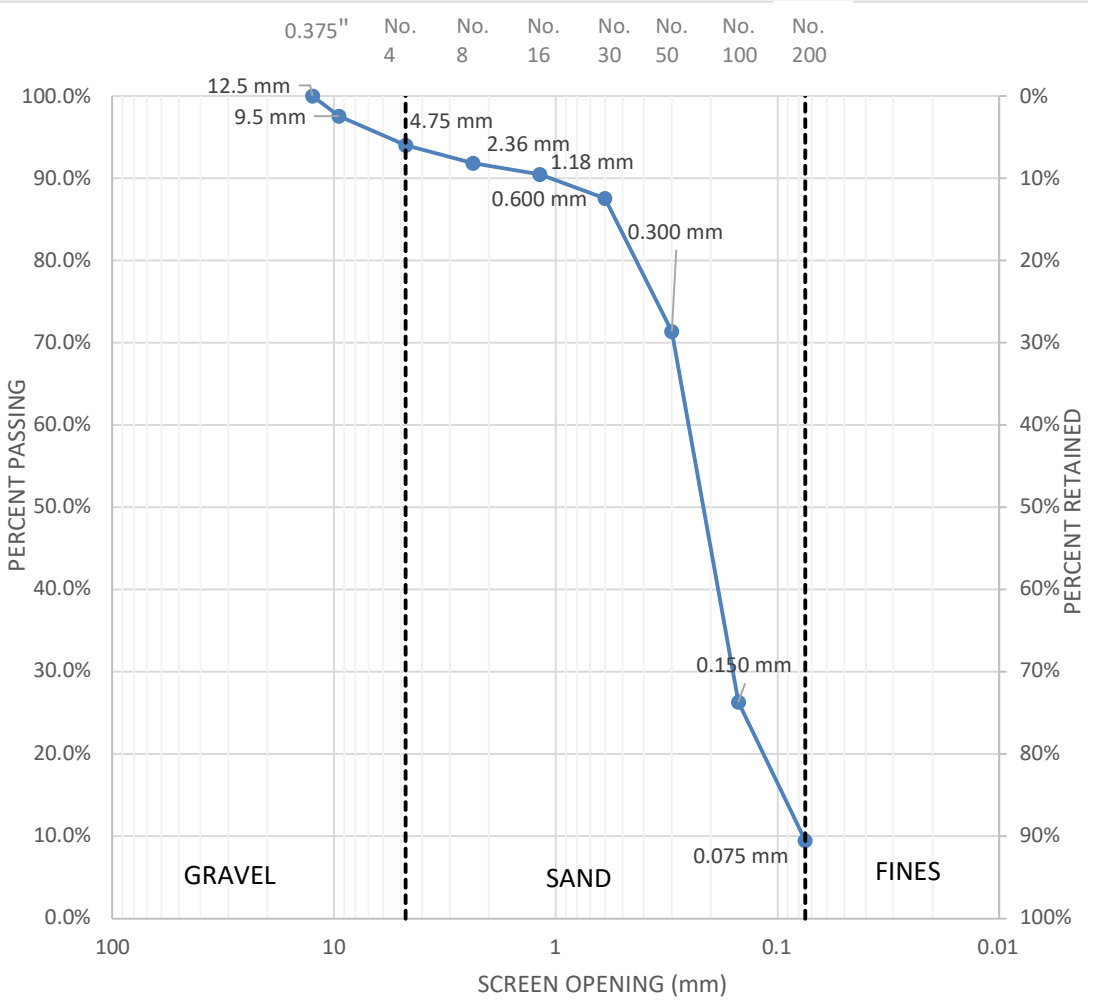
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SAND, TRACE GRAVEL, TRACE SILT	METHOD	WASHED
IN-SITU MOISTURE	10.8%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-04, GR-9 @45'-48'	REPORT NO.	15

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	
37.5 mm	1.5"	
25.0 mm	1"	
19.0 mm	0.75"	
16.0 mm	0.63"	
12.5 mm	0.5"	100.0%
9.5 mm	0.375"	97.6%
4.75 mm	No. 4	94.0%
2.36 mm	No. 8	91.8%
2.00 mm	No. 10	
1.18 mm	No. 16	90.4%
850 µm	No. 20	
600 µm	No. 30	87.5%
425 µm	No. 40	
300 µm	No. 50	71.4%
180 µm	No. 80	
150 µm	No. 100	26.3%
75 µm	No. 200	9.5%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	6.0%	84.5%	9.5%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

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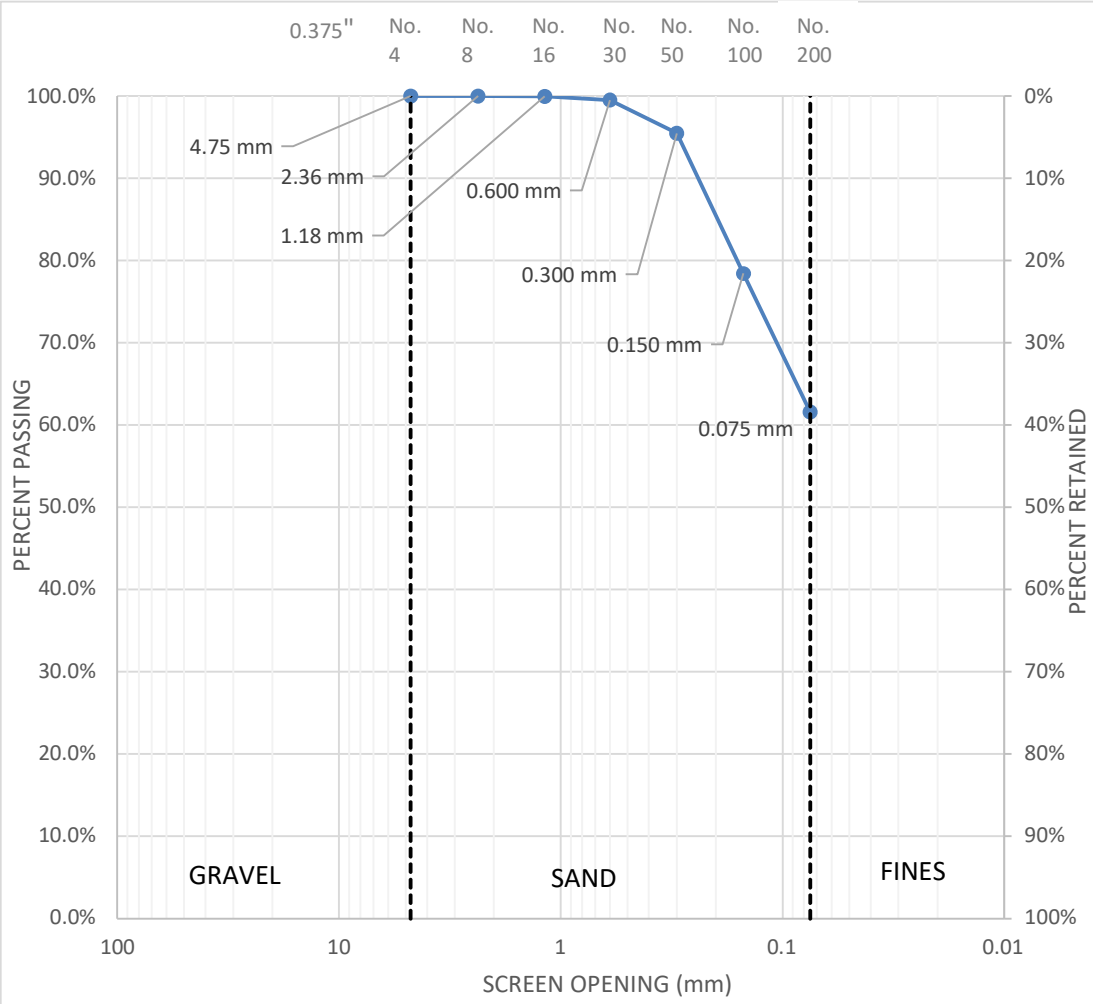
CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SAND AND SILT	METHOD	WASHED
IN-SITU MOISTURE	15.9%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-05, GR-1 @2'3"-4'3"	REPORT NO.	16

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	
37.5 mm	1.5"	
25.0 mm	1"	
19.0 mm	0.75"	
16.0 mm	0.63"	
12.5 mm	0.5"	
9.5 mm	0.375"	
4.75 mm	No. 4	100.0%
2.36 mm	No. 8	100.0%
2.00 mm	No. 10	
1.18 mm	No. 16	100.0%
850 µm	No. 20	
600 µm	No. 30	99.5%
425 µm	No. 40	
300 µm	No. 50	95.5%
180 µm	No. 80	
150 µm	No. 100	78.4%
75 µm	No. 200	61.6%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	0.0%	38.4%	61.6%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

SIEVE ANALYSIS
ASTM C136/C117

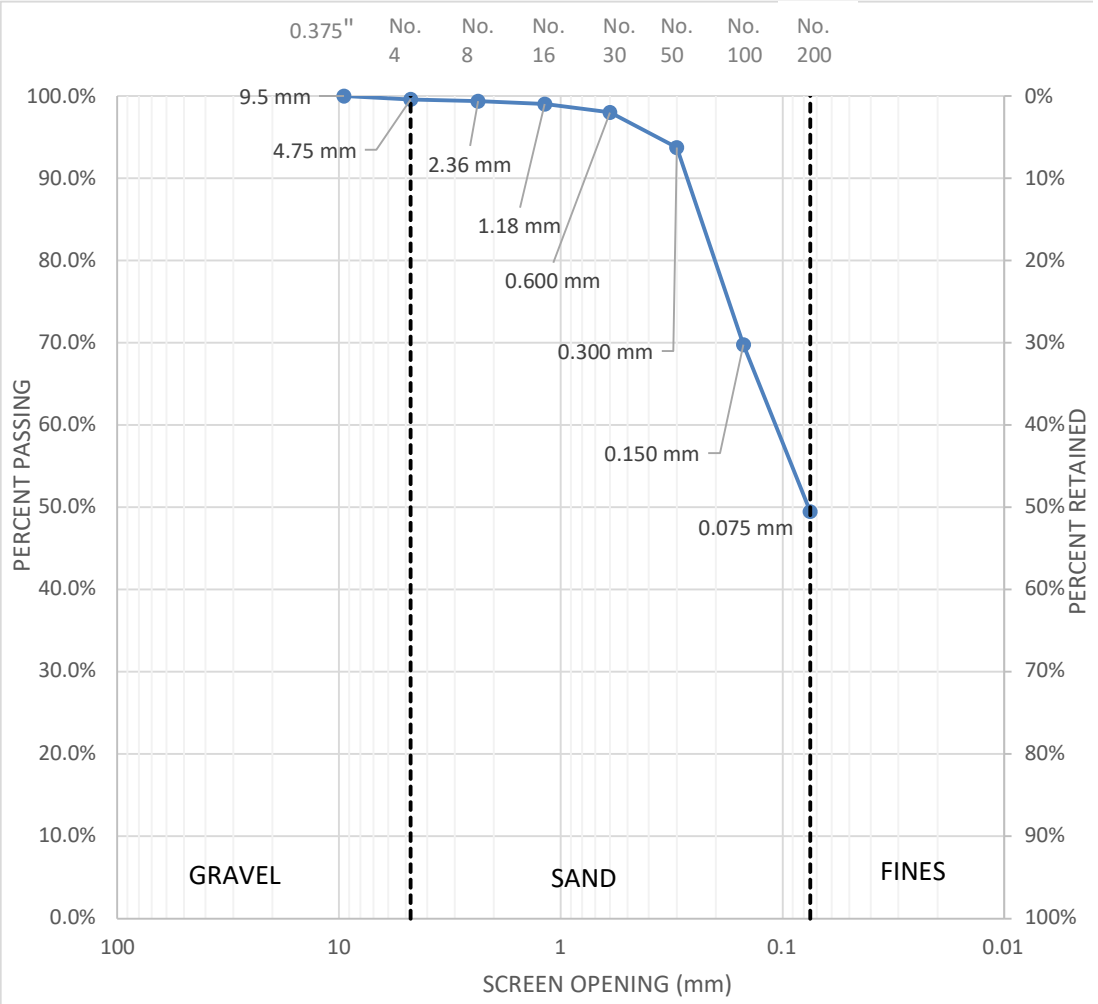
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SAND AND SILT, TRACE GRAVEL	METHOD	WASHED
IN-SITU MOISTURE	17.8%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-05, GR-2 @7'-8'7"	REPORT NO.	17

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	
37.5 mm	1.5"	
25.0 mm	1"	
19.0 mm	0.75"	
16.0 mm	0.63"	
12.5 mm	0.5"	
9.5 mm	0.375"	100.0%
4.75 mm	No. 4	99.6%
2.36 mm	No. 8	99.4%
2.00 mm	No. 10	
1.18 mm	No. 16	99.0%
850 µm	No. 20	
600 µm	No. 30	98.0%
425 µm	No. 40	
300 µm	No. 50	93.7%
180 µm	No. 80	
150 µm	No. 100	69.8%
75 µm	No. 200	49.5%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	0.4%	50.1%	49.5%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

SIEVE ANALYSIS
ASTM C136/C117

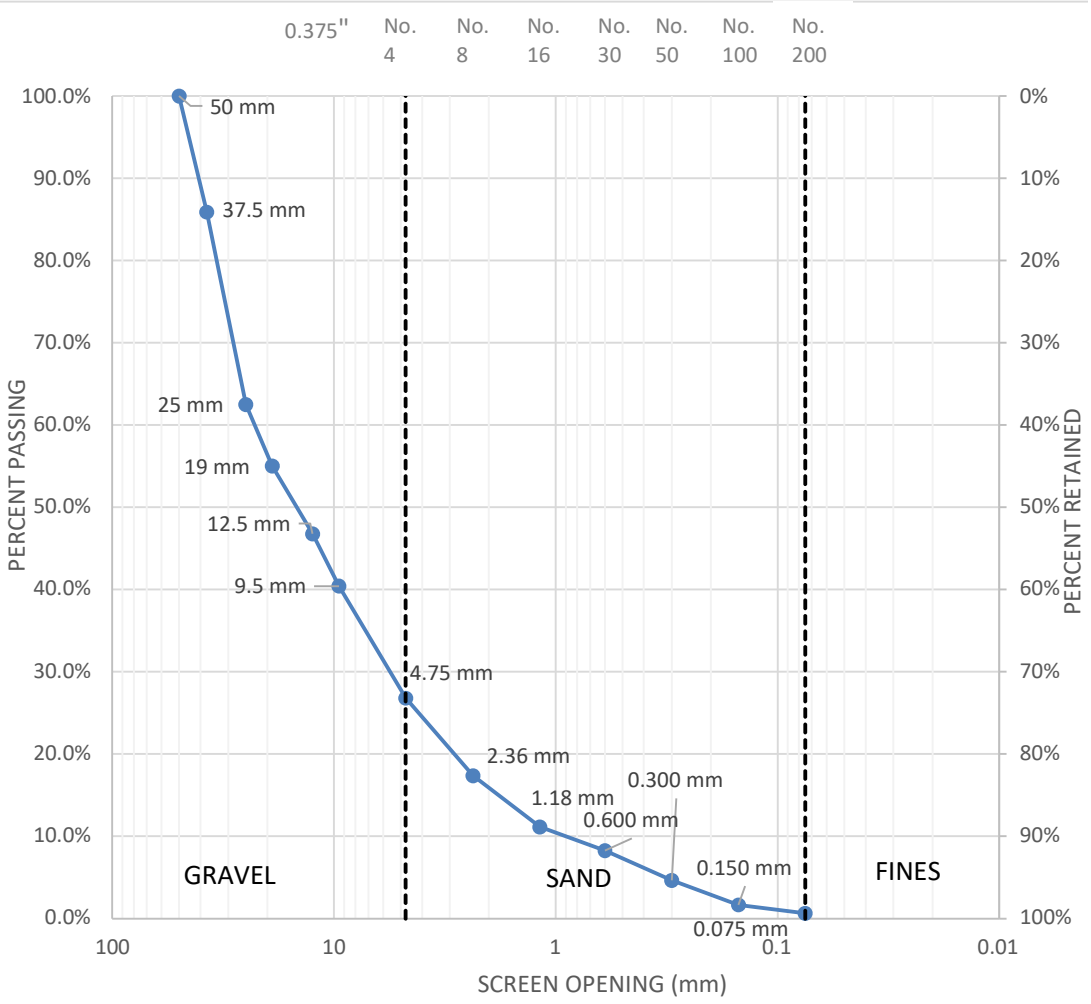
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	GRAVEL, SANDY, TRACE SILT	METHOD	WASHED
IN-SITU MOISTURE	6.7%	SAMPLED BY	AN
MATERIAL SOURCE	NATIVE	TESTED BY	NZ
SAMPLE LOCATION	BH23-05, GR-4 @13'-15'	REPORT NO.	18

SCREEN OPENING	PARTICLE SIZE	PERCENT PASSING
100.0 mm	4"	
90.0 mm	3.5"	
75.0 mm	3"	
50.0mm	2"	100.0%
37.5 mm	1.5"	85.9%
25.0 mm	1"	62.5%
19.0 mm	0.75"	55.0%
16.0 mm	0.63"	
12.5 mm	0.5"	46.8%
9.5 mm	0.375"	40.4%
4.75 mm	No. 4	26.8%
2.36 mm	No. 8	17.4%
2.00 mm	No. 10	
1.18 mm	No. 16	11.2%
850 µm	No. 20	
600 µm	No. 30	8.3%
425 µm	No. 40	
300 µm	No. 50	4.6%
180 µm	No. 80	
150 µm	No. 100	1.7%
75 µm	No. 200	0.7%



CONSTITUENT PERCENTAGES	GRAVEL	SAND	FINES (SILT & CLAY)
	73.2%	26.1%	0.7%

WORK ORDER NO:	2023-274

Distribution: Ali Nikkar, EXP
Ben Weiss, EXP

Comments:

Prepared by:

Nicolas Zhou
Lab Technician

Reviewed by:

James Burrows, EIT
Lab Manager

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

exp Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3
604-874-1245

Kamloops Branch
250-372-5321

CERTIFIED TESTING LABORATORY

SIEVE ANALYSIS REPORT
8 16 30 50 SERIES

PROJECT NO. 002-40098
CLIENT AECOM
C.C. exp - BEN WEISS

TO
exp - BEN WEISS

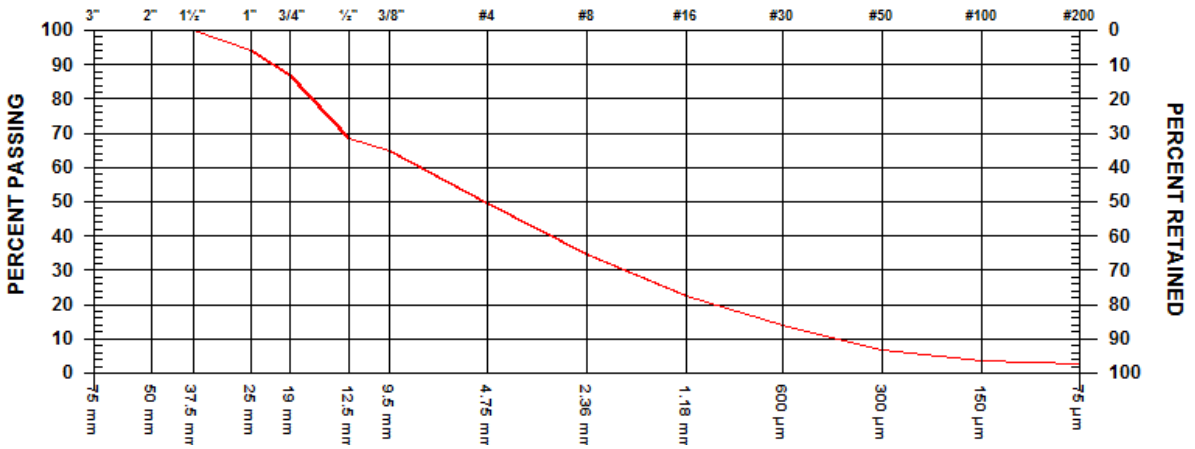
ATTN: MR. BEN WEISS

PROJECT FRENCH CREEK POLLUTION CONTROL CENTRE GEOTECHNICAL — 957 LEE ROAD PARKSVILLE
CONTRACTOR STAGE 4 EXPANSION PROJECT

SIEVE TEST NO. 1 DATE RECEIVED Jul 05,2017 DATE TESTED Jul 10,2017 DATE SAMPLED May 31,2017

SUPPLIER SITE/GRAB
SOURCE AH17-03 S19 @ 4.2M
SPECIFICATION
MATERIAL TYPE SANDY GRAVEL, TRACE SILT

SAMPLED BY D.G.S.
TESTED BY L.JEAN, AScT
TEST METHOD WASHED



GRAVEL SIZES		PERCENT PASSING	GRADATION LIMITS
3"	75 mm		
2"	50 mm		
1 1/2"	37.5 mm	100.0	
1"	25 mm	94.1	
3/4"	19 mm	86.8	
1/2"	12.5 mm	68.5	
3/8"	9.5 mm	64.8	

SAND SIZES AND FINES		PERCENT PASSING	GRADATION LIMITS
No. 4	4.75 mm	49.6	
No. 8	2.36 mm	34.6	
No. 16	1.18 mm	22.3	
No. 30	600 µm	14.1	
No. 50	300 µm	6.8	
No. 100	150 µm	3.8	
No. 200	75 µm	2.7	

MOISTURE CONTENT 8.7 %

COMMENTS
TEST METHOD: ASTM C136, C117.

 Jul 11,2017 exp Services Inc. KEVIN BOWYER, CTech PER. _____

exp Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3
604-874-1245

Kamloops Branch
250-372-5321

CERTIFIED TESTING LABORATORY

SIEVE ANALYSIS REPORT
8 16 30 50 SERIES

PROJECT NO. 002-40098
CLIENT AECOM
C.C. exp - BEN WEISS

TO
exp - BEN WEISS

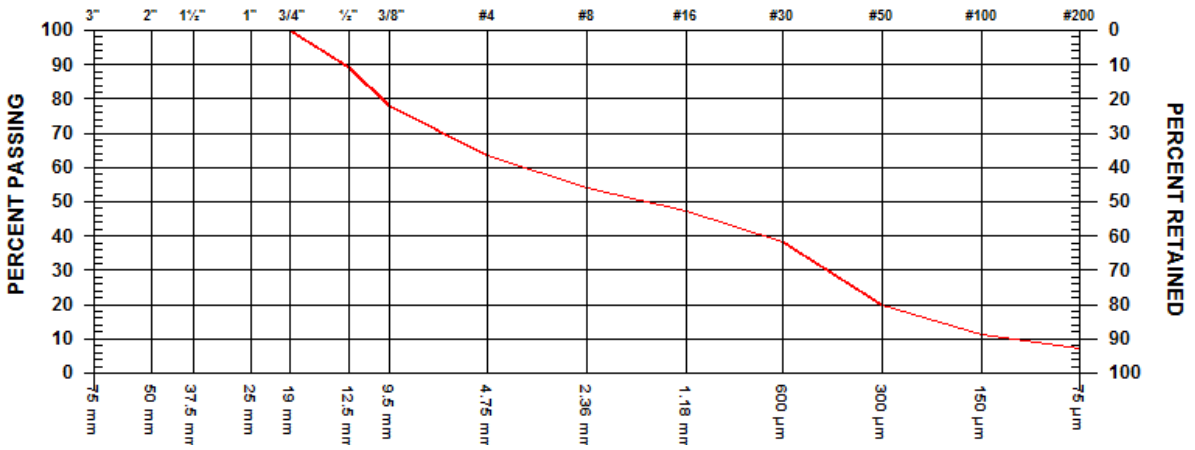
ATTN: MR. BEN WEISS

PROJECT FRENCH CREEK POLLUTION CONTROL CENTRE 957 LEE ROAD
GEOTECHNICAL PARKSVILLE
CONTRACTOR STAGE 4 EXPANSION PROJECT

SIEVE TEST NO. 2 DATE RECEIVED Jul 05,2017 DATE TESTED Jul 10,2017 DATE SAMPLED May 31,2017

SUPPLIER SITE/GRAB
SOURCE AH17-03 S18 @ 3.3M
SPECIFICATION
MATERIAL TYPE SAND AND GRAVEL, TRACE SILT

SAMPLED BY D.G.S.
TESTED BY L.JEAN, AScT
TEST METHOD WASHED



GRAVEL SIZES		PERCENT PASSING	GRADATION LIMITS
3"	75 mm		
2"	50 mm		
1 1/2"	37.5 mm		
1"	25 mm		
3/4"	19 mm	100.0	
1/2"	12.5 mm	89.0	
3/8"	9.5 mm	78.1	

SAND SIZES AND FINES		PERCENT PASSING	GRADATION LIMITS
No. 4	4.75 mm	63.7	
No. 8	2.36 mm	54.0	
No. 16	1.18 mm	47.4	
No. 30	600 µm	38.2	
No. 50	300 µm	19.6	
No. 100	150 µm	11.2	
No. 200	75 µm	7.4	

MOISTURE CONTENT 7.2 %

COMMENTS
TEST METHOD: ASTM C136, C117.

 Jul 11,2017 exp Services Inc. KEVIN BOWYER, CTech PER. _____

exp Services Inc.
275-3001 Wayburne Drive
Burnaby, BC V5G 4W3
604-874-1245

Kamloops Branch
250-372-5321

CERTIFIED TESTING LABORATORY

SIEVE ANALYSIS REPORT
8 16 30 50 SERIES

PROJECT NO. 002-40098
CLIENT AECOM
C.C. exp - BEN WEISS

TO
exp - BEN WEISS

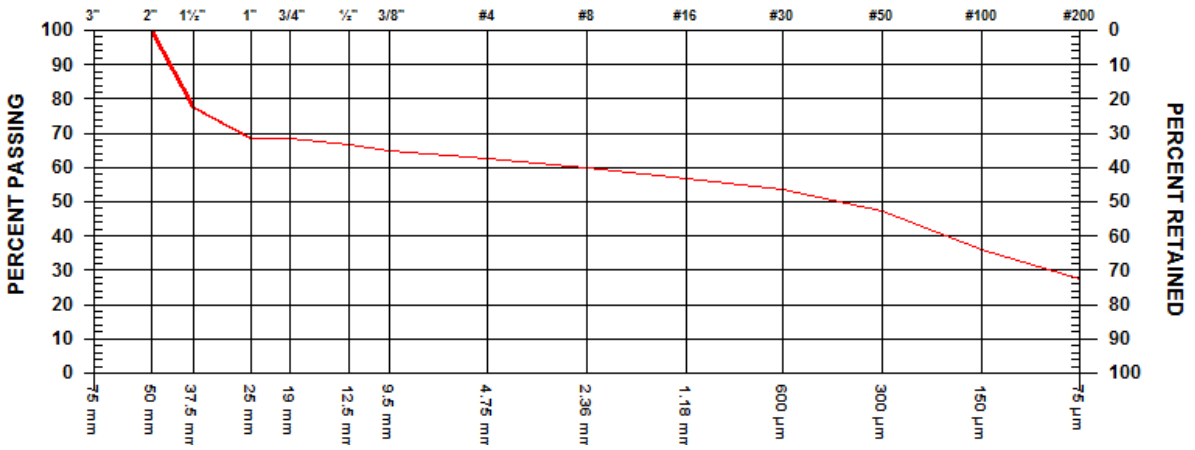
ATTN: MR. BEN WEISS

PROJECT FRENCH CREEK POLLUTION CONTROL CENTRE 957 LEE ROAD
GEOTECHNICAL PARKSVILLE
CONTRACTOR STAGE 4 EXPANSION PROJECT

SIEVE TEST NO. 3 DATE RECEIVED Jul 05,2017 DATE TESTED Jul 10,2017 DATE SAMPLED May 31,2017

SUPPLIER SITE/GRAB
SOURCE AH17-01 S5 @ 5.7M
SPECIFICATION
MATERIAL TYPE SILTY SANDY GRAVEL

SAMPLED BY D.G.S.
TESTED BY L.JEAN, AScT
TEST METHOD WASHED



GRAVEL SIZES		PERCENT PASSING	GRADATION LIMITS
3"	75 mm		
2"	50 mm	100.0	
1 1/2"	37.5 mm	77.3	
1"	25 mm	68.6	
3/4"	19 mm	68.6	
1/2"	12.5 mm	66.6	
3/8"	9.5 mm	64.7	

SAND SIZES AND FINES		PERCENT PASSING	GRADATION LIMITS
No. 4	4.75 mm	62.8	
No. 8	2.36 mm	59.8	
No. 16	1.18 mm	56.8	
No. 30	600 µm	53.5	
No. 50	300 µm	47.1	
No. 100	150 µm	36.1	
No. 200	75 µm	27.4	

MOISTURE CONTENT 8.2 %

COMMENTS
TEST METHOD: ASTM C136, C117.

 Jul 11,2017 exp Services Inc. KEVIN BOWYER, CTech PER. _____

REGIONAL DISTRICT OF NANAIMO

Appendix C
Sample Form of Contract

BETWEEN: _____ (the "Supply Contractor")

AND: Regional District of Nanaimo (the "Corporation")

THIS AGREEMENT WITNESSES that the Supply Contractor and the Corporation agree as follows:

1. The Supply Contractor shall provide all labour, Supply Contractor's Plant and Equipment and materials required to supply the Goods within the required time, as required by the Contract Documents.

2. The Corporation shall pay the Supply Contractor the Contract Price, as required by the Contract Documents.

3. The Contract Price shall be the sum in Canadian Dollars of the following:

   (a) $ _____, and

   (b) any payments made on account of changes, as may be required by the Contract Documents.

   The Contract Price shall be the entire compensation owing to the Supply Contractor by the Corporation for the Goods and shall cover and include necessary costs including but not limited to all supervision, labour, materials, Supply Contractor's Plant and Equipment, overhead, profit, financing costs, duty, shipping charges, fabrication and finishing, conveyance and delivery, packing, crating, freight, cartage, off-loading, drafting charges, tariffs, warranty and all other costs and expenses whatsoever incurred in performing the Contract.

   Except for the amounts which the RDN in good faith is disputing and except for any set off which the RDN may claim and except for invoices (or portions of invoices) in respect of which the RDN has requested and not received supporting evidence, the RDN shall pay invoices submitted to it for the Services within 30 days' receipt thereof.

4. The Supply Contractor shall supply all Goods to the Delivery Point no later than <XX weeks from receipt of order>.

5. The Contract Documents shall form a part of this Agreement as though recited in full.

6. The Contract supersedes all prior negotiations, representations, or agreements, whether written or oral and is the entire agreement between the Corporation and the Supply Contractor with respect to the subject matter of this Agreement.

7. The Supply Contractor shall not assign the Contract, or any portion of the Contract, or any payments due or to become due under the Contract, without the express written consent of the Corporation.

8. No action or failure to act by the Corporation or an authorized representative of the Corporation shall constitute a waiver of any right or duty afforded any of them under the Contract or constitute an approval or acquiescence in any breach thereunder, except as may be specifically agreed in writing.

9. This Agreement shall enure to the benefit of and be binding upon the Corporation and the Supply Contractor and their respective heirs, executors, legal representatives, successors and permitted assigns. In the event of more than one person being the Supply Contractor, the grants, covenants, provisos and claims, rights, powers, privileges, and liabilities shall be construed and held to be several as well as joint.

10. Time shall be of the essence of this Agreement.

11. This Agreement may be executed in any number of counterparts, each of which will be deemed to be an original and all of which taken together will be deemed to constitute one and the same instrument. Delivery by electronic transmission in portable document format (PDF) of an executed counterpart of this Agreement is as effective as delivery of an originally executed counterpart of this Agreement.

IN WITNESS WHEREOF the parties hereto have executed this Agreement as follows:

REGIONAL DISTRICT OF NANAIMO
by its authorized signatory on _____ day of _____, 20__ (the date of Agreement):

SIGNED on behalf of the Corporation by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

[SUPPLY CONTRACTOR'S NAME]

by its authorized signatory on _____ day of _____, 20__:

SIGNED on behalf of the Supply Contractor by:

Signature: _____

Name: _____

Title: _____

Signature: _____

Name: _____

Title: _____

END OF SECTION

PART 1 GENERAL

1.1 DEFINITIONS

The following words and terms, unless the context otherwise requires, in all Contract Documents, shall have the meanings set out below. Words importing the male gender include the female gender and either includes the neuter and vice versa and words importing the singular number includes the plural number and vice versa.

"Addenda" means any addition, deletion, clarification, or corrections issued with respect to the Original Solicitation Documents prior to execution of the Agreement;

"Agreement" means the Standard Form Supply Contract Form of Agreement executed by the Corporation and the Supply Contractor;

"Contract" means the contractual relationship formed between the Corporation and the Supply Contractor by each party's execution of the Agreement;

"Contract Documents" means the following documents:

(1) the executed Agreement;
(2) these General Conditions;
(3) any Addenda;
(4) the Original Solicitation Documents;
(5) the Proposal; and
(6) other relevant documents such as but not limited to letters of clarification and any reports, standards or the like included by reference in the Original Solicitation Documents or Addenda;

"Contract Price" has the meaning set out in the Agreement;

"Corporation" means the Regional District of Nanaimo;

"Day" means calendar day;

"Delivery Date" means the date set out in the Agreement as the latest date by which the Supply Contractor is required to supply Goods to the Delivery Point;

"Delivery Point" means the <Enter location and street address> as per Incoterms 2020 Delivery Duty Paid (DDP) with title transferring at the named place;

"Goods" means moveable property that the Supply Contractor is required to deliver to the Corporation pursuant to the Contract Documents and includes materials, products, equipment, and other physical objects of every kind and description whether in solid, liquid, gaseous, or electronic form;

"Inspector" means a person appointed by the Corporation having the authority set out in Clause 2.1.2.1 of these General Conditions.

"Original Solicitation Documents" means the request for proposals, invitation to tender or comparable form of solicitation posted by the Corporation which resulted in the Agreement being executed;

"Proposal" means the Supply Contractor's written submission to the Corporation in response to the Original Solicitation Documents;

"Specifications" means that part of the Contract Documents consisting of general requirements and written descriptions of the technical features of materials, equipment, construction systems, standards, and workmanship;

"Supply Contractor" means the person identified as such in the Agreement.; and

"Warranty Period" has the meaning set forth in Clause 3.4.1 of these General Conditions.

CONTRACT REQUIREMENTS

1.1.1 Successors' Obligations

The Contract shall enure to the benefit of and is binding upon not only the parties hereto but also their respective successors and permitted assigns.

1.1.2 Assignment of Contract

The Supply Contractor shall not assign the Contract in whole or in part, nor any payments due or to become due under the Contract without the prior written consent of the Corporation. No assignment of the Contract shall relieve the Supply Contractor from any obligation under the Contract or impose any liability on the Corporation. Involuntary assignment of the Contract because of bankruptcy, assignment of the Contract for the benefit of creditors or appointment of a receiver, or insolvency shall be deemed default under the Contract entitling the Corporation to terminate the Contract as hereinafter provided.

1.1.3 Waiver of Rights

Except as herein provided, no act or failure to act by the Supply Contractor or the Corporation at any time with respect to the exercise of any right or remedies conferred upon them under this Contract shall be deemed to be a waiver on the part of the Supply Contractor or the Corporation of any of their rights or remedies. No waiver shall be effective except in writing. No waiver of one right or remedy shall act as a waiver of any other right or remedy or as a subsequent waiver of the same right or remedy.

1.1.4 Amendment of Contract Documents

The Contract Documents shall not be amended except as specifically agreed in writing signed by both the Corporation and the Supply Contractor.

1.2 LAWS, REGULATIONS AND PERMITS

1.2.1 The Contract shall be construed under and according to the laws of the Province of British Columbia and subject to an agreement to refer a dispute to mediation as per Clause 2.3 of these General Conditions. The parties agree to irrevocably attorn to the jurisdiction of the Courts of the Province of British Columbia.

1.2.2 The Supply Contractor shall give all notices required by law and shall comply with all laws, acts, ordinances, rules, and regulations relating to or affecting the Goods. If any permits, authorizations, approvals or licences from any government or governmental agencies are necessary or desirable for the prosecution of the work they shall be obtained by the Supply Contractor at its expense, provided that the Supply Contractor shall not make application for any such permit, authorization, approval, or licence without first obtaining the written consent of the Corporation.

1.2.3 Patents, Royalties and Copyright

The Supply Contractor shall pay all fees, royalties or claims for any patented invention, article, process, or method that may be used upon or in a manner connected with the Goods or with the use of the Goods by the Corporation. Before final payment is made on the account of this Contract, the Supply Contractor shall, if requested by the Corporation, furnish acceptable proof of a proper release from all such fees or claims.

1.2.4 All references to money in the Contract Documents shall be interpreted as meaning lawful currency of Canada.

PART 2 CORPORATION-SUPPLY CONTRACTOR RELATIONS

2.1 AUTHORITY OF CORPORATION

2.1.1 Acceptability of Goods

The Corporation shall make the final determination of the acceptability of the Goods.

2.1.2 Appointment and Authority of Inspector

2.1.2.1 The Corporation may appoint an Inspector at any time before or after award of the Contract. If the Corporation appoints an Inspector, the Inspector shall represent the Corporation at the Delivery Point. The Inspector shall have the authority set out in the Contract Documents and such other authority as may be delegated in writing by the Corporation including but not limited to the following:

(a) to make determinations regarding the Goods; and

(b) to make determinations regarding the Supply Contractor's performance of its obligations under the Contract.

2.2 RESPONSIBILITIES OF THE SUPPLY CONTRACTOR

2.2.1 Attention to the Goods

The Supply Contractor shall diligently attend to the supply of the Goods so that they are delivered faithfully, expeditiously and in accordance with the Contract Documents.

2.2.2 Authorized Representative

The Supply Contractor shall advise the Corporation in writing of the name of the Supply Contractor's authorized representative.

2.2.3 Off-loading of Goods

The Supply Contractor shall provide all necessary instructions to ensure satisfactory off-loading of the Goods.

2.2.4 Shipment

The Supply Contractor shall properly package all Goods for safe shipment to the Delivery Point and a notice of shipment shall be sent by the Supply Contractor to the Corporation in advance of final delivery. The notice of shipment shall state the Delivery Date, the applicable purchase order number, description of the Goods, the Supply Contractor's name and the carrier by which the shipment is being made. Clear title to the Goods, free of all charges, liens and encumbrances shall pass to the Corporation when the Goods are received, inspected, deficiencies rectified, and accepted by the Corporation at the Delivery Point. Until such time as title of the Goods is accepted by the Corporation, all risk related to the Goods shall remain with the Supply Contractor. Except for the transfer of risk, the passing of title to the Corporation shall not affect any of the Supply Contractor's obligations.

2.2.5 Errors and Omissions

If the Supply Contractor discovers that there are any errors or omissions in the Contract Documents, it shall immediately notify the Corporation in writing. The Corporation will review the matter and if it concludes that there is an error or omission, it shall determine the corrective actions to be taken and will advise the Supply Contractor accordingly. If the corrective work associated with an error or omission increases or decreases the amount of work called for in the Contract, the Corporation shall issue an appropriate change order. After discovery by the Supply Contractor of an error or omission in the Contract Documents any work thereafter performed by the Supply Contractor shall be done at its risk unless otherwise agreed by the Corporation.

2.3 DISPUTE RESOLUTION

2.3.1 Disputes

A dispute occurs between the Corporation and the Supply Contractor where there is a difference between the parties as to the interpretation, application or administration of the Contract.

2.3.2 Dispute/Claim Resolution

(1) Any matters in dispute under this Contract which is not first resolved between the parties acting reasonably may, with the concurrence of both the Corporation and the Supply Contractor be submitted to mediation to a single mediator appointed jointly by them.

(2) No one shall be nominated to act as a mediator who is in any way financially interested in the business affairs of either the Corporation or the Supply Contractor.

(3) If the parties cannot agree on the choice of a mediator, each party shall select a nominee and the nominees shall jointly appoint a mediator.

(4) The mediation shall take place in Nanaimo, British Columbia, unless agreed otherwise. Parties will be responsible for their own costs.

PART 3 MATERIAL, EQUIPMENT AND WORKMANSHIP

3.1 GENERAL

The Goods shall be of the quality specified in the Contract Documents or better. All work related to the Contract Documents shall be done with equipment and workmanship of the best quality and description and by employment of properly skilled workers and in strict conformity with and as required by the Contract Documents. Materials and equipment shall be the product of suppliers or manufacturers of established good reputation, regularly engaged in the supply or manufacture of such materials or equipment.

3.2 DEMONSTRATION OF COMPLIANCE WITH CONTRACT REQUIREMENTS

3.2.1 Inspection

Inspections and testing shall not in any way relieve the Supply Contractor from any of its obligations or responsibilities under the Contract Documents, and shall not in any way prejudice or constitute a waiver of any rights or remedies of the Corporation or any guarantees, warranties or covenants in favour of the Corporation, and the Corporation shall be entitled to rely on the expertise and obligations of the Supply Contractor and its subcontractors and their consultants and engineers to the same extent as if such inspections and testing by the Corporation or any Inspector or agent had not taken place.

If the Contract Documents, laws, ordinances, or any public regulatory authority requires parts of the Goods to be specially inspected, tested or approved, the Supply Contractor agrees that the Goods shall comply.

The Goods are subject to inspection and acceptance by the Corporation within a reasonable time after receipt. The Corporation will notify the Supply Contractor in writing of the rejection of any of the Goods which are not in accordance with the Contract Documents, and the Goods will be held subject to disposition by the Supply Contractor at the Supply Contractor's risk and subject to all charges accruing because of such rejection.

Notwithstanding any prior payment therefor, all Goods are subject to inspection and testing by the Corporation at the Delivery Point.

3.2.2 Certification

The equipment must be certified by the Supply Contractor in accordance with the local authorities with jurisdiction. Where compliance of Goods with the Contract Documents is not readily determinable through inspection and tests, the Corporation may require that the Supply Contractor provide, at the Supply Contractor's expense, properly authenticated documents, certificates, or other satisfactory proof of compliance. These documents, certificates or other proof shall include performance characteristics, materials of construction and the physical or chemical characteristics of materials.

3.2.3 Electrical

Electrical products that plug into an electrical outlet must meet Canadian national safety standards and be certified by an accredited certification body such as CSA, cUL or cETL.

3.3 DEFECTIVE OR IMPROPER GOODS

3.3.1 Correction of Defective Goods

If upon inspection, testing or otherwise the Goods or any portion thereof are found to be non-conforming, unsatisfactory, defective, or inferior quality or workmanship, or fail to meet any guarantee of operating or other Specifications contained herein, or any other requirements of the Contract Documents, then without prejudice to any other rights or remedies, the Corporation may give notice of its dissatisfaction to the Supply Contractor in writing and the Supply Contractor shall immediately upon receipt of such notice do all things that are required to satisfy the Corporation. If the Supply Contractor refuses or neglects to do all things that are required to satisfy the Corporation within one week from the receipt of notice, the Corporation may employ some other person to do so and all expenses and costs consequent thereon or incidental thereto shall be charged to the Supply Contractor. The employment of such other person or the doing of the said work by the Corporation itself shall not affect the Supply Contractor's duties and liabilities hereunder or relieve the Supply Contractor from the performance and fulfilment of any or all of the Supply Contractor's warranties, covenants, undertakings, obligations and duties under the Contract.

3.3.2 If upon inspection, testing or otherwise the Goods or any portion thereof are found to be non-conforming, unsatisfactory, defective, or inferior quality or workmanship, or fail to meet any guarantee of operating or other Specifications contained herein, or any other requirements of the Contract Documents, then without prejudice to any other rights or remedies, the Corporation may return the Goods or any part thereof to the Supply Contractor at the Supply Contractor's sole cost and all amounts theretofore paid by the Corporation to the Supply Contractor on account of the Contract Price of such returned Goods, shall be repaid to the Corporation by the Supply Contractor. The Supply Contractor shall advise the Corporation in writing, where to return the Goods, and failing such advice from the Supply Contractor, the Supply Contractor agrees to accept the returned Goods at the Supply Contractor's registered office. Neither the inspection nor failure to make inspection, nor acceptance of Goods shall release the Supply Contractor from any warranties or other provisions of this Contract nor impair the Corporation's right to reject non-conforming Goods. The Corporation reserves the right even after it has paid for and accepted Goods to make a claim

against the Supply Contractor on account of any Goods which do not prove to be satisfactory or are defective irrespective of the Corporation's failure to notify the Supply Contractor of a rejection of non-conforming Goods or revocation of acceptance thereof, or to specify with particularity any defect in non-conforming Goods after rejection or acceptance thereof.

3.3.3 Retention of Defective Goods

If in the opinion of the Corporation any portion of the Goods supplied under the Contract is defective or not in accordance with the Contract Documents and if the defect or imperfection in the same is not of sufficient magnitude or importance to make the Goods dangerous or undesirable, or if the removal of such Goods is impracticable, or will create conditions which are dangerous or undesirable, the Corporation shall have the right and authority to retain such Goods instead of requiring the defective or imperfect Goods to be removed and reconstructed, but the Corporation shall be entitled to make such deductions from the payments due or to become due to the Supply Contractor as are just and reasonable.

3.3.4 No Implied Approval

The fact that the Corporation has not disapproved of or rejected any part of the Goods shall not be deemed or be construed to be an acceptance of any such part of the Goods or any such materials.

3.4 WARRANTY AND GUARANTEE

3.4.1 The Supply Contractor agrees that the warranty provisions outlined in the Proposal are to the benefit of the Corporation and that the Goods are free from all defects arising from faulty construction, manufacturing, materials, equipment or workmanship for the period which is twelve (12) months ("Warranty Period") commencing on the earliest of the following dates: (i) the date Corporation accepts clear title to the Goods, or (ii) the date that is six (6) months from the delivery date of the Goods at the Delivery Point.

3.4.2 During the Warranty Period, the Supply Contractor, upon the receipt of notice in writing from the Corporation, shall promptly make all repairs arising out of defects in the Goods. The Corporation shall be entitled to make such repairs, if 10 Days after the giving of such notice to the Supply Contractor, the Supply Contractor has failed to make or undertake with due diligence the repairs. In case of an emergency, where, in the opinion of the Corporation, delay could cause serious loss or damage, or inconvenience to the public, repairs may be made without notice being sent to the Supply Contractor, only after all reasonable attempts have been made to contact the Supply Contractor. The

costs of any repair made by the Corporation in connection with this clause shall be charged to the Supply Contractor and the Supply Contractor shall reimburse the Corporation for such costs. All covenants and agreements shall continue to be binding on the Supply Contractor until they have been fulfilled.

3.4.3 The Corporation is relying on Supply Contractor's skill and judgment in selecting and providing the proper Goods and any applicable services for the Corporation's particular use. The Supply Contractor warrants to the Corporation and its successors in interest that the Goods and any services covered hereby will correspond with the description of the same in the Contract Documents, will conform to all applicable Specifications, will be of the best quality and, unless otherwise specified, will be fit for the purpose for which they are to be used and will conform in all aspects, both in the manufacture and use thereof, with all applicable safety orders or regulations of the Province of British Columbia. The Supply Contractor also warrants that the Goods are free and clear of all liens and encumbrances whatsoever and that the Supply Contractor has a good and marketable title to the same.

3.4.4 The Supply Contractor warrants and guarantees that the Goods are free from all defects arising at any time from faulty design in any part of the Goods.

3.4.5 The Supply Contractor represents that it has read the Contract Documents and, particularly, the Specifications and has satisfied itself that the Goods can be supplied in accordance with the Contract Documents, free of defects and fit for the purpose for which they are to be used.

3.4.6 The warranty should be made out to the Regional District of Nanaimo, 6300 Hammond Bay Road, Nanaimo, B.C. V9T 6N2

PART 4 INDEMNIFICATION AND INSURANCE

4.1 INDEMNIFICATION AND RELEASE

4.1.1 The Supply Contractor shall save harmless and indemnify the Corporation and its directors, officers, servants, employees and agents (the “Indemnified Parties”) from and against all actions, claims, demands, proceedings, suits, losses, damages, costs and expenses of whatsoever kind or nature (including but not limiting the generality of the foregoing, in respect of death, injury, loss or damage to any person or property) arising in any way out of or connected with negligent acts, omission, willful misconduct or breach of this Contract by the Supply Contractor, except to the proportionate extent that such actions, claims, demands, proceedings, suits, losses, damages, costs and expenses were caused by the Indemnified Parties or any of them.

4.1.2 Unless otherwise specified in the Contract, the Supply Contractor shall save harmless and indemnify the Indemnified Parties from and against all actions, claims, demands, proceedings, suits, losses, damages, costs and expenses of whatsoever kind or nature arising in any way from liability of any nature or kind for or on account of any copyrighted or uncopyrighted composition, secret or other process, patented or unpatented invention, articles or appliances manufactured, supplied or used in the Goods, and/or used or to be used by the Corporation before or after supply of the Goods as a result of work performed by the Supply Contractor, and if the Supply Contractor shall fail to save harmless and indemnify in manner aforesaid, any money collected from the Indemnified Parties shall be charged to the Supply Contractor.

4.1.3 The Supply Contractor shall release and discharge the Corporation and its directors, officers, servants, employees and agents (the "Released Parties") from and against all actions, claims, demands, proceedings, suits, losses, damages, costs and expenses of whatsoever kind or nature (including but not limiting the generality of the foregoing, in respect of death, injury, loss or damage to any person or property) which the Supply Contractor or its servants or employees might have in any manner arising in any way out of or connected negligent acts, omission, willful misconduct or breach of this Contract by the Supply Contractor except to the proportionate extent that such actions, claims, demands, proceedings, suits, losses, damages, costs and expenses were caused by the Released Parties or any of them.

4.1.4 The indemnity provided in this clause by the Supply Contractor to the Indemnified Parties shall not in any way be limited or restricted by any insurance or by limitations on the amount or type of damages, compensation or benefits payable under the Workers' Compensation Act or any other similar statute.

4.2 INSURANCE

4.2.1 General

The Supply Contractor and subcontractors shall provide at their own cost any insurance which they are required by law to provide or which they consider necessary to protect their own interests.

4.3 PATENT, TRADEMARK OR COPYRIGHT

4.3.1 The Supply Contractor represents that it has fully investigated all Specifications, including any furnished by the Corporation, in connection with the Goods and based on such investigation and its experience and superior

knowledge with respect to such Goods has determined that the production and supply thereof will not infringe any patent, trademark or copyright.

PART 5 SHIPMENT OF GOODS/DAMAGE TO GOODS

5.1 SHIPMENT OF GOODS

5.1.1 Delivery of Goods

The Supply Contractor must deliver the Goods to the Delivery Point DDP (Incoterms 2020). Delivery of the Goods to a carrier for transmission to the Delivery Point does not constitute delivery of the Goods to the Corporation. Any such carrier is deemed to be the Supply Contractor's agent and not the Corporation's agent.

5.1.2 Delivery Costs

The Supply Contractor is responsible for all costs and expenses whatsoever in relation to the supply and delivery of the Goods to the Delivery Point, including without limitations, all shipping, carrier, transportation, freight, insurance, storage, handling, and off-loading costs, as well as any customs or excise charges or duties.

5.1.3 Supply Contractor to Bear Risk

The Supply Contractor shall bear all risks and shall assume all responsibility for the Goods, including, without limitation, any loss or damage to the Goods from any cause whatsoever, up to acceptance of the Goods by the Corporation.

5.1.4 Loss or Damage

If loss or damage to the Goods occurs for which the Supply Contractor is responsible, the Supply Contractor shall immediately effect repairs or replace any property as necessary to make good any such loss or damage. If the Supply Contractor refuses or neglects to do so, the Corporation may make good any such loss or damage, either by itself or by employing some other person, and the expense of doing so shall be charged to the Supply Contractor. If any repair or replacement of property is performed on the Goods because of loss or damage to the Goods for which the Supply Contractor is responsible the Supply Contractor represents and warrants that the warranty provided shall not be affected or changed to any manner or respect whatsoever.

5.1.5 Acceptance of Delivery of Goods by Corporation

Notwithstanding any other provision in the Contract Documents, the Corporation is not deemed to have accepted the Goods until the Goods have been delivered to and off-loaded at the Delivery Point and the Corporation has had a reasonable opportunity of examining them for the purpose of ascertaining whether they are in conformity with the Contract. The Corporation's acceptance or deemed acceptance of the Goods shall not prejudice any rights or remedies the Corporation may have hereunder relating to Goods that are found to be non-conforming, unsatisfactory, defective, of inferior quality or workmanship, or which fail to meet any Specifications or requirements of the Contract Documents.

PART 6 PROGRESS AND COMPLETION

6.1 CONTRACT TIME

6.1.1 Prosecution of the Goods

Time shall be strictly of the essence. The Supply Contractor shall supply the Goods in accordance with the Contract Documents. The Supply Contractor acknowledges that the schedule for supply of the Goods as set out in the Contract Documents is reasonable.

6.1.2 Schedule

The Supply Contractor shall provide a schedule and periodic updates co-ordinating the supply of Goods within the prescribed time. Contract time extensions, if any, shall be incorporated into updated schedules. The failure of the Supply Contractor to comply with this requirement may entitle the Corporation to terminate the Supply Contractor's right to continue with the supply of Goods or to delay progress payments.

6.2 TERMINATION

6.2.1 The Corporation may terminate the Contract if the Supply Contractor at any time becomes bankrupt, makes an assignment of his property for the benefit of his creditors, or if a receiver or liquidator should be appointed. Such termination shall be effective upon the Corporation giving notice thereof.

6.2.2 If at any time the Corporation reasonably forms the opinion that the Supply Contractor is in default under this Contract because the Supply Contractor:

(1) has breached a fundamental term of the Contract or is in substantial breach of the terms of the Contract;

(2) has failed to supply the Goods, within the time specified in the Contract Documents or extensions mutually agreed between the parties in writing;

(3) has failed or is failing to furnish or to maintain a detailed schedule;

(4) has become in any way unable to supply the Goods or any part thereof; or

(5) has repeatedly failed to make prompt payments to subcontractors, suppliers or others for labour, materials, or equipment;

then the Corporation may give notice in writing to the Supply Contractor of such opinion and require that such default or defaults be remedied forthwith. If, within five Days of such notice, such default or defaults are not remedied to the satisfaction of the Corporation or the Supply Contractor has not taken reasonable measures to commence remedying the default(s), the Corporation may terminate the Contract. Such termination shall be effective immediately.

6.2.3 The Corporation may terminate the Contract, without any cost or penalty or consequence whatsoever, if it concludes, acting reasonably on the information available to it, that the Supply Contractor is in material non-compliance with, or has been convicted of a material offence or violation of, health, safety, labour, or environmental laws.

6.3 NO CLAIM

Except as herein before provided, the Supply Contractor shall have no claim against the Corporation for any reason whatsoever by reason of the termination of the Contract.

PART 7 PAYMENT

7.1 PAYMENTS TO SUPPLY CONTRACTOR

7.1.1 Payments to the Supply Contractor will be made as per the Agreement and set forth otherwise in the Contract Documents.

7.1.2 Notwithstanding Clause 7.1.1 the Corporation may withhold from payment:

(1) Such reasonable amount as the Corporation determines appropriate with respect to any part of the Goods not in compliance with the Contract Documents;

(2) Statutory holdback if the supply of Goods is of a nature that creates an obligation on the Corporation to retain a holdback under the Builders Lien Act;

(3) The amount of any bona fide builder's lien claim asserted against the Corporation or which the Corporation acting reasonably anticipates will be made against the Corporation; or

(4) Any deduction or set-off the Corporation may otherwise be entitled to under the Contract.

7.1.3 Payments may be withheld until the relevant operating manuals and all operating and maintenance materials together with all warranties have been delivered to the Corporation.

7.1.4 In addition to any other remedy the Corporation may have in the Contract or law, the Corporation may refuse to make payment because of subsequently discovered evidence or test results, and shall be compensated for any payment previously made to the Supply Contractor to such extent as may be necessary to protect the Corporation from loss because of:

(1) Defective or damaged Goods;

(2) A deductive change order;

(3) Failure of the Supply Contractor to supply the Goods in accordance with the Contract Documents, including failure to maintain the supply of the Goods in accordance with the schedule; or

(4) Disregard by the Supply Contractor of the authority of the laws of any public body having jurisdiction.

The Corporation may refuse to make payment of the full amount because of claims made against the Corporation on account of the Supply Contractor's performance or supply of Goods. In such case, the Corporation shall give the Supply Contractor prompt written notice stating the reasons for each action.

7.1.5 Prior to payment to the Supply Contractor, if requested by the Corporation, the Supply Contractor shall deliver to the Corporation a statutory declaration in form satisfactory to the Corporation declaring that all subcontractors, labour and accounts for material and equipment have been paid and that no persons, firms or corporations have any lien against the lands comprising the

Delivery Point or the work together with such other documentation as the Corporation, acting reasonably, determines is necessary or desirable.