REQUEST FOR PROPOSALS No. 24-031

French Creek Pollution Control Centre
Morningstar Creek Crossing Replacement

ISSUED: April 30, 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

Mandatory Onsite Information Session
10:00 AM (10:00 hrs) Local Time on May 7, 2024
French Creek Pollution Control Centre
957 Lee Road
Parksville, BC

Proposals will not be opened in public

Instructions to Proponents

The Regional District of Nanaimo (RDN) invites qualified firms to submit a proposal to replace the existing concrete bridge across Morningstar Creek at the French Creek Pollution Control Centre (FCPCC) with a new corrugated steel plate arch culvert crossing and construct a new secondary access to the site 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. 24-031 FCPCC Morningstar Creek Crossing Replacement**" 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.

Onsite Information Session (Mandatory)

A mandatory onsite information session will be held to provide Proponents an opportunity to review the site conditions and ask questions. Proponents are required to bring their own PPE; CSA hard-toe boots and safety vest. The meeting will be held at FCPCC at the date and time indicated on the cover-page. **Please RSVP** by email to the listed RDN contact for this RFP.

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 (https://www.rdn.bc.ca/current-bid-opportunities) and BC Bid (www.new.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 is to solicit submissions from qualified contractors to replace the existing concrete bridge across Morningstar Creek at the French Creek Pollution Control Centre (FCPCC) with a new corrugated steel plate arch culvert crossing and construct a new secondary access to the site. The work is in preparation for an expansion of the FCPCC planned to commence several months after completion of the new creek crossing and site access.

Contract award is subject to approval from the Board of Directors of the RDN.

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.

Creek Crossing and Site Access Project Background

Secondary Site Access Road

A new secondary site access for the plant from Highway 19A near the highway bridge across French Creek along with removal and offsite disposal of an earthen berm is included in the scope of work. The new access road is required to be constructed before the creek crossing work commences in order to establish free and clear access to the site for the creek crossing work. The secondary site access will also be used for construction of the expansion project and will ultimately be a permanent secondary access for the plant.

The RDN has obtained a permit from the Ministry of Transportation and Infrastructure (MoTI) for construction of the secondary site access. A copy of the permit is in **Appendix F**. The new access to Highway 19A will be right-turn in, right-turn out only. The existing plant access on Lee Road may be used during construction, if required, with approval from the RDN.

Morningstar Creek Crossing

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 (see **General Notes Item 7 Dwg. C-1005**); and it is unable to accommodate the additional linear infrastructure required for the plant expansion project. Several services currently cross the creek underneath the bridge for the Dewatering

Building and storage facilities on the other side. It is planned to shutdown the Dewatering Building operations during construction of the new crossing and provide temporary electrical and communication service to maintain key functions. The creek crossing work will also include installation of several small and large diameter pipes as well as electrical conduit for the proposed 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**. A copy of the permit is in **Appendix G**. The RDN also intends to procure the design and supply of the new corrugated steel plate arch culvert and precast concrete foundations separately.

Geotechnical information on the site is available in **Appendix E**. Additional geotechnical investigation will be undertaken at Morningstar Creek for design of the arch culvert footings. The geotechnical report from the additional investigation will not be available before close of this RFP but will be available well in advance of construction.

Temporary Infrastructure for Continuity of Dewatering Operations (Optional Work)

An alternate option to shutting down dewatering operations during construction, which would require hauling sludge to Nanaimo, is to continue dewatering operations by installing temporary utilities across a scaffold bridge downstream of the proposed new crossing works as roughly depicted on drawing **C-1005**.

Dewatering operations can be shutdown for a maximum of two (2) days to facilitate construction and tie-in of the temporary works.

3. SCOPE OF SERVICES

The Proponent is required to provide the following services:

Secondary Site Access

1. All labour, materials, equipment and temporary works necessary to construct a new access road from Highway 19A to the plant property on the north side of Morningstar Creek as further described below and in the drawings and specifications contained in the appendices.
2. Removal and offsite disposal of the earthen berm (**Dwg. C-1005**) to match surrounding existing grade.

Morningstar Creek Crossing

1. Clearing and grubbing of the right-of-way for installation of the final effluent pipe adjacent to Morningstar Creek (**Dwg. C-1005**).
2. Unloading of the corrugated steel arch culvert and precast concrete footings at site.
3. Provision of temporary electrical and communication cabling across Morningstar Creek during demolition and construction of the creek crossing to maintain power and communications to the buildings on the north side of the creek. The required cabling includes:
    a. 3 – Electrical teck cables.
    b. 1 – Ethernet cable.
    c. 1 – Fibre communications cable.

d. 1 – Phone communication cable (unarmoured).

4. Demolition and disposal of the existing concrete bridge across Morningstar Creek including concrete abutments and existing linear infrastructure underneath bridge up to tie-in locations with proposed infrastructure.

5. Installation of a new Owner-supplied corrugated steel-arch culvert with precast concrete foundations as further detailed in the drawings contained in **Appendix B**. Shop drawings from the culvert supplier will be available to the successful contractor following award of this contract.

6. Installation of the MSE wall (owner-supplied), linear infrastructure, backfill materials and finished grade surfacing as detailed in the drawings contained **Appendix B**. Shop drawings from the culvert supplier will be available to the successful contractor following award of this contract.

7. Supply, installation, testing and tie-in / capping of all utilities across Morningstar Creek.

Temporary Infrastructure for Continuity of Dewatering Operations (Optional Work)

1. Design, supply and install a temporary scaffold bridge for utility and pedestrian access across Morningstar Creek to be used during demolition and construction of the Morningstar Creek crossing to facilitate continuity of dewatering operations.

2. Provision of gravel or boardwalk pedestrian path from paved / gravel surface to temporary bridge.

3. Supply, installation, testing and tie-in of temporary utilities for continuity of dewatering operations, see drawing **C-1003**. The utilities include:

    a. 1 – 75mm dia. HDPE potable water line.

    b. 1 – 75mm dia. HDPE reclaimed service water (disinfected final effluent) line.

    c. 1 – 100mm dia. HDPE digested sludge line.

    d. 1 – 100mm dia. HDPE centrate (liquid from dewatered sludge) line.

    e. 3 – Electrical teck cables.

    f. 1 – Ethernet cable.

    g. 1 – Fibre communications cable.

    h. 1 – Phone communication cable (unarmoured).

4. Removal and handover to RDN of temporary piping and cables on completion of project.

5. Removal of temporary bridge and pedestrian access and restoration of disturbed areas.

General Requirements

3. Daily reinstatement of the existing 2m high steel construction fencing to secure the FCPCC site north of the creek.

4. Installation of temporary 2m high steel construction fencing to maintain secure site in locations where existing fence is removed (**Dwg. C-1005**).

5. Meet all requirements of the drawings and specifications found in **Appendices B and C**.
6. Meet all construction related requirements of the MoTI permit found in **Appendix F**.
7. Meet all construction related requirements of the DFO permit found in **Appendix G**.
8. Adhere to the requirements of the environmental impact study in **Appendix D**, including restoration of disturbed areas.
9. Adhere to the requirements of the "WWS-COM-10.1 Contractor-Supplier Package" in **Appendix I**.

4. OWNER PROVIDED MATERIALS AND SERVICES

1. Design, supply and delivery to site of the corrugated steel arch culvert c/w assembly hardware and precast concrete foundation.
2. Design, supply and delivery to site of the MSE walls at the upstream and downstream ends of the arch culvert.
3. Isolation and flushing of existing infrastructure necessary for demolition of existing Morningstar Creek crossing and for connection to temporary infrastructure required to maintain sludge dewatering activities.
4. Environmental monitoring and field services during construction, including any required fish and/or amphibian salvage.

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 14 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.
2. Traffic control plan, meeting MoTI requirements, for:
    a. Site access (e.g. for equipment and material transport) prior to establishment of the new access road.
    b. Construction of the portion of the new site access road close to Highway 19A.
    c. Use of the new site access road during construction.
3. Environmental Management Plan prepared by a Qualified Environmental Professional. In particular, the plan shall include erosion and sediment control during construction, spill prevention, containment and mitigation measures for wastewater, fuel, etc, and restoration of disturbed areas. Reference the Environmental Impact Study in **Appendix D** and the "WWS-COM-10.1 Contractor-Supplier Package" in **Appendix I** for more information on environmental management requirements.
4. Site Specific Safety Plan.
5. Insurance per the requirements of Item 7 in the sample contract in **Appendix H**.

6. Bonding per the requirements of Item 31 in the sample contract in **Appendix H**.

6. SCHEDULE

- Contract award is expected to be made by **June 14** with Notice to Proceed by **July 12**.
- The in-stream portion of the works must be completed between **August 15 and September 15** per regulatory requirements.
- Substantial Completion of the project shall be achieved by **October 31, 2024**.

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** – Fee Proposal Form
- **Appendix B** – Drawings and Sketches
- **Appendix C** – Specifications
- **Appendix D** – Environmental Impact Study
- **Appendix E** – Geotechnical Information
- **Appendix F** – MoTI Permit
- **Appendix G** – DFO Permit
- **Appendix H** – Sample Form of Contract
- **Appendix I** – WWS-COM-10.1 Contractor-Supplier Package – EMS Requirements
- **Appendix J** – Prime Contractor Preconstruction Meeting Form

8. PROPOSAL SUBMISSION AND EVALUATION

Submission

The RDN requests submissions, from qualified bypass pumping contractors, 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.

Please include with your proposal:

a) GANTT chart schedule outlining the main activities and sequence of work, including the Optional Work, complete with the following milestone dates: start date, in-stream work window, Substantial Completion.
b) Curriculum vitae for the key project personnel, including the project manager and site superintendent.
c) Description of three reference projects that include construction of similar creek crossings and/or in-stream work in sensitive, fish-bearing waterbodies.
    a. List project manager and site superintendent for each project.
    b. Provide contact information for project owner and/or engineer.
d) A completed Schedule of Quantities and Prices found in **Appendix A**.
e) A completed Fee Proposal Form found in **Appendix A**.

Evaluation

Proposals will be evaluated on a 40% financial, 60% technical basis. The evaluation will review:

Submission Requirements and Evaluation Criteria	Points
Financial component per Fee Proposal Form. Includes Optional Work.	40
Schedule. The schedule meets the RFP requirements, is sequenced in a logical manner and provides sufficient detail to understand the interaction of the major activities and transition between activities.	10
Key personnel CV's. Key personnel exhibit relevant experience in their current roles with similar work.	20
Project references. Project references demonstrate organisational knowledge and experience with similar work and an ability to adhere to permitting requirements while maintaining schedule, meeting specifications and working with the project team with in a professional, solution-focused manner. Including project references that involve the proposed key personnel in their current role is peferrable.	30
TOTAL	**100**

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 H**. The Contract will also include the following forms: 'WWS-COM-10.1 Contractor-Supplier Package – EMS Requirements' and the 'Prime Contractor Preconstruction Meeting Form' in **Appendices I and J**, respectively. 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
Schedule of Quantities and Prices and Fee Proposal Form

SCHEDULE OF QUANTITIES AND PRICES

Item	Description	Unit	Quantity	Unit Price ($)	Subtotal ($)
3.2	Clearing and Grubbing				
	a) Clearing and Grubbing	m^2	960		
	b) Isolated Tree Clearing	ea	3		
	c) Topsoil stripping and removal	m^3	1920		
	d) Remove stockpile material	m^3	4000		
3.3	Excavating, Trenching and Backfilling				
	a) Over-excavation, removal and disposal of native material, and supply and placement of imported Type 3 granular fill material	m^3	100 (1)		
	b) Common excavation and disposal	m^3	250		
3.5	Yard Piping				
	a) Watermain HDPE 75mm diameter depth of main 1.2m Granular Backfill	m	90		
	b) Forcemain Pipe HDPE DR17 50mm diameter, for depth of main 1.2m deep Granular Backfill	m	85		
	c) Forcemain Pipe HDPE DR17 75mm diameter, for depth of main 1.2m deep Granular Backfill	m	85		
	d) Forcemain Pipe HDPE DR17 100mm diameter, for depth of main 1.2m deep Granular Backfill	m	200		
	e) Forcemain Pipe HDPE DR17 150mm diameter, for depth of main 1.2m deep Granular Backfill	m	65		
	f) Forcemain Pipe HDPE DR17 711mm diameter OD, for depth of main 1.8m deep Granular Backfill	m	40		
	g) Bends 711mm diameter DR17 HDPE fabricated fittings	ea	3		

SCHEDULE OF QUANTITIES AND PRICES

	h) Fittings 711mm diameter x 200mm diameter tee c/w 200mm flange and blind flange	ea	2		
	i) In-line Gate Valves 75mm FL-FL	ea	4		
	j) Tie -Ins & capping	ls	n/a		
3.6	Morningstar Creek Culvert and Crossing Work				
	a) Culvert Pipe CSP 500mm diameter, granular backfill inc. sandbag headwalls	m	15		
	b) Culvert SPCSP Arch 3350 wide X 1360 high , c/w precast footings, Engineered Backfill	m	19		
	c) End Walls MSE	ea	2		
	d) Class 250 Uniform Riprap - Machine Placed	tonne	60		
	e) Class 50 Graded Riprap - Machine Placed	tonne	290		
	f) Permeable pavers c/w aggregate base and geotextile	m^2	150		
	g) Regrade and restore creek bed	ls	n/a		
3.7	Site Grading and Roadway				
	a) Subgrade Preparation	m^2	3,300		
	b) Replace Unsuitable Subgrade	m^2	200		
	c) Common Excavation - Offsite Disposal	m^3	250		
	d) Import Embankment Fill - 75mm Minus Granular Fill	m^3	6,250		
	e) Granular Sub-Base 300mm Thickness for Roads	m^2	1,250		
	f) Granular Base 150mm Thickness for Roads	m^2	1,250		

SCHEDULE OF QUANTITIES AND PRICES

	g) Granular Construction Access 200mm Thickness for Roads	m^2	800		
	h) Signs and Pavement Marking	ls	n/a		
3.8	Asphalt Paving				
	a) Asphalt Pavement - Lower Course # 1	tonne	161		
	b) Asphalt Pavement - Upper Course # 1	tonne	81		
3.9	Fencing and Gates				
	a) Remove and reinstate fence	m	20		
	b) Chain link gate	ea	1		
3.11	Landscaping				
	100mm thick topsoil and hydraulic seed	m^2	1,000		

(1) Over-excavation will be as directed by the Engineer at the unit price for this item.

END OF SECTION

FEE PROPOSAL FORM
French Creek Pollution Control Centre
Morningstar Creek Crossing Replacement
Page 1 of 3

Date: _____

Company: _____

Address: _____

Telephone:_____

Email: _____

To: Regional District of Nanaimo
Rob Wood, Project Engineer
rwood@rdn.bc.ca

Having had the opportunity to examine the Project site, and having carefully examined all of the documents including any Addenda issued as supplements thereto, we hereby offer to perform the Work set forth in the aforesaid documents for the Stipulated Contract Price, understanding that the number of days to complete the Work may vary. The Price includes the Contractor's labour, material and equipment costs, overhead and profit, all taxes and duties, and shall represent the complete cost to the Owner of such charges excluding GST which shall be shown separately.

The **Optional Work** price shall include any impacts to construction activities from implementing the temporary infrastructure and being required to work around it and the dewatering operations versus the base case of providing temporary electrical and communications cables to the Dewatering building and a cessation of dewatering operations during construction.

REGIONAL DISTRICT OF NANAIMO

FEE PROPOSAL FORM
French Creek Pollution Control Centre
Morningstar Creek Crossing Replacement
Page 2 of 3

Item				Lump Sum Price
1	DIVISION 0 – CONTRACT REQUIREMENTS			
	.1	Bonding and Insurance	$	_____
2	DIVISION 1 - GENERAL REQUIREMENTS			
	.1	Mobilization and Demobilization	$	_____
	.2	Record Drawings	$	_____
3	DIVISION 2 - SITEWORKS			
	.1	Demolition and Removal	$	_____
	.2	Clearing and Grubbing	$	_____
	.3	Excavating, Trenching and Backfilling	$	_____
	.4	Dewatering	$	_____
	.5	Yard Piping	$	_____
	.6	Morningstar Creek Culvert and Crossing Work	$	_____
	.7	Site Grading and Gravel Roadway	$	_____
	.8	Asphalt Paving	$	_____
	.9	Fencing and Gates	$	_____
	.10	Temporary Measures, Works and Restoration	$	_____
	.11	Landscaping	$	_____
	.12	All Other Sitework	$	_____
17	DIVISION 16 - ELECTRICAL			
	.1	U/G Conduit and Wiring	$	_____
Subtotal:			**$**	_____
GST (5%):			**$**	_____
Total Stipulated Contract Price:			**$**	_____

REGIONAL DISTRICT OF NANAIMO

FEE PROPOSAL FORM
French Creek Pollution Control Centre
Morningstar Creek Crossing Replacement
Page 3 of 3

Optional Work

Temporary Infrastructure for Continuity of Dewatering Operations: $ _____

GST (5%): $ _____

Subtotal Optional Work: $ _____

Total Stipulated Contract Price including Optional Work: $ _____

ACCEPTANCE

.1 This fee proposal is open to acceptance for a period of sixty calendar (60) days from the closing date.

.2 Submission of this fee proposal implies acceptance of the existing conditions at the site.

.3 We understand that the lowest or any proposal will not necessarily be accepted. The RDN, in its sole discretion, reserves the right not to proceed with the Project.

.4 The Owner reserves the right to waive minor defects or irregularities in the proposal or fee.

.5 We agree to be designated as the Prime Contractor for this project per WorkSafeBC OH&S Regulations and have the necessary qualifications and are willing to accept the responsibilities as Prime Contractor for the project.

.6 We can complete the work per Item 6 Schedule of the RFP.

Company: _____

Signature: _____
(Authorized Officer)

Printed: _____
(Authorized Officer)

REGIONAL DISTRICT OF NANAIMO

Appendix B
Drawings and Sketches

REGIONAL DISTRICT OF NANAIMO

Issued For Proposal 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**

1. IT IS INTENDED THAT EROSION AND SEDIMENT CONTROL STRATEGIES BE IMPLEMENTED DURING ALL CONSTRUCTION PHASES.

2. THE EROSION CONTROL MEASURES OUTLINED HERE ARE INTENDED TO:
   - PREVENT THE GENERATION OF SUSPENDED SEDIMENT.
   - SUPPORT EROSION CONTROL MEASURES BY CAPTURING AND RETAINING SUSPENDED SEDIMENT.
   - TO LIMIT THE TRANSPORT OF SEDIMENT ONTO ROADWAYS. ALL SITE ACCESS FROM DISTURBED AREAS TO PAVED SURFACES WILL BE RESTRICTED WHERE POSSIBLE.
3. ALL PERSONS INCLUDING, BUT NOT LIMITED TO, ENGINEER, THE EROSION AND SEDIMENT CONTROL SUPERVISOR, THE GENERAL CONTRACTOR AND ALL SUB-CONTRACTORS INVOLVED WITH THE PROJECT (ALL PERSONS INVOLVED) SHALL COMPLY WITH ALL FEDERAL, PROVINCIAL AND REGIONAL DISTRICT OF NANAIMO (RDN) REGULATORY REQUIREMENTS FOR EROSION AND SEDIMENT CONTROL (ESC).

4. ALL CONTRACTOR PERSONNEL AND SUB-CONTRACTORS INVOLVED WITH THE PROJECT ARE RESPONSIBLE FOR ALL SITE ACTIVITIES THAT RESULT IN NON-COMPLIANCE WITH REGULATORY REQUIREMENTS.

5. PRIOR TO CONSTRUCTION START-UP, THE PROJECT PROPONENT OR PRIME CONTRACTOR MUST SCHEDULE AN ENVIRONMENTAL PRE-CONSTRUCTION MEETING TO DISCUSS SCHEDULING, ROLES AND RESPONSIBILITIES, AND ESC AND OTHER POLLUTION PREVENTION PRACTICES. MEETING INVITEES SHOULD INCLUDE THE OWNER, CONSULTANT, CONTRACTORS AND REGULATORS.

6. THE FOLLOWING INFORMATION MUST BE ON SITE (AND AVAILABLE UPON REQUEST), AND FILED FOR A MINIMUM OF TWO YEARS FOLLOWING FINAL SITE STABILIZATION:
   - THE EROSION AND SEDIMENT CONTROL REPORT AND/OR DRAWING(S), INCLUDING ALL AMENDMENTS.
   - DOCUMENTATION (INCLUDING PHOTOS AND UP-TO-DATE WRITTEN RECORDS) DETAILING IMPLEMENTATION, INSPECTION AND MAINTENANCE OF ESC PRACTICES.

7. REGULAR MONITORING INSPECTIONS ARE TO BE CARRIED OUT BY A QUALIFIED ESC MONITOR UNDER THE SUPERVISION OF THE ESC SUPERVISOR UNTIL PROJECT COMPLETION.

8. CONTRACTOR TO INSPECTIONS OF ALL ESC PRACTICES MUST BE COMPLETED AND DOCUMENTED AT LEAST EVERY 7 DAYS AND AT CRITICAL TIMES WHEN EROSION OR SEDIMENT RELEASES COULD OCCUR. NOTE: INSPECTIONS MUST BE COMPLETED AND DOCUMENTED DURING, OR WITHIN 24 HOURS OF, HEAVY SNOWMELT AND HEAVY AND/OR PROLONGED RAINFALL (DEFINED AS >12 MM PRECIPITATION WITHIN ANY 24 HOUR PERIOD, OR PRECIPITATION OR SNOWMELT ON WET OR THAWING SOILS).

9. AS DIRECTED BY THE ENGINEER OR ESC SUPERVISOR, PERSONS INVOLVED IN ESC MAINTENANCE ARE REQUIRED TO INSPECT AND UNDERTAKE ACTIVITIES TO MODIFY OR MAINTAIN ESC FACILITIES. THESE INCLUDE, BUT ARE NOT LIMITED TO ONSITE OR ADJACENT PAVED ROAD SURFACES, ONSITE OR ADJACENT CATCH BASIN AND FILTRATION FACILITY AND EQUIPMENT, AND ONSITE SEDIMENT FENCING.

10. THE ESC SUPERVISOR WILL BE RESPONSIBLE FOR ENSURING THAT MONITORING INSPECTIONS ARE CONDUCTED ON A REGULAR BASIS. THE ESC SUPERVISOR WILL REPORT TO THE RDN AND THE CONTRACTOR ON ESC MEASURES AND SITE DISCHARGE. ESC MONITORING AND STORM DISCHARGE FROM THE SITE TESTED WEEKLY AND AFTER HIGH RAINFALL EVENTS (>25mm IN 24 HOURS).

11. THE ESC DRAWINGS ILLUSTRATES THE MINIMUM MEASURES REQUIRED TO MEET RDN REQUIREMENTS.ALL CONTRACTOR PERSONNEL AND SUB-CONTRACTORS INVOLVED WITH THE PROJECT WILL COMPLY WITH THE ESC PLAN AND WITH ALL INSTRUCTIONS ISSUED BY THE PROJECT'S ESC SUPERVISOR, RDN, AND FISHERIES AND OCEANS CANADA TO CORRECT DEFICIENCIES THAT WOULD RESULT IN NON-COMPLIANCE.

12. THE APPROVED EROSION AND SEDIMENT CONTROL REPORT AND/OR DRAWING(S) MUST BE UPDATED WHEN THERE ARE CHANGES TO THE EROSION AND SEDIMENT CONTROL PRACTICES OR IMPLEMENTATION.

13. THE CONTRACTOR IS REQUIRED TO HAVE A COPY OF THE ESC PLAN ONSITE AT ALL TIMES AND PROVIDE CONTACT DETAILS FOR THE ESC SUPERVISOR.

14. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ALL ESC MEASURES SPECIFIED ARE INSTALLED BEFORE CONSTRUCTION BEGINS. THE ESC SUPERVISOR SHALL CONDUCT MONITORING INSPECTIONS AS REQUIRED BY THE CONTRACT.

15. THE CONTRACTOR SHALL INSTALL ADDITIONAL EROSION AND SEDIMENT CONTROL WORKS AND FACILITIES INCLUDING BUT NOT LIMITED TO WHEEL WASH, SEDIMENT COLLECTION AND TEMPORARY DISCHARGE FACILITY AT SITE ACCESS POINT AS WORK PROGRESSES AND AS REQUIRED TO SUIT CONTRACTORS WORK FLOW AND METHODOLOGY TO ACHIEVE THE INTENT OF THE CONTRACTORS EROSION AND SEDIMENT CONTROL PLAN.

16. THE INTENT OF THE PLAN IS TO DIRECT CLEAN STORMWATER RUNOFF AWAY FROM THE WORK AREAS WHILE DIRECTING RUNOFF FROM ERODIBLE AREAS AND GRAVEL SURFACES SUBJECT FOR VEHICLE TRAFFIC TO CATCH BASINS WITH SEDIMENT BARRIERS OR SILT FILTERS.

17. SEDIMENT BARRIERS AND OTHER FACILITIES INTENDED TO PREVENT SEDIMENT FROM BEING DISCHARGED TO THE STORM DRAINAGE SYSTEM OR OTHER RECEIVING WATERS ARE CONSIDERED TO BE THE LAST LINE OF DEFENSE AND SHALL BE IMPLEMENTED IN CONJUNCTION WITH OTHER MEASURES THAT CONTROL SEDIMENT, SUCH AS SWEEPING, OR EROSION PREVENTION.

18. ALL EROSION AND SEDIMENT CONTROL WORKS AND FACILITIES SHALL BE MONITORED AND MAINTAINED IN PROPER OPERATING CONDITION ON AN ON-GOING BASIS. ALL COLLECTED SEDIMENT SHALL BE REMOVED AFTER SIGNIFICANT RAIN EVENTS.

19. GEOTEXTILE SEDIMENT FENCES ARE TO BE INSTALLED ALONG DITCHES AND OPEN WATER AT THE TOP OF BANK TO REDUCE MOVEMENT OF ERODED SEDIMENT. SEDIMENT FENCE WILL BE PLACED DUG IN A MINIMUM 150mm INTO THE GROUND, TO REDUCE SEDIMENT TRANSPORTATION AND ENSURE SEDIMENT IS KEPT AWAY FROM RIPARIAN AREAS (SEE DETAIL).

20. SILT FENCE IS TO BE 'CONTROL SILT FENCE PLUS' OR EQUIVALENT AS APPROVED BY THE ENGINEER. FENCE TO HAVE MIN. CLEAR WATER FLOW RATE OF 0.10cfs/sf. FENCE TO BE STAPLED @150mm O/C TO TREATED POSTS SPACED AT 1.0m O/C. BOTTOM OF SILT Ø100mm FENCE TO BE ANCHORED AS PER DETAIL.

21. GEOTEXTILE SEDIMENT FENCES ARE TO BE INSPECTED AND REPAIRED PRIOR TO EXPECTED RAIN EVENTS AND AFTER ALL SIGNIFICANT STORM EVENTS. SEDIMENT FENCES ARE TO BE CLEARED OF SEDIMENT OR REPLACED WHEN DEFICIENCIES ARE PRESENT.

22. PAVED ROAD SURFACES WITH ACCUMULATED SEDIMENT WILL BE CLEANED / SWEPT REGULARLY AS REQUIRED. FLUSHING OF ROADWAYS IS PROHIBITED.

23. ANY TEMPORARY STOCKPILES CONTAINING ERODIBLE MATERIAL WILL BE COVERED WITH A TARPAULIN OR PLASTIC TO PREVENT EROSION (SEE STOCKPILE DETAIL). A GEOTEXTILE SEDIMENT FENCE WILL BE PLACED 1 TO 2m FROM THE DOWNSLOPE TOE OF THE STOCKPILE AND DUG IN A MINIMUM 150mm INTO THE GROUND. TO REDUCE SEDIMENT TRANSPORTATION AND ENSURE SEDIMENT IS KEPT AWAY FROM DITCHES. STOCKPILES LEFT FOR PERIODS LONGER THAN ONE MONTH, WILL BE COVERED WITH VEGETATION (I.E., HYDROSEED). NO SEDIMENT LADEN MATERIALS SHALL BE DEPOSITED OR PILED OUTSIDE OF THE PROJECT BOUNDARIES, PARTICULARLY ON ACCESS ROAD SURFACES.

24. ALL INSTALLED EROSION AND SEDIMENT CONTROL FACILITIES ARE TO BE REPAIRED AND MAINTAINED WITHIN 24-HR OF DAMAGE BEING OBSERVED.

25. INSTALL GRAVEL SITE ACCESS AS SHOWN ON THE PLAN AT START OF CONSTRUCTION.

26. ALL CATCH BASIN PROTECTION DEVICES ARE TO BE INSPECTED WEEKLY AT A MINIMUM, OR FOLLOWING SIGNIFICANT RAINFALL EVENTS, AND CLEANED-OUT OR REPAIRED AS NECESSARY WITHIN 24 HOURS. (MINIMUM CLEAN-OUT AT 40% CAPACITY)

27. AS CONSTRUCTION PROGRESSES, AND IF SITE GRADING REQUIRES TEMPORARY ELIMINATION OF DITCHES AND/OR OTHER MITIGATION MEASURES, THEY ARE TO BE IMMEDIATELY RESTORED BY THE END OF THE WORK DAY.

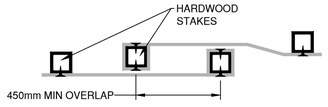
28. ALL GRAVEL PADS ARE TO BE IMMEDIATELY REPAIRED IF AFFECTED BY TRAFFIC OR CONSTRUCTION ACTIVITIES. ALL ROCK DRIVEWAY AND ACCESS PADS ARE TO BE MAINTAINED OR, IF SEDIMENT-LADEN, REPLACED.

29. ANY IRREGULARITIES SHALL BE REPORTED TO THE ENGINEER IMMEDIATELY.

30. SOLID WASTE (INCLUDING COLLECTED SEDIMENT, ASPHALT AND CONCRETE MILLINGS, FLOATING DEBRIS, PAPER, PLASTIC, FABRIC, CONSTRUCTION AND DEMOLITION DEBRIS AND OTHER WASTES) WILL BE DISPOSED OF PROPERTY AND WILL COMPLY WITH THE DISPOSAL REQUIREMENTS.

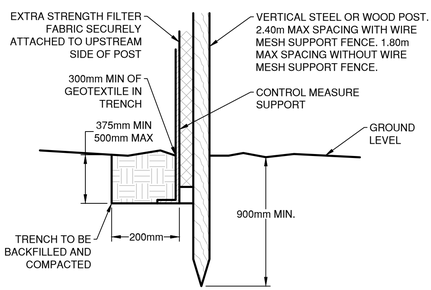
31. HAZARDOUS MATERIAL (INCLUDING OIL, GASOLINE, PAINT AND ANY HAZARDOUS SUBSTANCES) WILL BE PROPERLY STORED, INCLUDING SECONDARY CONTAINMENT, TO PREVENT SPILLS. LEAKS OR OTHER DISCHARGE. STORAGE AND DISPOSAL OF HAZARDOUS WASTE WILL BE IN COMPLIANCE WITH RDN REGULATIONS.

32. THE INTERNAL HAUL ROUTE(S) WILL BE DETERMINED BY THE EARTHWORKS CONTRACTOR AND CIRCULATED FOR REVIEW. THE HAUL ROAD WILL BE SPRAYED WITH WATER AS REQUIRED , OR AS DIRECTED BY THE ENGINEER, TO MINIMIZE DUST AND WIND EROSION.



WHEN INSTALLING SEVERAL LENGTHS OF SILT FENCE END TO END, OVERLAP THE EDGES OF THE FABRIC AT LEAST 450mm.

TOP VIEW

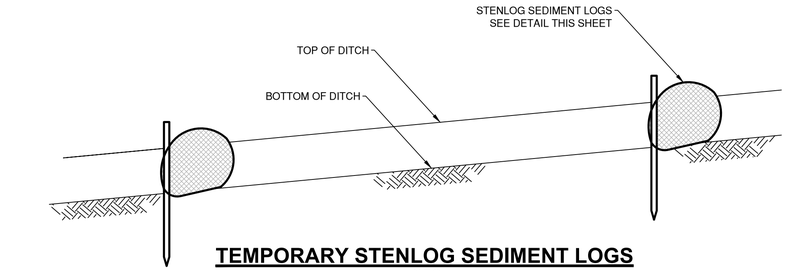


SECTION VIEW

NOTES:
1. TO ENSURE OPTIMAL PERFORMANCE, SILT FENCE TO BE INSTALLED IN AN EXCAVATED TRENCH, MIN 150mm X 150mm OR AS REQUIRED BY THE LOCAL REGULATORY AUTHORITY.
2. STAKES TO BE POUNDED IN UNTIL FABRIC REACHES BOTTOM OF THE TRENCH.
3. POSTS TO BE INSTALLED FACING DOWNHILL. RUNOFF SHOULD PUSH FABRIC AGAINST POST NOT AWAY FROM THEM.
4. THE TRENCH TO BE BACKFILLED BY A BACKHOE OR OTHER EARTH MOVING EQUIPMENT.

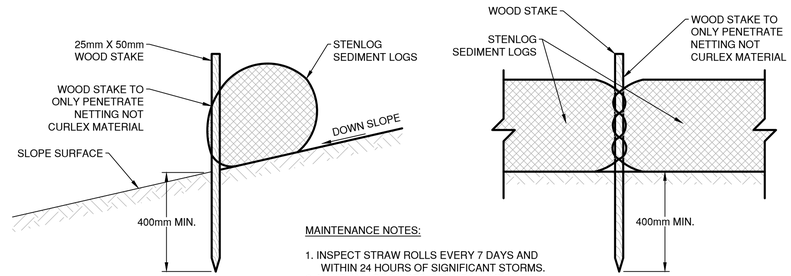
SILT FENCE INSTALLATION

N.T.S.



TEMPORARY STENLOG SEDIMENT LOGS

N.T.S.



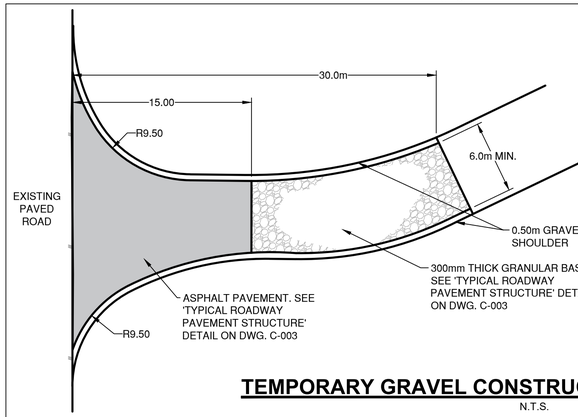
MAINTENANCE NOTES:

1. INSPECT STRAW ROLLS EVERY 7 DAYS AND WITHIN 24 HOURS OF SIGNIFICANT STORMS.
2. MAKE ANY REQUIRED REPAIRS IMMEDIATELY.
3. ENSURE CONTACT WITH UNDERLYING SOIL.

PROFILE FRONT VIEW

STRAW WATTLE DETAIL

N.T.S.

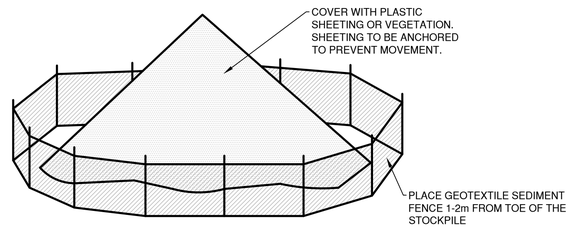


NOTES:

1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURED USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT OF WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AND APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE / EXIT

N.T.S.



GRANULAR MATERIAL STOCKPILE

N.T.S.

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

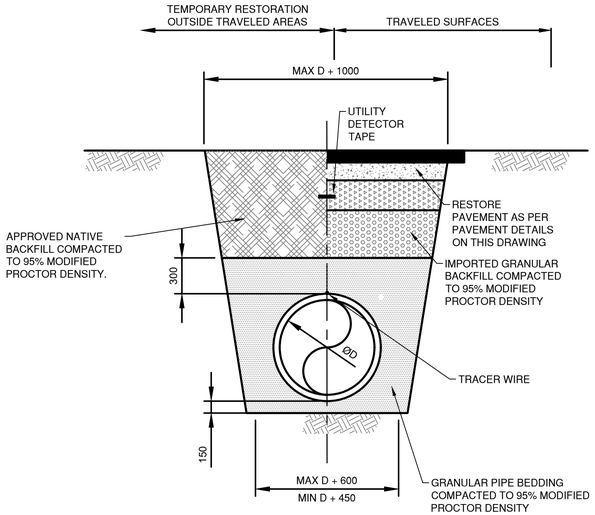
AECOM

TITLE: **EROSION AND SEDIMENT CONTROL NOTES 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-002** REV: **0**

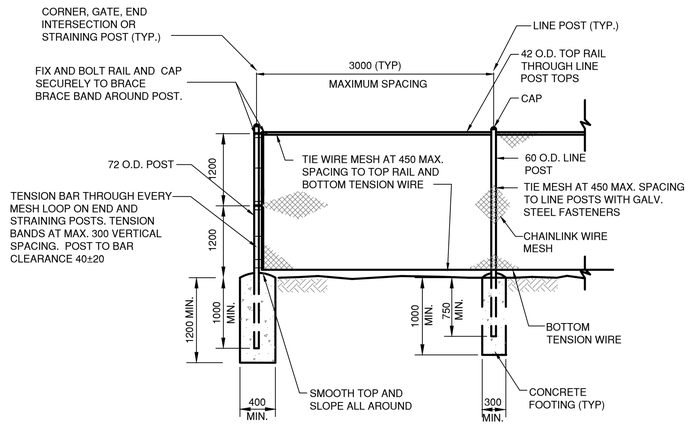


NOTE:

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

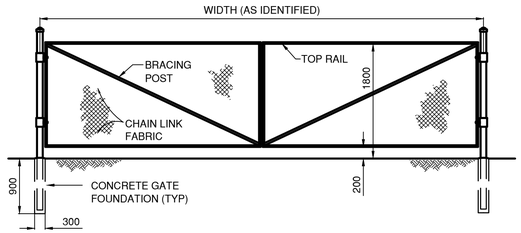
TYPICAL TRENCH DETAIL

NTS



FENCE DETAIL

NTS



SWING GATE DETAIL

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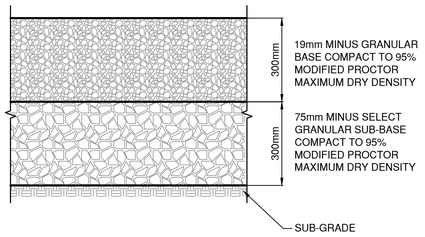
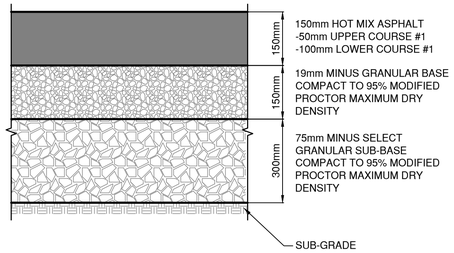


DETAIL 'A'

GRAVEL PAVEMENT SECTION

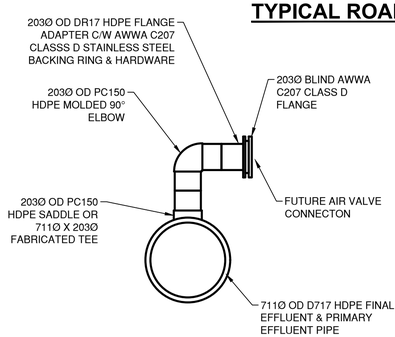


DETAIL 'B'

ASPHALT PAVEMENT SECTION

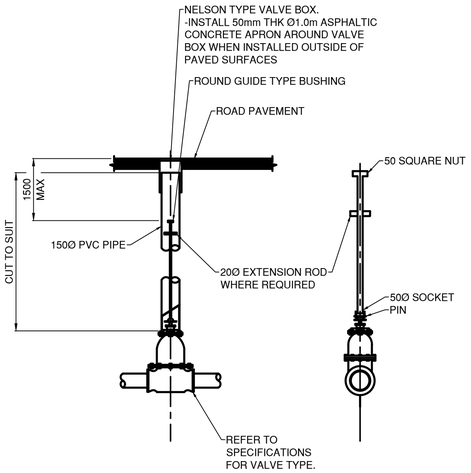
TYPICAL ROADWAY PAVEMENT STRUCTURE DETAILS

NTS



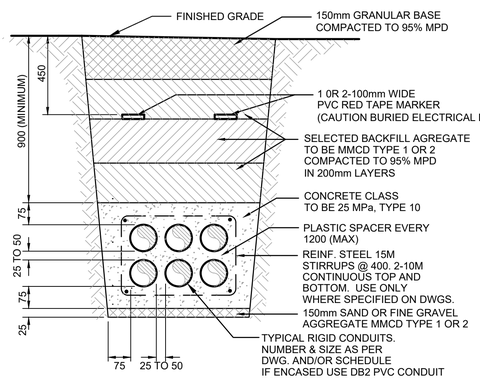
AIR VALVE PIPING DETAIL

NTS



TYPICAL VALVE INSTALLATION DETAIL

NTS

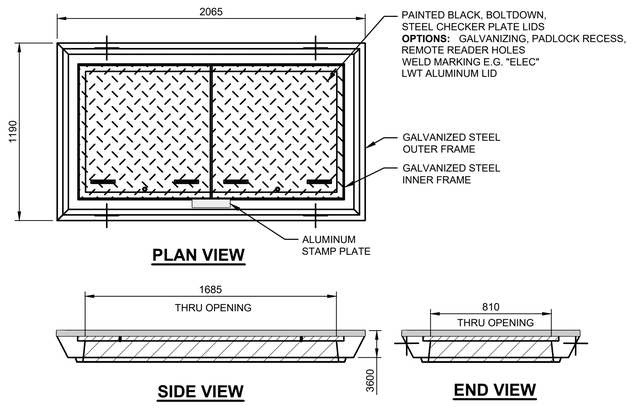


NOTES:

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

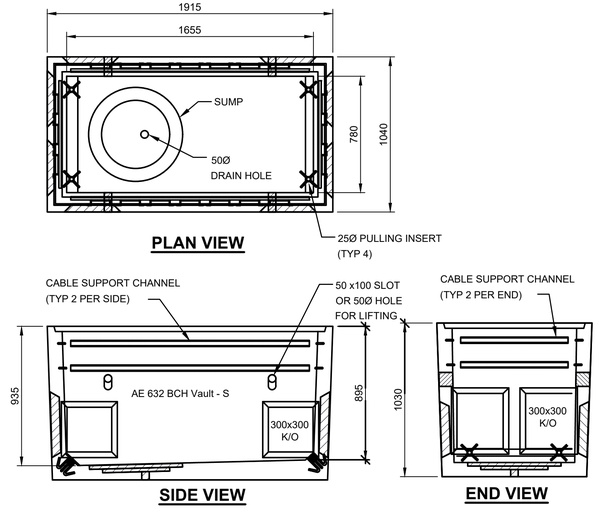
SIDE VIEW END VIEW

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

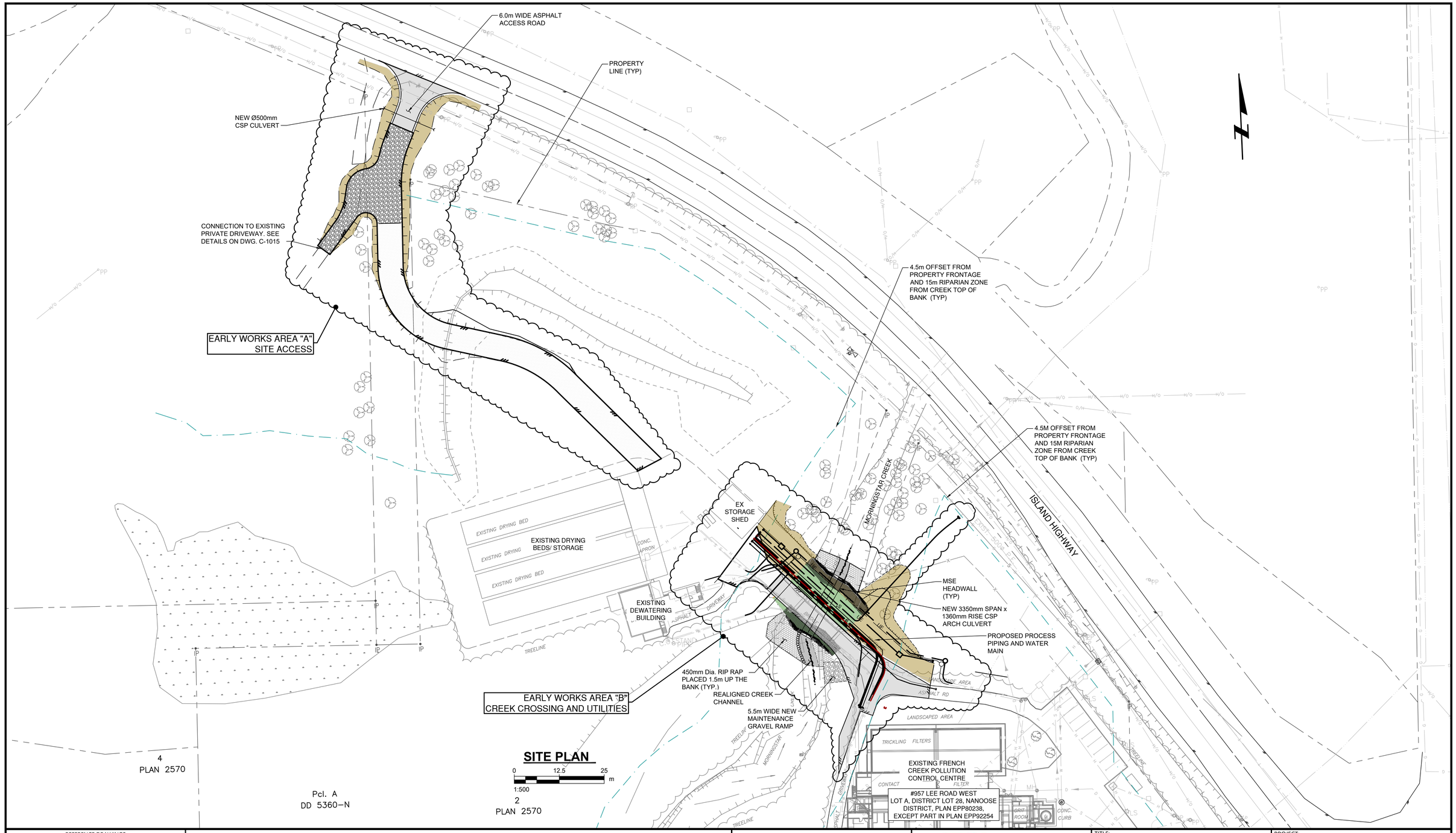
AECOM

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**



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

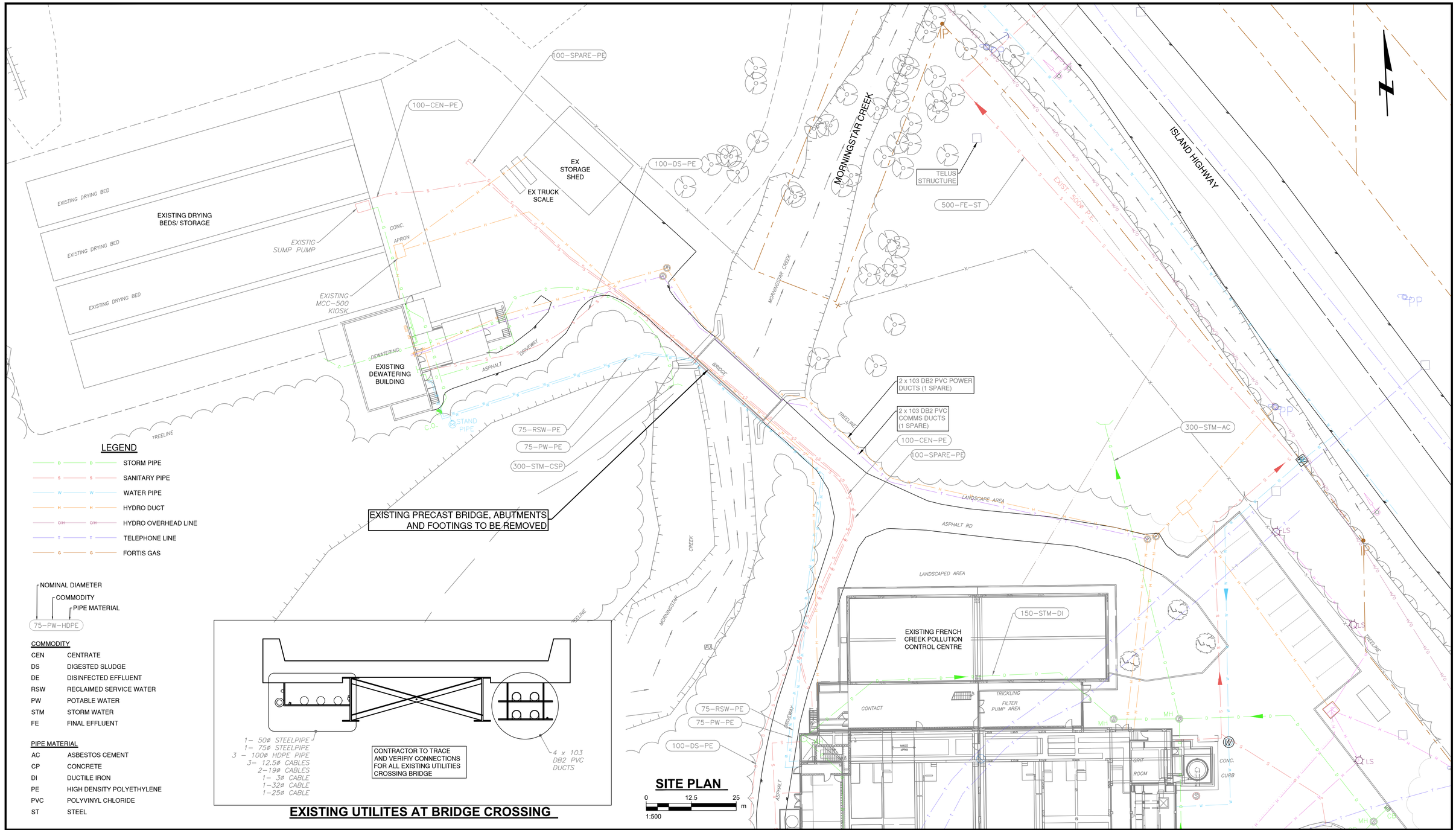
AECOM

TITLE: **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

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

NOMINAL DIAMETER – COMMODITY – PIPE MATERIAL

75–PW–HDPE

COMMODITY

CEN	CENTRATE
DS	DIGESTED SLUDGE
DE	DISINFECTED EFFLUENT
RSW	RECLAIMED SERVICE WATER
PW	POTABLE WATER
STM	STORM WATER
FE	FINAL EFFLUENT

PIPE MATERIAL

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

EXISTING UTILITES AT BRIDGE CROSSING

SITE PLAN

0 12.5 25 m

1:500

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

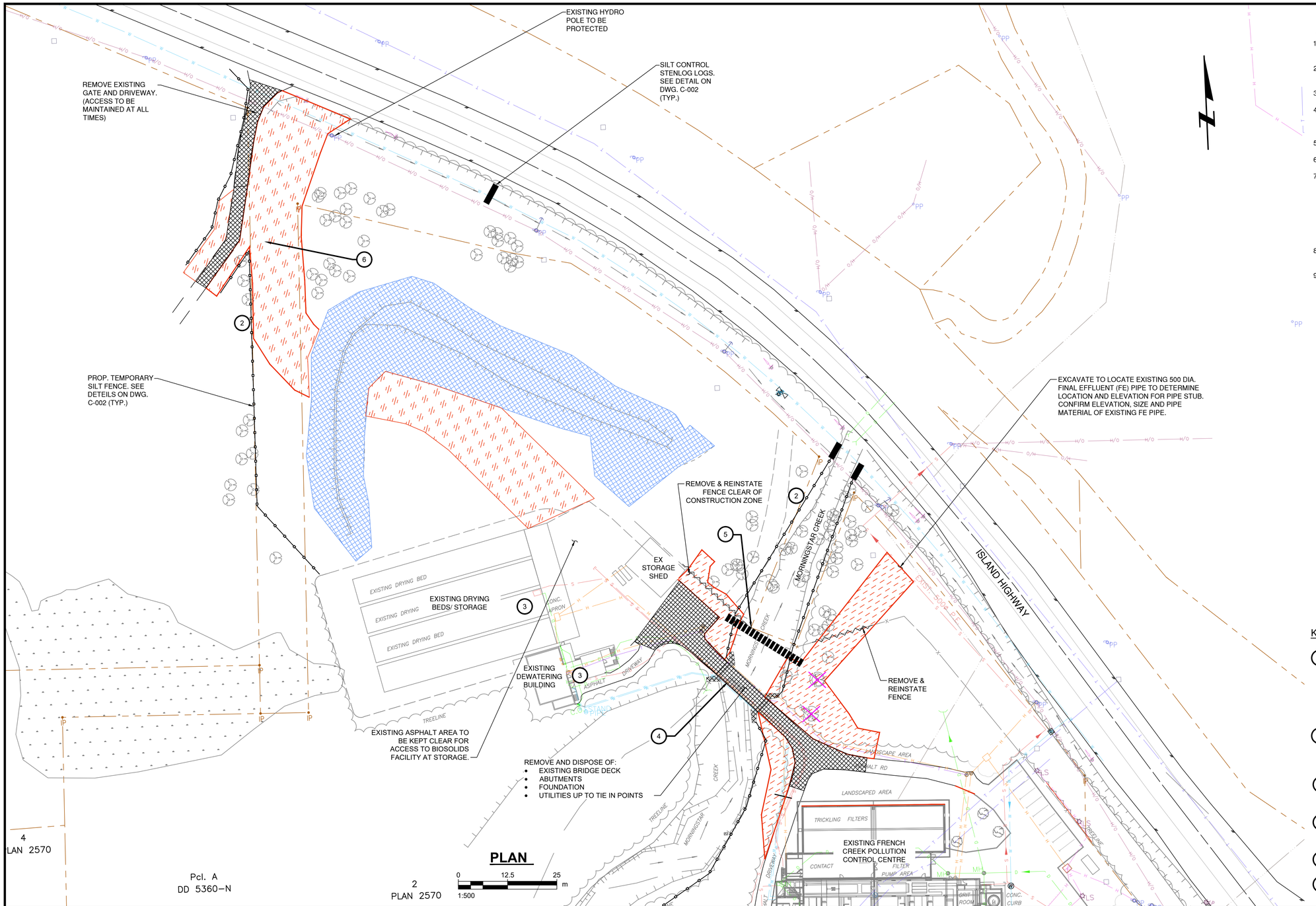
AECOM

TITLE: **EXISTING SITE UTILITIES 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-1003** REV: **0**



GENERAL NOTES

1. ALL VEGETATION CLEARING AND TREE REMOVAL ARE TO OCCUR DURING BIRD NESTING WINDOW (MARCH 15 - AUGUST 15). CONTRACTOR TO COORDINATE BIRD NESTING SURVEY WITH AECOM
2. TREES ARE TO BE REMOVED PRIOR TO ANY CONSTRUCTION WORK. CONTRACTOR IS TO HAVE A FLAGGER OR WORKER ON SITE TO ENSURE AREA IS FREE OF PEDESTRIANS PRIOR TO FALLING TREES.
3. AREA TO BE GRUBBED MUST BE CLEARED OF GRUBBING REMAINS / MATERIALS AND REMOVED AND DISPOSED OFF SITE.
4. AT NO POINT DURING SITE PREPARATION IS DEBRIS OF ANY KIND TO ENTER EXISTING DRAINAGE SYSTEM. CONTRACTOR TO SET UP SEDIMENT CONTROL AS REQUIRED PRIOR TO GRUBBING / SITE PREPARATION.
5. CONTRACTOR TO CONTACT BC HYDRO @604-6233637 Ext 4 FOR POWER POLE PROTECTION.
6. PROVIDE ACCESS AT ALL TIMES DURING CONSTRUCTION FOR OPERATING AND REMOVAL OF DEWATERED SOLIDS BIN.
7. MAXIMUM LOAD OVER THE BRIDGE TO BE THE FOLLOWING:

   2.7 TONNES -SINGLE AXLE WEIGHT
   5.4 TONNES-COMBINED TANDEM WEIGHT
   7.2 TONNES-COMBINED TRIDEM WEIGHT
   7.2 TONNES GVW FOR SINGLE-UNIT VEHICLE
   12.6 TONNES GVW FOR TWO-UNIT VEHICLE
   18 TONNES GVW FOR VEHICLE TRAIN

8. PROVIDE TEMPORARY SECURED FENCING AROUND PERIMETER OF CONSTRUCTION SITE AT ALL TIMES.
9. ALL AREAS OUTSIDE OF THE CONSTRUCTION FOOTPRINT ARE TO THE CONTRACTORS RESPONSIBILITY TO PROTECT OR RESTORE TO ORIGINAL CONDITIONS.

LEGEND:

- CLEARING AND GRUBBING AREA
- STRIP ONLY (PREVIOUSLY CLEARED AND GRUBBED)
- ASPHALT REMOVAL
- SOIL STOCKPILE FOR REMOVALS AND DISPOSAL OFF SITE
- EXISTING TREES TO REMAIN
- EXISTING TREES TO BE REMOVED
- EXISTING TREE LINE
- TEMPORARY SILT FENCE
- SILT CONTROL STENLOG LOGS

KEY NOTES

1. CONSTRUCTION ACCESS VIA LEE ROAD AT BEGINNING OF CONSTRUCTION. CONTRACTOR TO CONSTRUCT TEMPORARY SITE ACCESS VIA ISLAND HIGHWAY AT BEGINNING OF PROJECT. TEMPORARY ACCESS TO BE FINISHED AS PER CIVIL C-1005 AT COMPLETION OF CONSTRUCTION. CONSTRUCTION ACCESS VIA LEE ROAD TO BE TERMINATED UPON CONSTRUCTION OF TEMPORARY ACCESS VIA ISLAND HIGHWAY.
2. SILT FENCE IS TO BE 'CONTROL SILT FENCE PLUS' OR EQUIVALENT AS APPROVED BY THE ENGINEER. FENCE TO HAVE MIN. CLEAR WATER FLOW RATE OF 0.10cfs/sf. FENCE TO BE STAPLED @ 150mm O/C TO TREATED POSTS SPACED AT 1.0m O/C. BOTTOM OF SILT Ø100mm FENCE TO BE ANCHORED AS PER DETAIL.
3. PROVIDE ACCESS AT ALL TIMES DURING CONSTRUCTION FOR OPERATING AND REMOVAL OF DEWATERED SOLIDS BIN AND POLYMER DELIVERY.
4. OPTIONAL WORK: EXISTING UTILITIES AT BRIDGE CROSSING TO BE TEMPORARILY RELOCATED CLEAR OF EXCAVATION LIMITS AND COMMISSIONED PRIOR TO REMOVAL OF THE BRIDGE.
5. OPTIONAL WORK: DESIGN, SUPPLY AND INSTALL A TEMPORARY CROSSING FOR UTILITIES AND PEDESTRIAN ACCESS TO MAINTAIN DEWATERING OPERATIONS.
6. ENSURE ACCESS AT ALL TIMES FOR BIOSOLID TRUCKS AND RDN PRIOR TO STARTING WORK ON MORNING STAR CREEK CROSSING.

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:

REMOVALS AND SITE PREPARATION PLAN

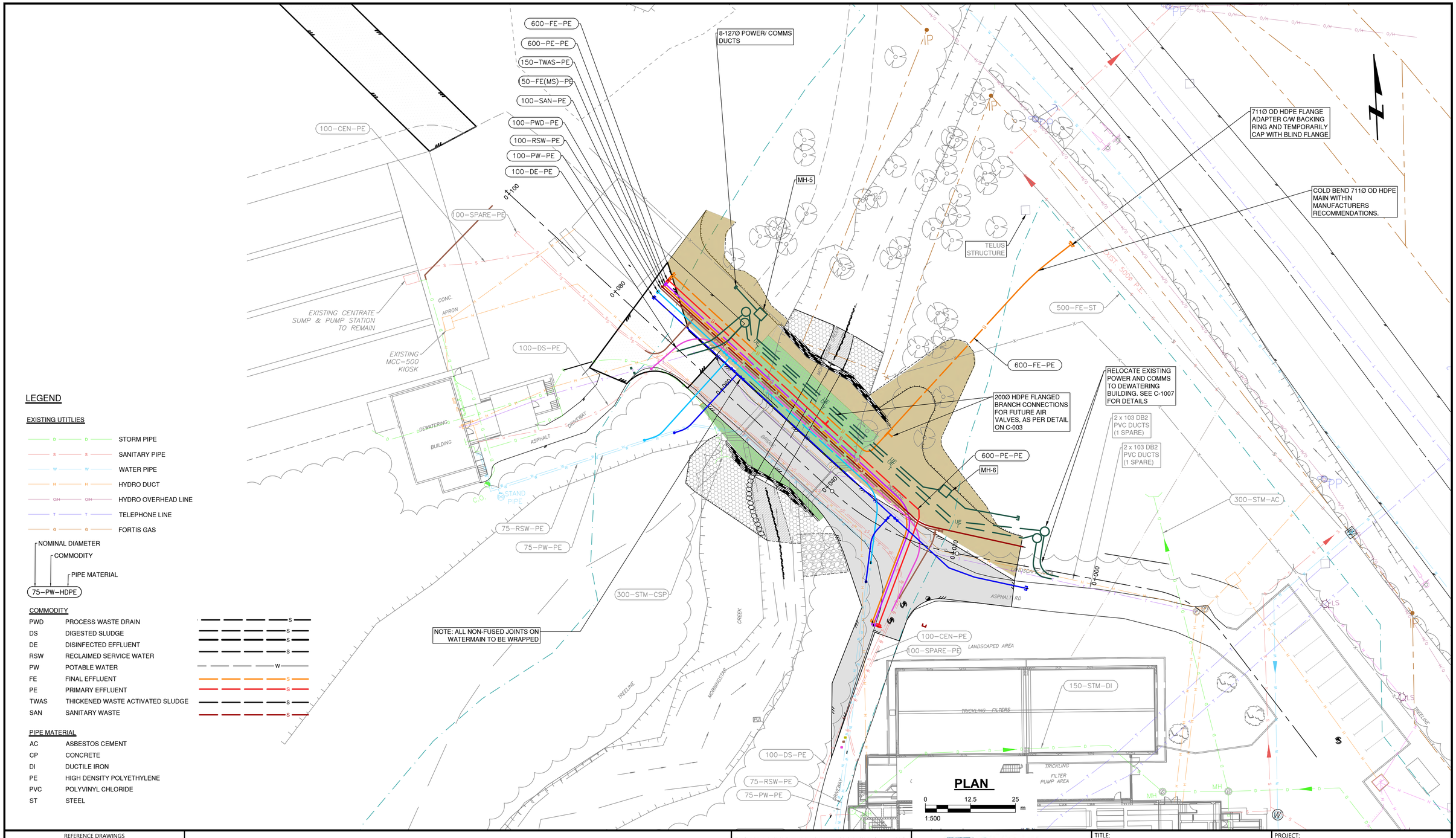
PROJECT:

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-1005

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

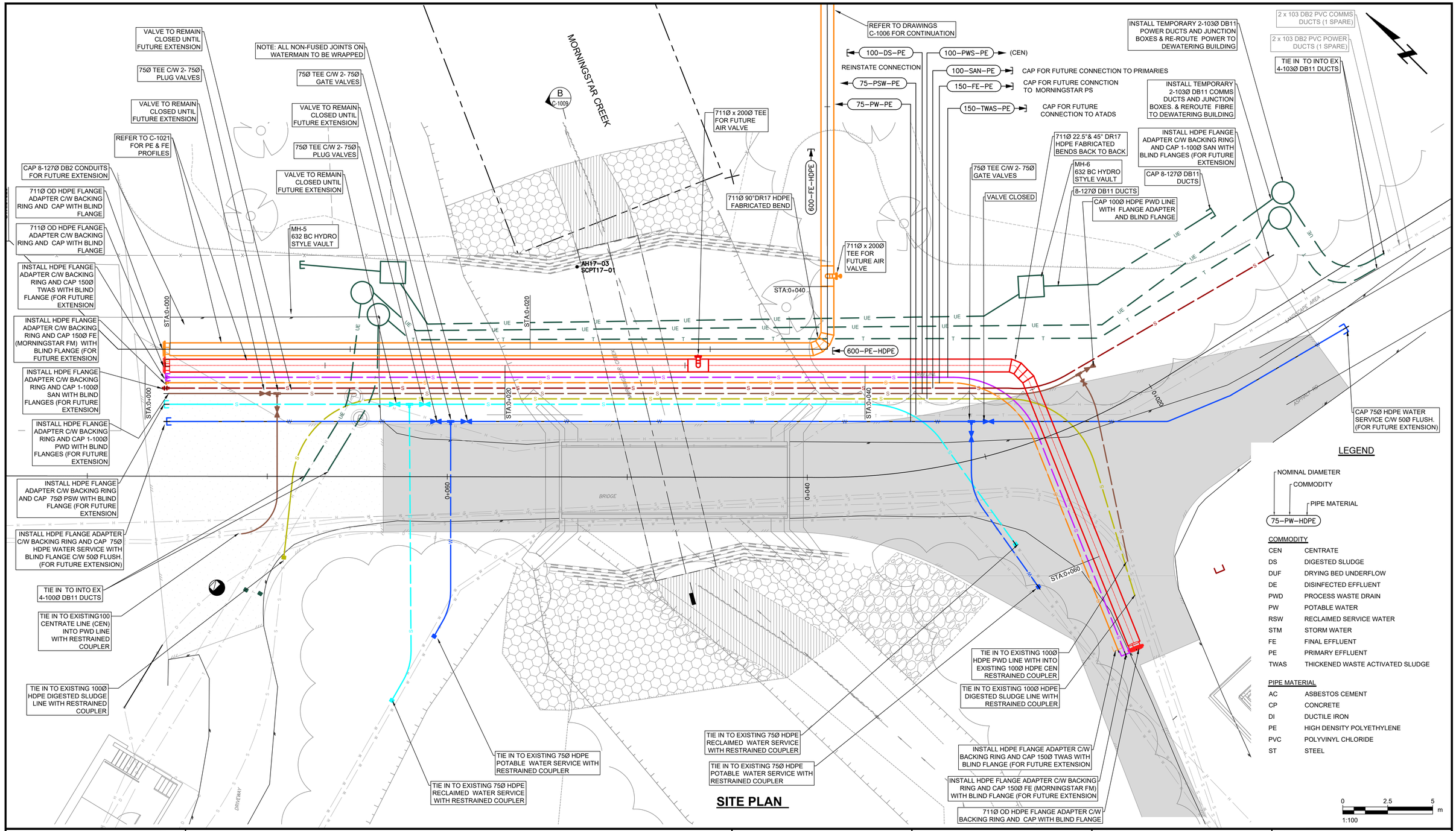
CONSULTANT
AECOM

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

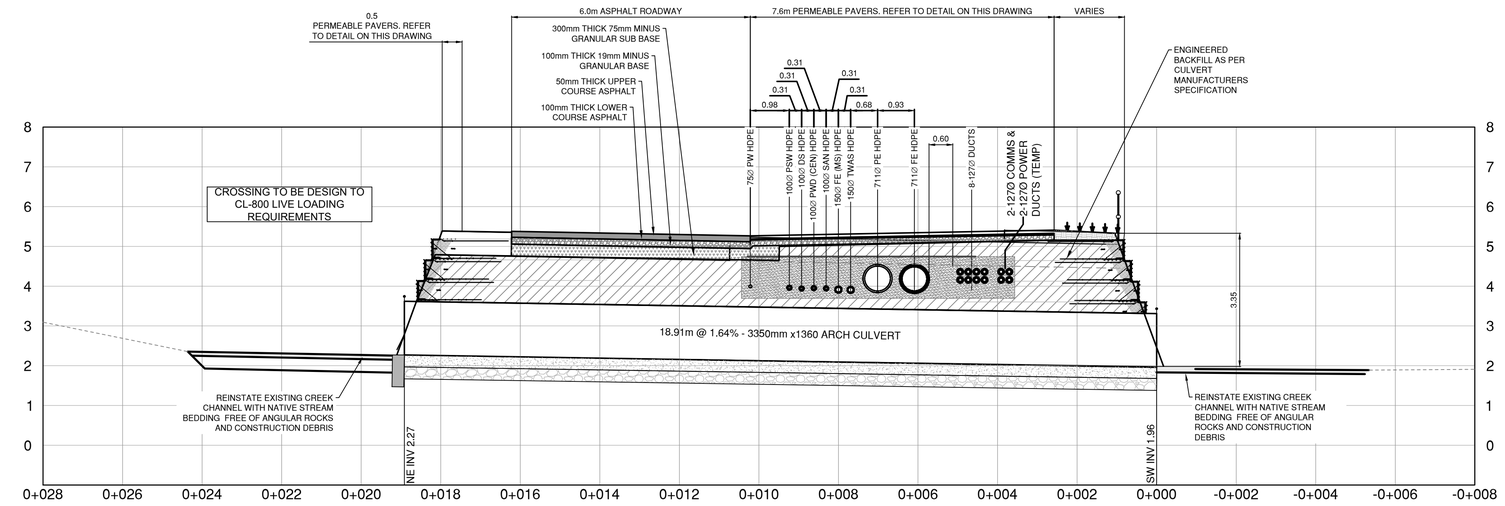
PROJECT NO:	60714632	DSGN:	MW	DATE:	-
RDN PROJECT NO:	-				
DRAWING SIZE:	ANSI "D"	CHKD:	-	DATE:	-
SCALE:	AS NOTED	APVD:	-	DATE:	-

PROJECT:

FRENCH CREEK POLLUTION CONTROL CENTRE STAGE 4 EXPANSION - EARLY WORKS

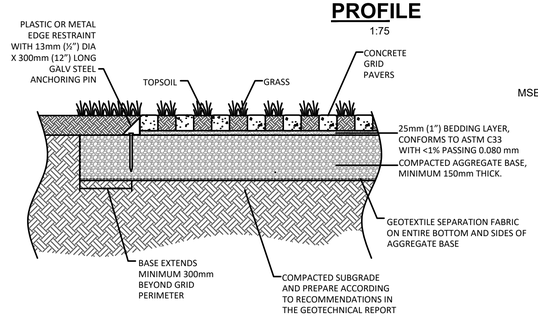
DWG NO: **FCPCC-SHT-C-1008**

REV: **P1**



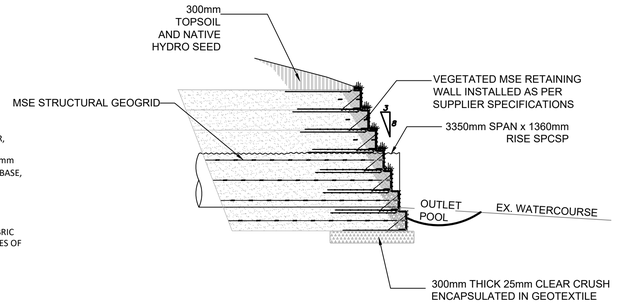
PROFILE

1:75



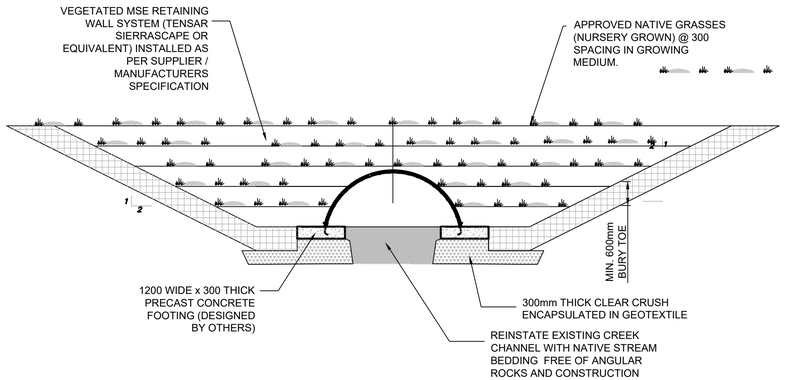
PERMEABLE PAVER DETAIL

N.T.S.



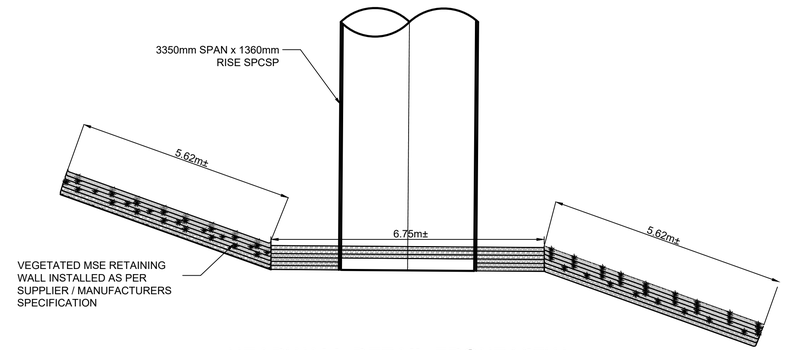
HEADWALL DETAIL-SIDE VIEW

1:75



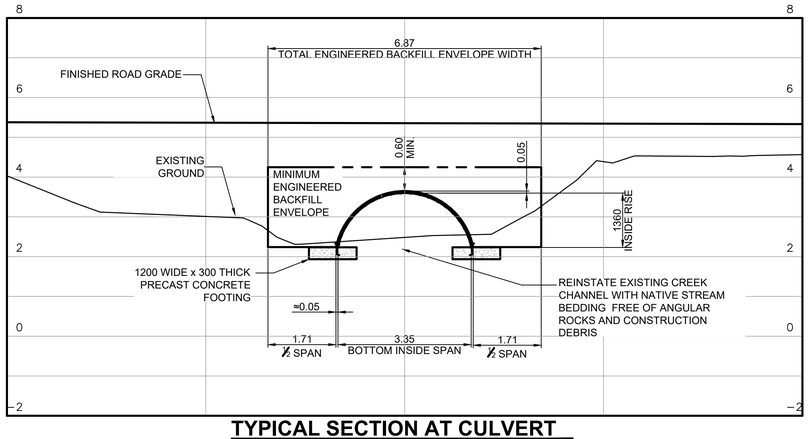
HEADWALL DETAIL-PLAN VIEW

1:75



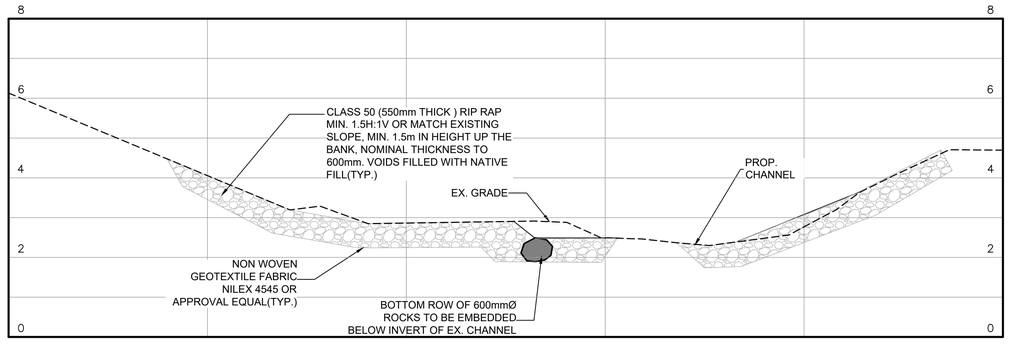
HEADWALL DETAIL-FRONT VIEW

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

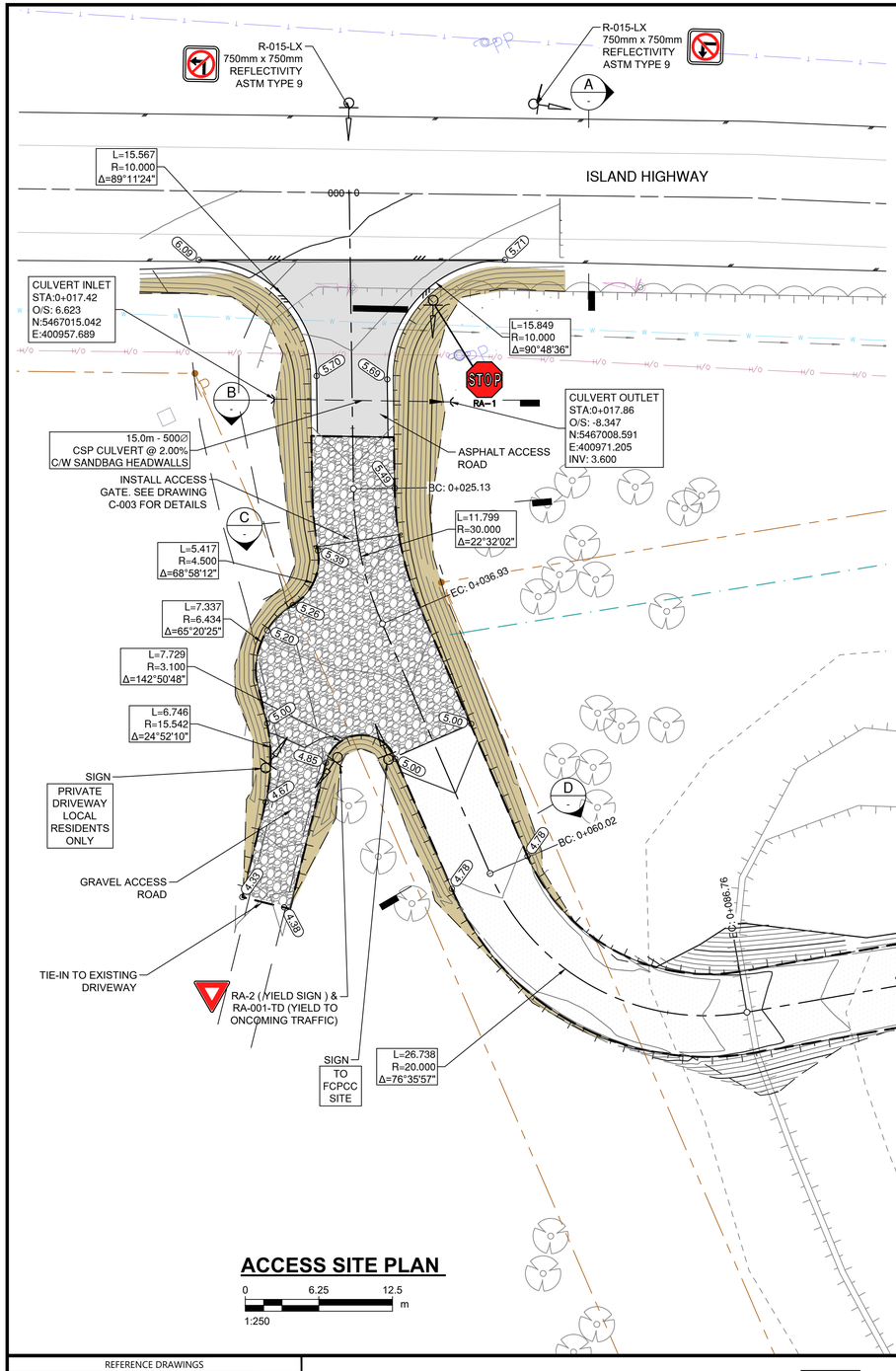
AECOM

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**



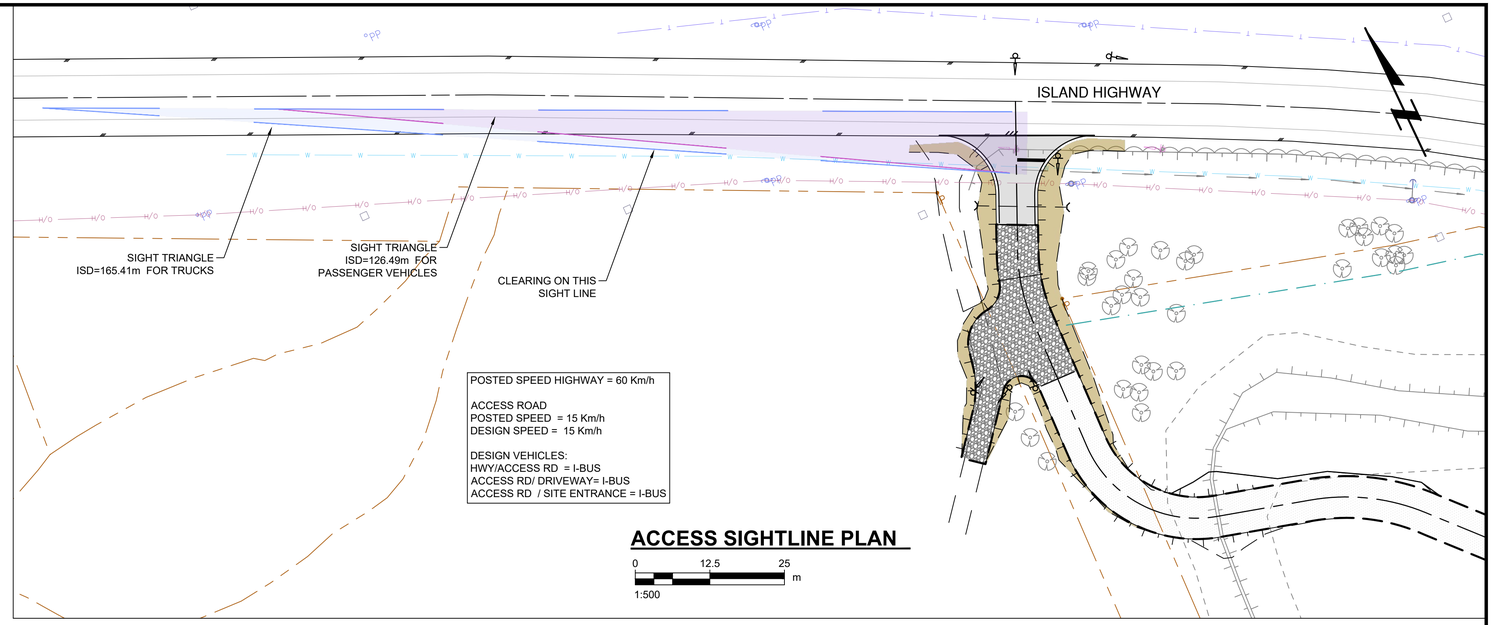
ACCESS SITE PLAN

0 6.25 12.5 m

1:250

NOTE:

1. SIGNS AND PAVEMENT MARKINGS IN ACCORDANCE WITH THE MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE MANUAL OF STANDARD TRAFFIC SIGNS AND PAVEMENT MARKINGS.



POSTED SPEED HIGHWAY = 60 Km/h

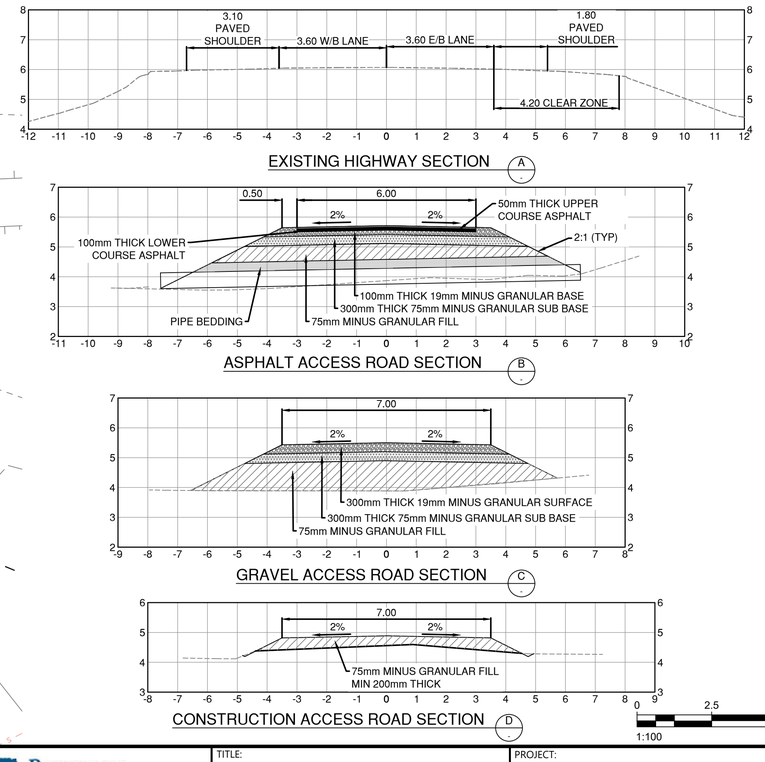
ACCESS ROAD
POSTED SPEED = 15 Km/h
DESIGN SPEED = 15 Km/h

DESIGN VEHICLES:
HWY/ACCESS RD = I-BUS
ACCESS RD/ DRIVEWAY= I-BUS
ACCESS RD / SITE ENTRANCE = I-BUS

ACCESS SIGHTLINE PLAN

0 12.5 25 m

1:500



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

150mm THICK ASPHALT ROAD SURFACE

300mm THICK GRAVEL ROAD SURFACE

GRAVEL CONSTRUCTION ROAD ROAD SURFACE, MIN 200mm THICK

HYDRO-SEED BOULEVARD AND SIDE SLOPE AREAS

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

REGIONAL DISTRICT OF NANAIMO

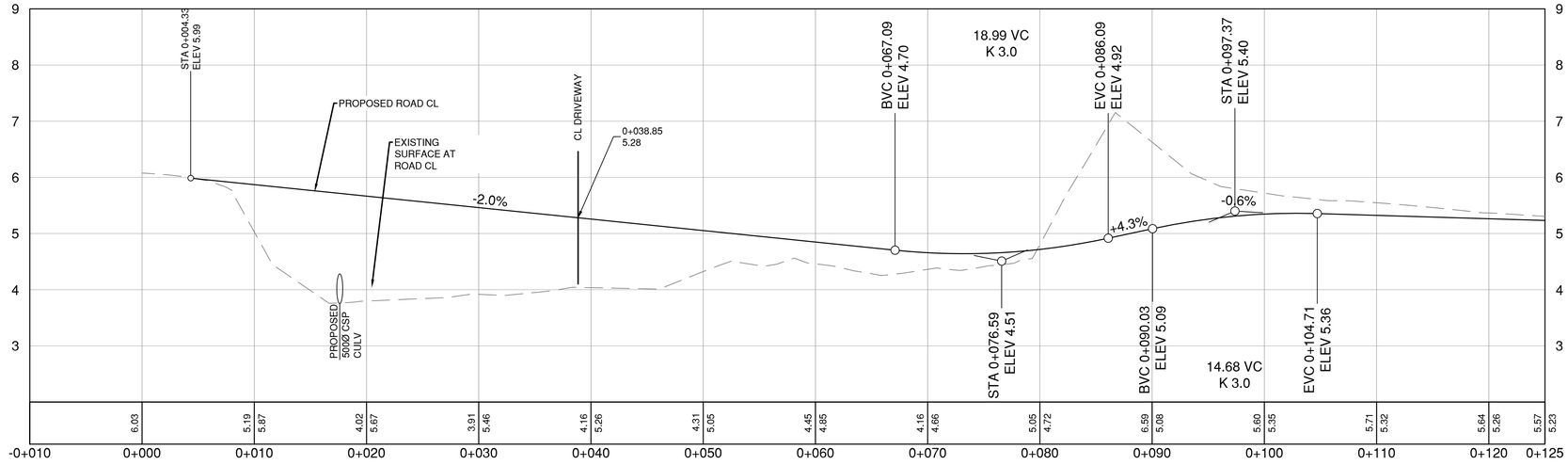
CONSULTANT

TITLE: **SITE ACCESS PLAN**

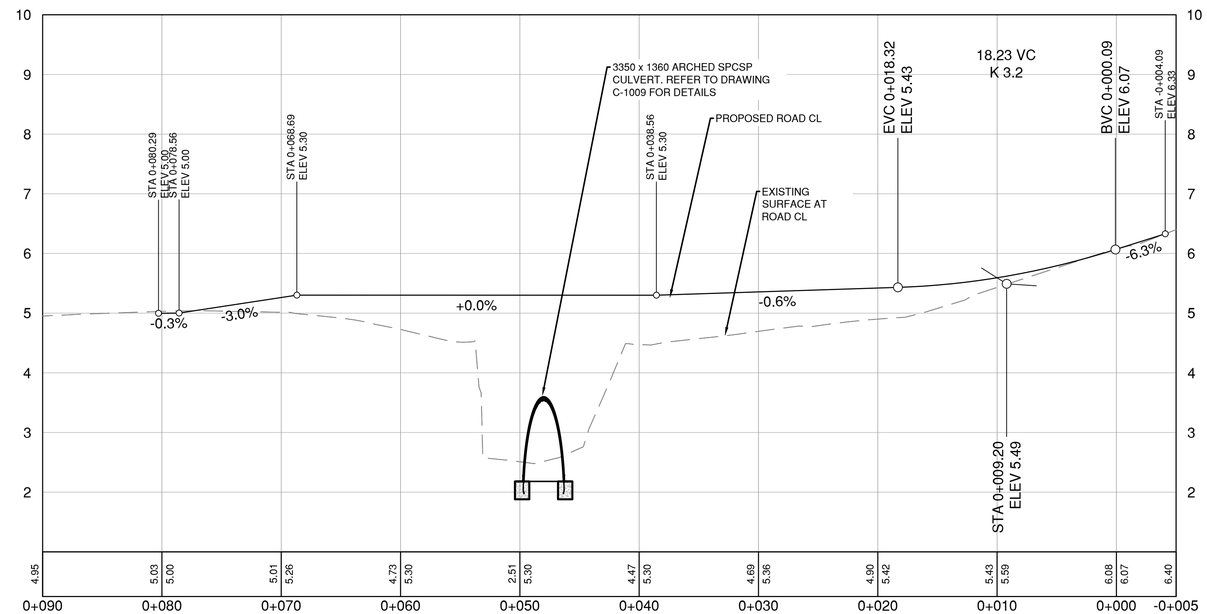
PROJECT: **FRENCH CREEK POLLUTION CONTROL CENTRE STAGE 4 EXPANSION - EARLY WORKS**

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-1015** REV: **0**



PROFILE - SITE ACCESS



PROFILE - CREEK CROSSING

0 6.25 12.5 m HORIZONTAL
1:250
0 1.25 2.5 m VERTICAL
1:50

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

TITLE:

SITE ACCESS AND CULVERT CROSSING PROFILES

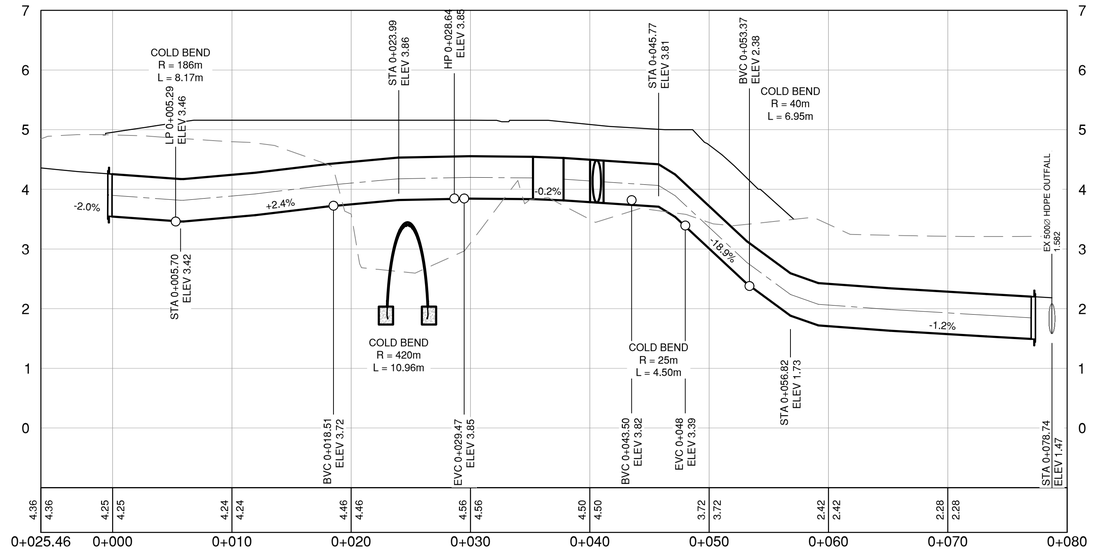
PROJECT:

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:	-

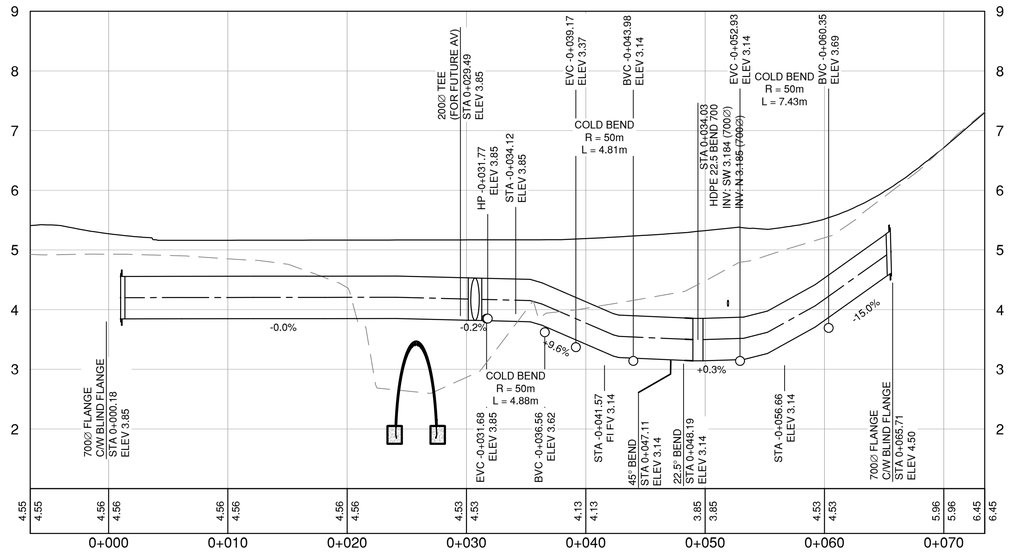
DWG NO: **FCPCC-SHT-C-1018**

REV: **0**



PROFILE - FINAL EFFLUENT (FE)

1:250



PROFILE - PRIMARY EFFLUENT (PE)

1:250

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:

PRIMARY & FINAL EFFLUENT PROFILES

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:	-

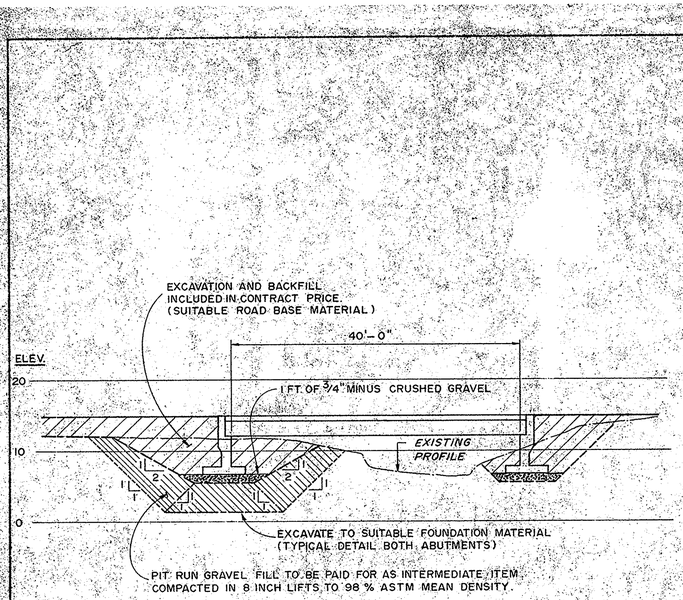
DWG NO: **FCPCC-SHT-C-1021**

REV: **P1**

REGIONAL DISTRICT OF NANAIMO

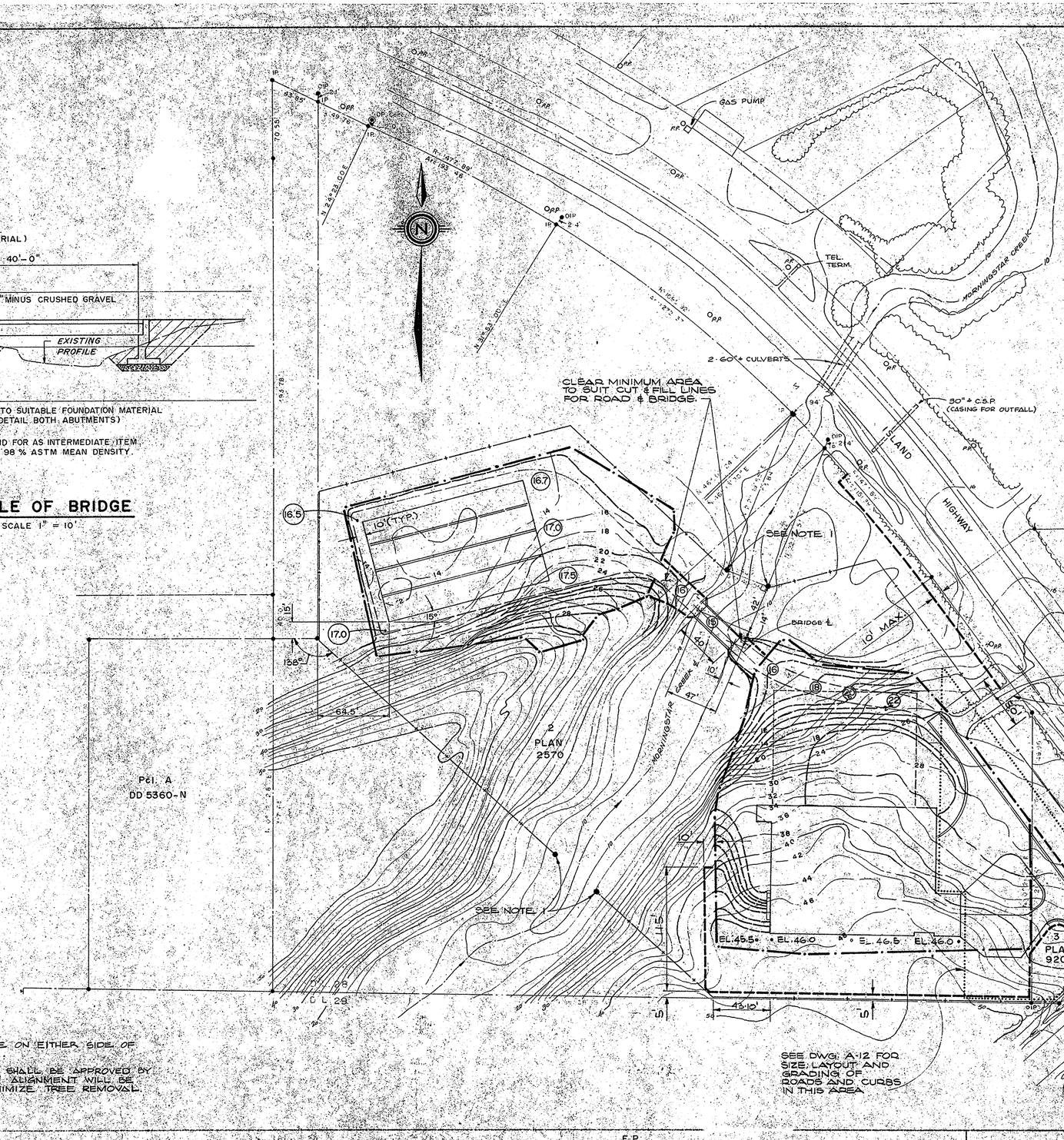
Reference Drawings

PV-INT-107



℄ PROFILE OF BRIDGE

SCALE 1" = 10'



LEGEND

- BOUNDARY OF AREAS CLEARED UNDER CONTRACT 122-42-1
- MAXIMUM LIMIT OF ADDITIONAL CLEARING
- POWER POLE, TELEPHONE POLE
- CONTOUR - GEODETIC DATUM
- DITCH
- ROAD SHOULDER
- FENCE
- CULVERTS
- WATERMAIN
- EDGE OF CLEARING
- APPROXIMATE OUTLINE OF PROPOSED CONSTRUCTION
- PROPOSED FENCE
- FINAL CONTOUR (FINISHED GRADE)
- FINAL ELEVATION
- CURBS

NOTES:

1. TERMINATE FENCE ON EITHER SIDE OF CIRCLE AS SHOWN.
2. FENCE ALIGNMENT SHALL BE APPROVED BY THE CORPORATION. ALIGNMENT WILL BE ADJUSTED TO MINIMIZE TREE REMOVAL.

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — E. A. PRATT

FC-C-1003

PV-INT-107

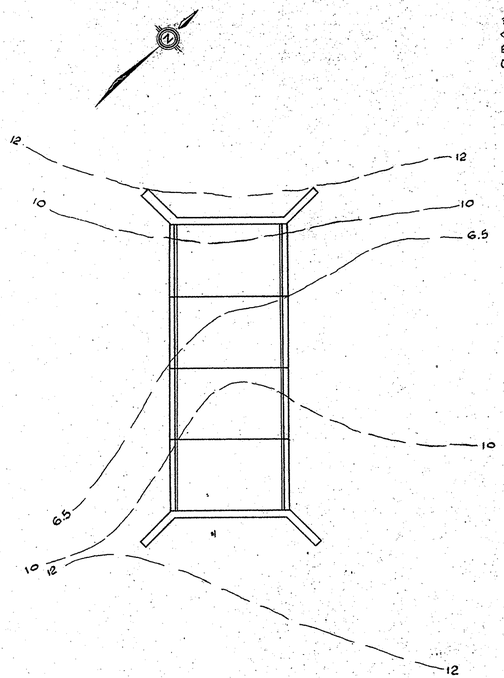
C MAY 78 I.K. BHP WH — "AS CONSTRUCTED" — E.P.
B FEB. 77 B. EAP W — construction incorporated — D.B.C.

DAYTON & KNIGHT LTD. CONSULTING ENGINEERS — Jan 7 1977

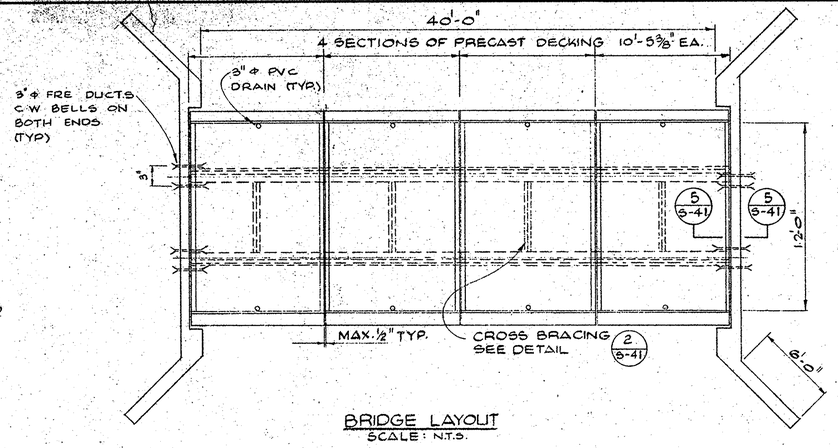
REGIONAL DISTRICT OF NANAIMO
FRENCH CREEK WATER POLLUTION CONTROL CENTRE
SITE GRADING & FENCE LAYOUT

SCALE 1" = 50'
DRAWING NO. 122-41.3
SHEET G-8 OF 17 ISSUE C

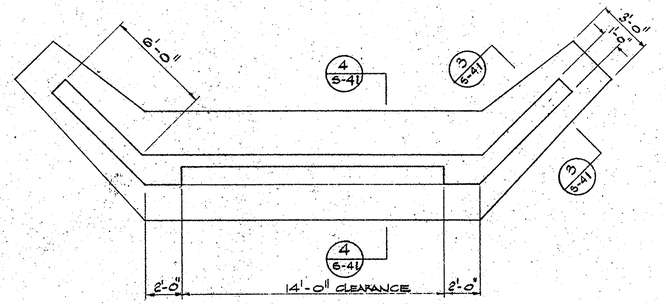
PV-INT-188



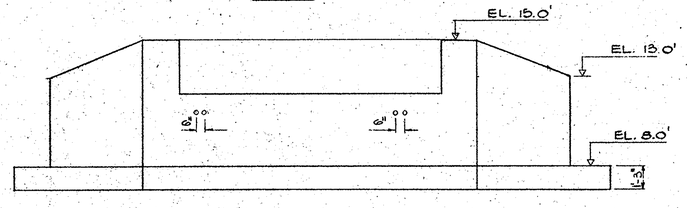
BRIDGE KEY PLAN
SCALE 1"=10.0'



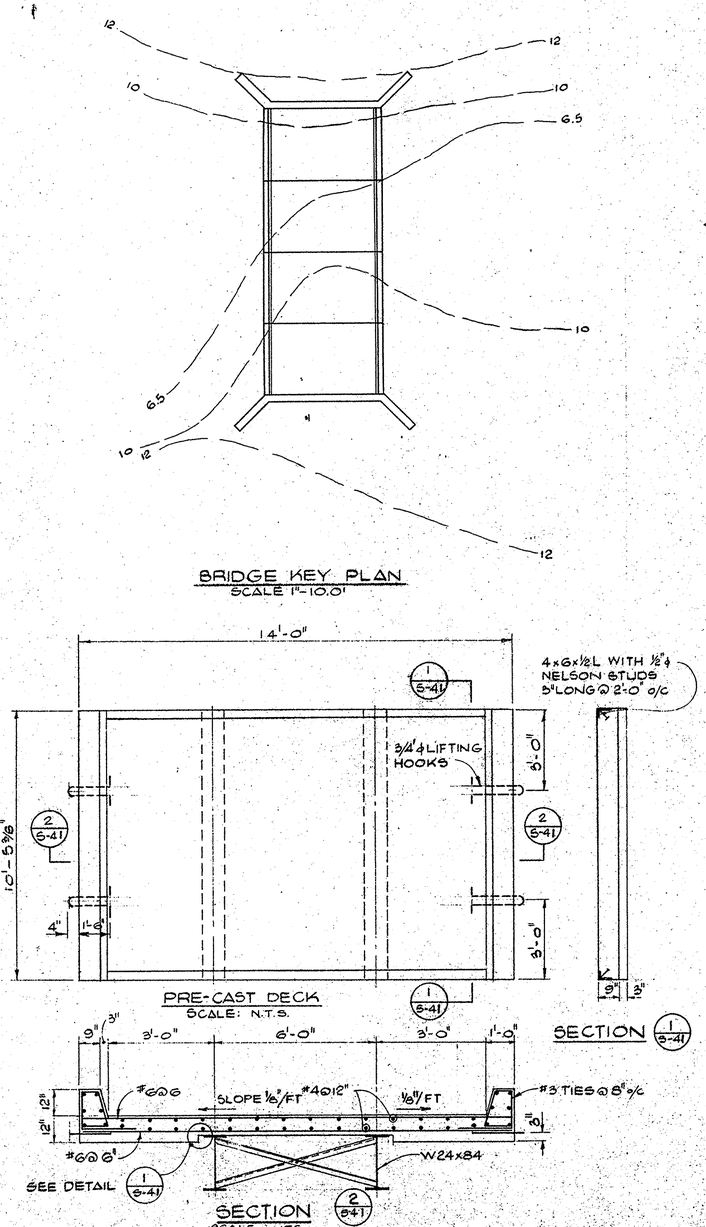
BRIDGE LAYOUT
SCALE : N.T.S.

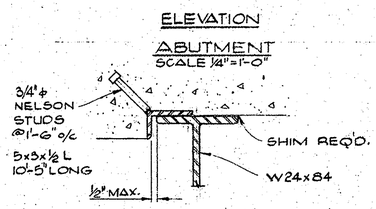


PLAN

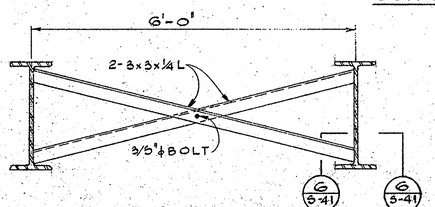


ELEVATION

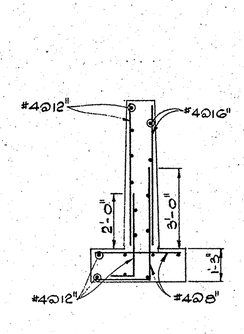




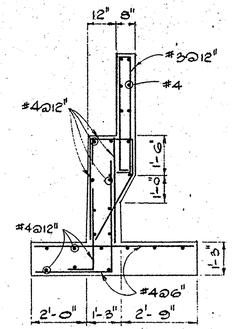
DETAIL 1 5-41
SCALE 1½"=1'-0"



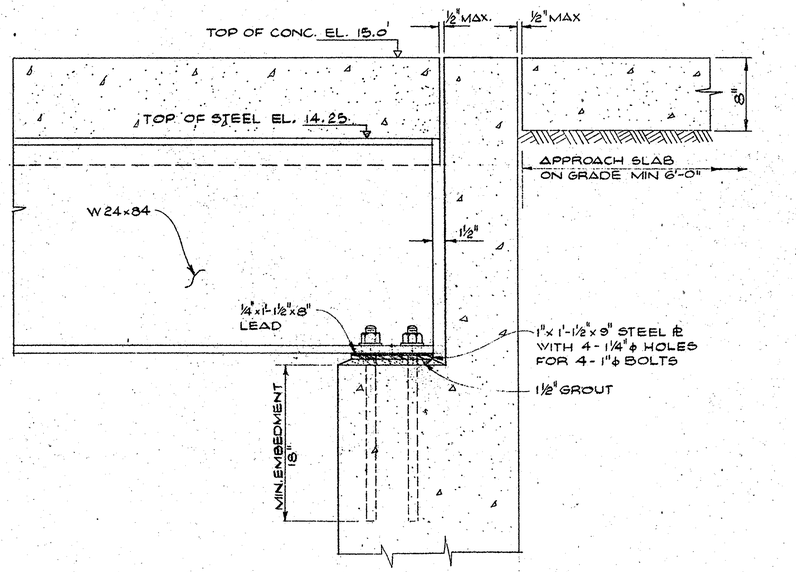
DETAIL 2 5-41
SCALE 3/4"=1'-0"



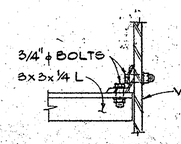
SECTION 3 5-41
SCALE 3/8"=1'-0"



SECTION 4 5-41
SCALE 3/8"=1'-0"



SECTION 5 5-41
CONNECTION BETWEEN W24x84 AND ABUTMENT
SCALE 1½"=1'-0"



SECTION 6 5-41
SCALE 1½"=1'-0"

FC-S-1006

PROFESSIONAL ENGINEER PROVINCE OF B.C. S. OKUMUS

PV-INT-188

REVISIONS	ISSUE	DATE	DR'N	CH'D	APP'D	DESCRIPTION
	C	MAY/78	I.K.	BAP	WH	"AS CONSTRUCTED"
	B	FEB.'77	ADB	BAP	W	Issued for Construction incorporating Addendum # 1 & 2.
	A	DEC.'76				

DESIGNED S. OKUMUS
DRAWN T.T. FORGACH
CHECKED

DAYTON & KNIGHT LTD.
CONSULTING ENGINEERS
Jan 7 1977

REGIONAL DISTRICT OF NANAIMO
FRENCH CREEK WATER POLLUTION CONTROL CENTRE
BRIDGE-LAYOUT & DETAILS-REINF.

SCALE: AS SHOWN
DRAWING No. 122·41·5
SHEET 5-41 OF 44 ISSUE C

REGIONAL DISTRICT OF NANAIMO

Appendix C
Specifications

Division 1

01010 Summary of Work
01015 Work Sequences and Tie-Ins
01050 Field Engineering
01055 Site Conditions
01070 Special Project Requirements
01200 Project Meetings
01280 Measurement and Payment
01550 Traffic Control, Vehicle Access and Parking
01561 Environmental Protection
01600 Products and Workmanship
01770 Closeout

Division 2

02225 Sitework Demolition and Removal
02226 Removal of Existing Asphalt Pavement
02231 Clearing and Grubbing
02311 Site Grading
02315 Excavating Trenching and Backfilling
02401 Dewatering
02510 Yard Piping
02701 Aggregates and Fill Materials
02721 Granular Base
02723 Granular Sub-Base
02741 Hot Mix Asphalt Concrete
02821 Chain Link Fences and Gates
02922 Hydraulic Seeding

Division 16

16105 Duct Banks and Manholes
16125 Communication Cables
16126 Cables and Hardware to 1000V

SUMMARY OF WORK

1. GENERAL

1.1 Description of Work

.1 The work to be performed under this Contract shall include the labour, equipment, and materials required to complete the construction of the French Creek Control Pollution Centre (FCPCC) Stage 4 Expansion – Early works, as specified in the Contract Documents.

.2 The Work includes, but is not limited to the following elements:

.1 Siteworks including upgrades to the Morningstar Creek crossing, excavating, backfilling, grading, drainage, asphalt paving, fencing, site dewatering and landscaping.

.2 Roadworks including new site access from the Island Highway with vehicle gate, signage, gravel roadway and asphalt paving.

.3 Site utilities including drainage culverts, sanitary sewers, water, reclaimed service water system and underground electrical.

.4 Yard process mechanical piping at the Morningstar creek crossing, tested and capped for future extension.

1.2 Coordination

.1 Cooperate and liaise with other contractors, utility agencies, the Owner's employees or their appointed representatives in order to make appropriate working arrangements to ensure satisfactory execution and timely completion of the work. The Contractor will not have exclusive rights to the construction area.

.2 Attend coordination meetings, as directed by the Engineer, when the Engineer considers that they are necessary for ensuring the sufficiency of the liaison and co-operation with other contractors. The Contractor shall be deemed to have allowed in his Price for any interference to his operations which may result from any of the above. He must also take all precautions necessary to ensure that he does not hinder or delay in any way the progress of these other parties or cause damage to their completed work.

1.3 Sequence of Work

.1 Every effort shall be made in the scheduling of the work to ensure that plant operations are disrupted as little as possible. With this in mind, a specified sequence of work is proposed.

.2 Refer to Section 01015 – Work Sequences and Tie-ins.

1.4 Contractor Use of Premises

.1 Generally restrict operations to the construction and laydown areas as indicated on the drawings or directed by the Engineer.

.2 The Owner will make reasonable efforts to accommodate the work of the Contractor. However, the FCPCC must remain in operation throughout the Construction Period. Refer to Section 01070 for special requirements when work has to be completed in occupied areas of the plant.

.3 Ascertain and abide by conditions pertaining to use of temporary working easements or rights-of-way.

.4 Obtain and pay for use of additional storage, access or work areas needed for work under this Contract.

1.5 Completion Dates

.1 The completion dates for the project are noted in Section 00300. These dates will establish the Time Limits for the Contract.

.2 Time and all time limits stated in the Contract Documents are of the essence of the Contract. The Contractor shall perform his work expeditiously and with adequate forces to achieve the completion dates.

2. PRODUCTS

Not Applicable.

3. EXECUTION

Not Applicable.

END OF SECTION

WORK SEQUENCES AND TIE-INS

1. GENERAL

1.1 Continuity of Plant Operations

.1 The existing French Creek Pollution Control Centre continuously receives and treats wastewater. Do not interrupt functions except as specified herein. Coordinate the Work to avoid any interference with normal operation of plant staff, equipment and processes.

.2 Entire plant shutdowns will not be permitted.

.3 In the event of accidental bypassing of untreated or partially treated sewage to the outfall, surface waters or drainage courses is caused by the Contractor's operations, the Owner may employ others or use its own forces to stop the bypassing and recover the costs from the Contractor.

.4 Pay all penalties and costs including legal fees and other expenses imposed on the Owner as a result of any bypass to the outfall, surface waters or drainage courses caused by or resulting from the actions of the Contractor, its employees, or subcontractors.

.5 The work sequences and tie-in procedures specified in this Section enable the Contractor to perform construction activities concurrently with Owner activities required to maintain plant operations to meet applicable effluent requirements. The Contractor may propose alternative work sequences, tie-in plans or procedures that maintain normal plant operations for review by the Engineer.

.6 Ensure that access is maintained for all operation and maintenance requirements of the existing plant at all times, housekeeping is maintained at the highest possible level to minimize interference, security requirements are fulfilled, and the existing facilities are maintained in weather-tight conditions.

.7 Complete all tie-ins to existing facilities in the shortest practical time frame and within the time limits specified in this Section to minimize interferences and prevent effluent bypassing. Scheduling must reflect that priority.

.8 Maintain sludge dewatering or notify the plant of shutdowns and obtain approval from the Engineer. **Dewatering shutdowns must not last longer than 2 days over a 5-day period.**

.9 Plan, schedule and coordinate all work in operating plant areas to minimize interferences. Conduct work by area while maintaining access for Owner operations.

1.2 Shutdown and Tie-In Plan

.1 Prepare a detailed plan for any shutdown, tie-in, or construction activity which will potentially affect existing plant operations, describing temporary provisions, the length of time required to complete, and the necessary personnel and equipment which the Contractor will provide in order to prevent bypassing of associated treatment units.

.2 Prepare and submit the shutdown or tie-in plan to the Engineer a minimum of two weeks prior to conducting a scheduled shutdown or tie-in. Allow for review by the Engineer, followed by a meeting to be held between the Engineer, Owner operations personnel, and

the Contractor to discuss activities and responsibilities relating to the shutdown or tie-in and potential limitations and requirements not addressed in the plan. Refer to Section 01070 for the requirements associated with receiving a Work Permit that allows the work to proceed.

1.3 General Requirements

.1 Existing systems or individual equipment items will be isolated, dewatered, de-commissioned, de-energized and de-pressurized by the Owner where such isolation, dewatering, de-commissioning, de-energizing and de-pressurizing can be done with existing valves and circuit breakers. Where such isolation, dewatering, de-commissioning, de-energizing and de-pressurizing requires disassembly, such work to be done by the Contractor including any associated clean-up. Perform all such work in accordance with the shutdown plan submitted by the Contractor and reviewed by the Engineer.

.2 Provide all necessary temporary pumps, blinds, piping, electrical wiring, controls, and labour during and subsequent to all activities as required. Pumps and upstream water levels to be continuously monitored by the Contractor to make all provisions necessary to prevent process upsets, flooding, and bypassing during all diversion pumping operations.

.3 Some shutdowns may have to take place during other than normal working hours (i.e. night-time and/or weekends) in order to comply with plant shutdown limitations as described in this Section.

1.4 Work Plans and Schedule

.1 Provide detailed plans and schedules for all work activities which will create a disruption to or require the participation of Owner Operations. Such activities will include shutdowns, tie-ins, or any work disrupting existing access, services, utilities or normal operations procedures. Submit two copies of detailed plans and schedules in accordance with Section 01070, no later than two weeks prior to the scheduled activity. No shutdowns, tie-ins, outages or disruptive work activities will be allowed without approval by the Engineer of the appropriate plan and schedule. Coordinate the shutdown, tie-in or disruptive work with the construction schedule as provided by the Contractor. Identify each shutdown, tie-in, or disruptive work activity in the construction schedule.

1.5 Work Sequence and Tie-In – General

.1 Written request to the Engineer is required for any equipment shutdown under any circumstances, including but not limited to the interruption of power supplies, control systems, or water, air, or lubricant supply. Approved shutdowns may be limited in duration so as to not impact the treatment operations.

.2 The Owner's ability to accommodate shutdowns as described above is dependant upon several factors, including but not limited to plant operating status, equipment availability, influent flow rates and loading, manpower availability, timing (i.e. weekdays versus weekends and holidays, and day versus night), and other circumstances beyond the direct control of the Owner. While the Owner will make every effort to cooperate and accommodate shutdowns within the limitations expressed herein, the Contractor shall not rely on plant shutdowns being immediately available or occurring precisely as planned in every instance.

.3 Provide adequate protective coverings and take other measures as appropriate to prevent dropping concrete or other debris into the process flow or equipment during demolition and construction. In the event that foreign materials are inadvertently introduced into the process streams, advise the Engineer and operations staff immediately so that appropriate action can be taken to prevent damage to operating equipment. Where possible, the relevant equipment will be shut down and drained by the Owner, and the Contractor will take the necessary action to retrieve the foreign materials. The Contractor shall be liable to the Owner for all damage to operating equipment and for all related costs incurred by the Owner (shutdown, drainage, inspection, establishment and implementation of remedial measures, etc.) as a result of the introduction of debris into the process stream(s) during the course of the work.

.4 Owner Occupancy of Existing Facilities: Provide all protective measures and temporary utilities as required to support operations personnel access to and occupancy of the existing buildings and other areas as required to operate and maintain existing equipment.

.5 In all instances, temporary power and control equipment required to commission any equipment or systems in accordance with contract completion dates, but in advance of permanent power and control equipment or services being available, will be provided by the Contractor. Purchase and install all such temporary power and control equipment and related devices in accordance with the requirements of the relevant contract specification. Provide all necessary labour, equipment and services required to convert the above systems or equipment to permanent control. Upon removal, all temporary power and control equipment supplied by the Contractor shall be dismantled, tagged and packaged as spares (where applicable) and become the property of and be turned over to the Owner.

.6 Electrical and Instrumentation tie-ins to existing facilities: Coordinate electrical connections and instrumentation connections and perform both in the same shutdown so as to minimize the overall number of equipment shutdowns. Combined power and instrument connection shutdowns must occur one at a time and each must be a maximum of 4 hours duration unless noted otherwise. Total plant shutdowns will not be permitted unless approved by the Owner and a contingency plan put in place. Supply and install temporary lighting for building interiors that will not have permanent lighting. Determine specific services affected and minimize impacts.

.7 Allow a maximum of 4 hours for piping tie-ins unless specifically noted otherwise. Allow a maximum of 2 hours for capping off existing piping. Coordinate all work with the Engineer and Owner. Minimize the duration that any equipment is out of service by pre-installation of as much piping as possible. Provide bypass piping and pumping as required to complete the Work.

.8 Construction Work Areas, as identified on the Plans define the general area of the Work only and are not to be interpreted as limits of the Contract. Work outside the Construction Zones is subject to interference from and Owner Operations.

1.6 Suggested Work Sequence and Tie-In Plan

.1 Construction means and methods are ultimately the responsibility of the Contractor. However, a suggested construction sequence and tie-in plan has been developed to minimize the interruption in the Plant operations.

.2 The Contractor is responsible for the work sequence and tie-ins and all costs associated with undertaking the Work.

.3 Submit a construction sequence plan two (2) weeks in advance of the scheduled work for approval. No work shall commence without the Engineer's approval.

.4 The following information is intended to assist the Contractor in formulating a tie-in plan and construction and commissioning plan for the Work.

.5 **Site Access Road and Morningstar Creek Crossing**

.1 Construct new site access road from the Island Highway.

.2 Construct the new Morningstar Creek Crossing culvert and all buried utilities.

2. PRODUCTS

Not Applicable.

3. EXECUTION

Not Applicable.

END OF SECTION

FIELD ENGINEERING

1. GENERAL

1.1 Requirements Included

.1 Field engineering survey services to be provided by the Contractor, to measure and stake the site, verify existing conditions, to lay out the Work for construction, obtain as-built information and for measurement of quantities.

1.2 Survey Reference Points and Legal Survey Markers

.1 Existing survey control points are designated on Drawings.

.2 Engineer will provide the Contractor with the existing digital survey and AutoCAD files with reference points and benchmark information.

.3 Locate, confirm and protect control points and legal survey markers prior to starting Work. Preserve permanent reference points during construction.

.4 Replace legal survey markers lost or destroyed as a result of construction activities at no cost to the Owner.

.5 Make no changes or relocations without prior written notice to the Engineer.

1.3 Survey Requirements

.1 Establish permanent benchmarks onsite, referenced to established benchmarks by survey control points. Record locations, with horizontal and vertical data in project record documents.

.2 Perform all surveying, establish lines and levels, locate and layout, by instrumentation.

.3 Perform all surveys affecting the line and elevation under the direction of a qualified surveyor licensed to practice in the Province of British Columbia.

.4 Provide surveys, checking of layout, measurement of quantities and compilation of record data as requested by the Engineer.

.5 Provide as-built survey of all above ground and underground utilities, including inverts, and structures based upon UTM co-ordinates.

.6 Provide acceptable survey assistants to the Engineer to assist in measuring and checking the Work.

1.4 Records

.1 Maintain a complete, accurate log of control and survey work as it progresses.

.2 On completion of foundations and major siteworks, prepare and submit to the Owner a certified digital survey showing dimensions, locations, angles, and elevations of the work.

.3 Submit a certificate signed by a registered surveyor certifying that the elevations and locations of completed Work are in conformity with the Contract Documents.

1.5 Submittals for Information Only

.1 Submit documentation in accordance with Section 01330 to verify accuracy of field engineering work.

2. PRODUCTS

Not Applicable.

3. EXECUTION

Not Applicable.

END OF SECTION

SITE CONDITIONS

1. GENERAL

1.1 Site Conditions/Limits

.1 Examination of Site

.1 Prior to commencing actual construction work, inspect field conditions, obtain and confirm actual site dimensions, examine surface conditions as required to ensure correct execution of the Work.

.2 Maintain or arrange for the removal, relocation and replacement as appropriate of any existing utilities which may be affected by the works, whether buried or surface utilities, signs, structures or any other object which may be in conflict with the works.

.3 Ensure that all structures fronting a highway right-of-way are setback greater than 4.5 m from the property line prior to construction. Notify the Engineer of any conflicts.

2. PRODUCTS

Not Applicable.

3. EXECUTION

Not Applicable.

END OF SECTION

SPECIAL PROJECT REQUIREMENTS

1. GENERAL

1.1 General Requirements

.1 These special project requirements and site sensitivities are over and above the requirements and care normally taken on a project.

.2 The Contractor, Subcontractor and all workers on site shall be made aware of the fact that the wastewater treatment plant operation will take priority over construction activity in this contract. Also they shall be made aware that there are special site sensitivities that site personnel must be aware of and conform to, together with supplemental rules and regulations that will be established, as set out below.

.3 Prior to any construction taking place, submit details of means and methods to be used for the installation of the major components.

.4 Cooperation will be required by all parties.

1.2 Orientation Program

.1 The Contractor shall be responsible for ensuring that all his sub-contractors and suppliers are familiar with statutory and special requirements for this project and all other regulations governing their work including the plant's health and safety requirements.

.2 An Orientation Program outlining the nature of the work and the special project requirements will be instituted by the Contractor for all workers on the site. The Owner will cooperate and provide their special requirements for this purpose. The Orientation Program will consist of the following:

.1 Description of the existing plant and the plant upgrades.

.2 General description of planned construction activities.

.3 Summary of special project sensitivities including odour (need to maintain operations and operations access, work permit system, security requirements, etc.)

.4 Safety requirements associated with work activities on the project site.

.5 Reporting requirements.

.3 An agenda and summary of the Orientation Program will be submitted for review to the Engineer prior to the Contractor moving any operations on site. The Engineer will provide a reasonable level of information to the Contractor to facilitate preparation of this agenda and summary.

.4 The Orientation Program will be scheduled at regular intervals at the discretion of the Contractor, as necessary to ensure that all employees attend prior to working on the site.

.5 All Contractor personnel will be required to complete the Orientation Program prior to working on the site. The Contractor will prepare indicators (hardhat stickers) to be applied upon the workers hardhats in visible locations. No Contractor personnel will be allowed on

site for more than three days without attending the Orientation Program. Contractor personnel who have not attended the Orientation Program be required to be accompanied by personnel who have completed the Orientation Program.

.6 The Contractor will allow for the attendance of up to five Owner and Engineer personnel at any Orientation Program proceeding.

1.3 Cloud Document Management Site

.1 Contractor to establish and maintain a cloud-based document management site for the duration of the project to maintain and share all documentation related to the Work.

.2 Contractor to provide the Owner and Engineer full access to the document management site.

1.4 Future Work

.1 The Contract has been designed for future additions where shown. Ensure the Work of this Contract avoids encroachment into areas shown for future additions.

.2 Where capped services, empty conduit, empty outlet boxes and similar items are shown for future extension, clearly identify and record the terminations for ready access for future use.

.3 Where such terminations are concealed, accurately dimension their location on record drawings.

1.5 Work Adjacent to Public or Private Property

.1 Obtain written consent from the Owner of adjacent property before proceeding with a part of the Work that necessitates entry onto such property for the underpinning of adjacent structures and where overswing of cranes may occur. Such written consent will not limit the Contractor's responsibility for property damage or personal injury.

.2 The Contractor is to be aware that Morningstar Creek, located adjacent to treatment plant, is a fish bearing watercourse with protected riparian zone.

1.6 Access to Site

.1 Access to the site will be via the new access road constructed from the Island Highway.

.2 It will be the Contractor's responsibility to check that the access to the site is in suitable condition before any plant, equipment, or materials are dispatched to site.

.3 Access to the site from Lee Road will require approval from the Owner. All costs associated with providing access to the site other than via the new access road will be borne by the Contractor.

1.7 Hours of Work

.1 Work inside the Owner's property may be carried out between the hours of 0700 hours (7:00 AM) and 1900 hours (7:00 pm) seven (7) days a week unless other arrangements are

made between the Owner and the Contractor. Comply with all applicable RDN bylaws regarding noise, construction traffic, etc.

.2 Normal working hours at the existing French Creek Pollution Control Centre are 8:00 a.m. to 4:30 p.m. seven (7) days a week. Minimal RDN staff are onsite on weekends. When work is planned for periods outside of this time frame, arrange with the Engineer and Owner a minimum of 7 days prior to when the work is to be completed.

1.8 Work Permits

.1 Work Permits will be used to coordinate and approve all work that will directly or indirectly affect the plant operations, such as the relocation of all process piping equipment, and electrical services, and all work requiring parts of the operation to be taken out of service.

.2 The purpose of Work Permits is to prevent injury to the Plant Operators and Contractor personnel, prevent damage to the process piping, electrical system and wastewater treatment facilities. The work permit serves as a communication paper between the Plant Operators, the Contractor and the Engineer so that all procedures will be clear and understood by all parties. The Operators reserve the right to require alterations to proposed work methods or timing where such alterations will result in minimization of disruption to plant operations.

.3 The Work Permit will be prepared by the Contractor; reviewed by the Owner and Engineer; and, when finalized, posted.

.4 The Work Permit will contain the following information:

.1 Work to be done

.2 Time period - potential hazards - safety precautions

.3 Safety equipment and personnel

.4 Equipment status prior, during and after work

.5 Effect on other work permits

.6 Amount of supervision

.7 Number of workers

.8 Any other special items required by the Engineer

.5 The Work Permit is required for all work including but not limited to the following:

.1 Any work involving a confined space

.2 In potentially flammable situations

.3 Near high voltage, toxic materials or high pressure areas

.4 Radiographic testing

.5 Re-routing of individual process and electrical lines

.6 Work below grade where underground piping or electrical cables are thought or known to exist

.7 Any work which will require any existing process, mechanical, electrical, or controls equipment to be taken out of service

.6 The Permit will be prepared by the Contractor and submitted to the Owner and Engineer **at least** two (2) weeks prior to the anticipated start of work. The Engineer and the Owner will review the permit. A meeting will be held to review the permit, or it may be returned, with comments to the contractor for re-submission. The Contractor must have a Work Permit totally approved by the Engineer and the Owner's Representative before work commences on any given system.

.7 When the Work Permit (with amendments) review is complete the Engineer and the Owner's representative will sign the permit.

.8 A copy of the signed Work Permit will be given to the Contractor. All equipment, pipelines, electrical feeds, valves, etc. that are shut off while the work is being done will be locked out by the Operators and the Contractor in the presence of the Contractor and have a copy of the Work Permit attached to or mounted in a clearly visible location adjacent to the lockout.

.9 There will be a brief meeting for all personnel at the beginning of each shift to communicate the conditions of the Permit.

.10 If any conditions change during the course of work, so that, in the opinion of the Engineer, the Owner or Contractor, such that safe continuation is questionable, the work must be stopped until a new Work Permit is issued.

.11 A copy of the signed Work Permit shall be posted in a conspicuous location close to the work site.

.12 The Work Permit Form to be used is located at the end of this section.

1.9 Line-Stopping

.1 Line-tapping, line-stopping or valve inserts may be required if any process line cannot be shut down when required or for the length of time required to do the work.

.2 When an installation operation is required it shall be properly coordinated, planned and executed.

.3 The work shall only be carried out by specialists well experienced in this type of work.

.4 Submit permits, procedures, schedules, scope and effect on plant operation for approval prior to carrying out this work.

2. PRODUCTS

Not Applicable.

3. EXECUTION

Not Applicable.

SPECIAL PROJECT REQUIREMENTS

Regional District of Nanaimo **French Creek Pollution Control Centre**	**WORK PERMIT**
CONTRACTOR	WORK LOCATION
SUBCONTRACTOR(S)	REFERENCE DRAWINGS
	WORK TIMES AND DATES
	START
	FINISH
	JOB FOREMAN
DESCRIPTION OF WORK	
	WORKER NAMES
PLANT FACILITIES AFFECTED	
HAZARDS	

REQUESTED BY:	DATE:

THE WORK DESCRIBED HEREIN IS PART OF THE WORK OF CONTRACT _____ AND SHALL BE PERFORMED IN ACCORDANCE WITH THE PROVISIONS OF THE CONTRACT.

NOTES:

ENGINEER:	DATE:
OWNER'S REPRESENTATIVE	DATE:
PLANT OPERATOR	DATE:

SPECIAL CONDITIONS:

ISSUED BY:		TIME:		DATE:	
RECEIVED BY:		TIME:		DATE:	
RETURNED BY:		TIME:		DATE:	
RETURNED TO:		TIME:		DATE:	

PERMIT NUMBER:		EXPIRY DATE:	

END OF SECTION

PROJECT MEETINGS

1. GENERAL

1.1 Preconstruction Meeting

.1 Within fifteen (15) days after award of Contract, the Engineer will request a project meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

.2 Representatives of the Owner, Engineer, Contractor, and Major Subcontractors must be in attendance.

.3 Representatives of the Contractor and Subcontractors attending the preconstruction meeting must be qualified and authorized to act on behalf of the party each represents.

.4 After the time and location of this meeting has been established, the Contractor shall notify all parties concerned a minimum of ten (10) days before the meeting.

.5 The Engineer will arrange space and facilities for this meeting.

.6 The Engineer will chair and record discussions and decisions, and circulate the meeting notes to all parties concerned.

.7 Agenda to include the following:

.1 Appointment and notification of official representatives of participants in the Work.

.2 Schedule of the Work, progress scheduling.

.3 Schedule of shop drawing submissions.

.4 Schedule for the procurement and delivery of specified equipment.

.5 Plant orientation program.

.6 Requirements for temporary facilities, site signs, offices, storage sheds, utilities, hoarding, site access and use.

.7 Site security.

.8 Health and Safety issues:

.1 As part of this agenda item, the contractor will be asked to complete a Safety Checklist.

.9 Modification procedures, Contemplated Change Notices and Change Order procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements (GC) as originated by the owner or in the case of a savings, by the Contractor.

.10 Product and tool storage.

.11 Weather protection.

.12 Record drawings.

.13 Operation and maintenance manuals.

.14 Commissioning, acceptance, and handover.

.15 Warrantees.

.16 Monthly progress claims, administrative procedures, photographs, holdbacks.

.17 Appointment of inspection and testing agencies or firms.

.18 Insurances and transcript of policies.

.19 Communications routing and logistics.

.20 Access to site and work areas.

.21 Survey.

.22 A schedule for progress meetings.

.23 Emergency telephone numbers.

.24 Other items as arise at the meeting.

1.2 Progress Meetings

.1 Schedule and administer progress meetings every two weeks throughout the construction period, and every week during the first and last two months of construction and through the commissioning period.

.2 Provide input to the Engineer for the meeting agenda at least two days prior to the meeting.

.3 Representatives of the Owner, Engineer, Contractor, and Major Subcontractors must be in attendance. Arrange for the attendance of other subcontractors and suppliers as necessary to address issues on the agenda.

.4 Representatives of the Contractor, Subcontractors, and Suppliers attending meetings must be qualified and authorized to act on behalf of the party each represents.

.5 Agenda for Construction Progress Meetings to include the following:

.1 Review and approval of minutes of previous meeting.

.2 Field observations, problems, conflicts.

.3 Review of environmental incidents.

.4 Review submittal schedules: Expedite as required.

.5 Review of off-site fabrication and delivery schedule.

.6 Progress, schedule, during succeeding work period.

.7 Problems which impede construction schedule.

.8 Corrective measures and procedures to regain projected schedule.

.9 Revisions to construction schedule.

.10 Site coordination review.

.11 Maintenance of quality standards.

.12 Review of site cleanliness.

.13 Review of site safety and security.

.14 Review of temporary facilities.

.15 Review requests for information.

.16 Review of contemplated change notices, field orders, change orders, and field instructions.

.17 Review proposed changes for effect on construction schedule and on completion date.

.18 Review of progress payments.

.19 Outstanding action items.

.20 Date and location of next meeting.

.21 Other business.

.6 The Engineer will preside at the meetings.

.7 The Engineer will record notes of the project meetings, including significant proceedings, decisions, “Action By" parties, dates for completion of duties, etc.

1.3 Special Meetings

.1 Special meetings may be requested by the Owner, Engineer, or Contractor to discuss specific issues. Generally, three days notice is required for special meetings. The agenda will be fashioned to suit the meeting. Minutes will be kept by the Engineer.

2. PRODUCTS

Not Applicable.

3. EXECUTION

Not Applicable.

END OF SECTION

MEASUREMENT AND PAYMENT

1. GENERAL

1.1 General

.1 This section of the Specification forms part of the Contract Documents, and is to be read, interpreted and coordinated with all other parts.

.2 Payment will be made on the basis of the Unit Prices in Section 00310 – Schedule of Quantities and Prices, additional items in the Fee Proposal Form and in accordance with the General and Supplementary General Conditions.

.3 Costs for Work and material not expressly listed in the Fee Proposal Form or Schedule of Quantities and Prices, but included in the Drawings and/or Specifications by either direct mention or implication, shall be included with items to which they pertain most closely.

.4 The prices for supply and installation of materials shall be full compensation of labour, materials, equipment, transportation, testing, and commissioning with all other work subsidiary and incidental thereto for which separate payment is not provided elsewhere.

.5 All payment items are inclusive of labour, material and equipment required to complete the Work.

.6 The method of measurement of the quantities for payment and the basis for payment will be in accordance with the following items of this Section. All measurements will be done by the Engineer using generally accepted methods of field survey.

.7 The items mentioned in this Section refer to the items so numbered in the Tender Price Breakdown.

.8 Descriptions contained in the payment clauses provide a general description of the tasks. They are not meant to limit the Work.

1.2 Applications for Payment

.1 Refer to Part 5 Payment – General Conditions (CCDC 2), and Section 00800 – Supplementary General Conditions.

.2 The Contractor shall use standard forms for submission of progress claims in the format agreed prior to the end of each month of Work.

.3 Show previous amount claimed and the amount claimed for the period ending. Show percentage of Work completed to date and holdback retained.

1.3 Changes in the Work

.1 Refer to Part 6 Changes in the Work – General Conditions (CCDC 2), and Section 00800 – Supplementary General Conditions.

.2 Changes to the work will be defined as below and be documented using the following forms:

.1 **Field Order** – Will be used when an instruction is given to the Contractor in the field, which may result in an adjustment to the Contract Price. A Field Order signed by the Engineer and the Owner is authorization to proceed with the Work on a Lump Sum, Unit Price or Force Account/Time and Material basis as stipulated on the Field Order form. Extra work shall not commence until the Contractor receives a copy of the Field Order signed by the Owner and the Engineer.

.2 **Field Memo** – Will be issued by the Engineer and be used as an instruction in situations where the change is not anticipated to result in an adjustment to the Contract Price.

.3 **Change Order** – Will be used for additions or deletions to the Work which originate in the form of revisions to Drawings and Specifications, and which may result in a change to the Contract Price. A Change Order signed by the Engineer and the Owner is authorization to proceed with the Work as stipulated in the Change Order. Extra work shall not commence until the Contractor receives a copy of the Change Order signed by the Owner and Engineer.

.3 Contemplated Changes in the Work

.1 Where a change in the Work is contemplated, the Engineer will give the Contractor written notice advising the Contractor of a contemplated change in the Work. Such notice requires that the Contractor submit either a lump sum quotation or an estimate based on unit prices and quantities, or labour and equipment rates, to the Engineer within the time specified on the form. **Such notice is for information only and is not an instruction to execute changes, or to stop Work in progress.** The Contractor's quotation shall:

.1 Make reference to the contemplated change order letter;

.2 Be set out in sufficient detail acceptable to the Engineer;

.3 Indicate the methodology and resources that the Contractor shall use to perform the extra work;

.4 Indicate the cost or credit to complete the changes in the work;

.5 Indicate the schedule to perform the changes in the work; and indicate the impact on the overall project schedule.

.6 Indicate any incremental cost impact included in quotation to maintain the Completion Date;

.7 Indicate that quotation will remain open for acceptance by the Owner for thirty (30) days; and

.8 Submit all required back-up documents.

.2 The Engineer will review the Contractor's quotations for contemplated changes in the Work to determine whether the quotation is acceptable, requires resubmittal or should be rejected. Support quotation with additional substantiating data if requested by the Engineer.

.3 When the quotation has been evaluated and is deemed acceptable to the Engineer, the Engineer will prepare and complete a Change Order entering the acceptable quotation adjustments to the Contract Price and Completion Date for the Owner's signature. Once the Change Order is signed and fully executed by the Owner, it will then be forwarded to the Contractor for signature. The Change Order, signed by the Owner, records and authorizes the Contractor to proceed with the Work.

.4 Methods for Valuing and Evaluating Changes on the Work

.1 Lump Sum Change Orders and Field Orders

.1 The content of Change Orders or Field Orders will be based on a prior quotation from the Contractor and agreed to by the Engineer and the Owner.

.2 The Contractor shall submit all necessary backup and the quotation shall be broken down as much as required by the Engineer.

.2 Unit Price Change Orders and Field Orders

.1 The content of Change Orders or Field Orders will be based on either prior agreed quantities or a survey of completed Work.

.2 The amounts of unit prices shall be those quoted in the Schedules to the Contract.

.3 When quantities can be determined prior to start of Work, the Engineer will prepare and complete a Change Order or Field Order describing the Work and entering the agreed confirmed unit prices, total quantities and total cost adjustments to the Contract Price and the construction schedule, for the Owner's signature. Once the Change Order or Field Order is signed and fully executed by the Owner, it will then be forwarded to the Contractor for signature. The Change Order, signed by the Owner, records and authorizes the Contractor to proceed with the Work.

.4 When quantities **cannot be determined** prior to start of Work, the Engineer will assign to the Contractor a Field Order signed by the Owner agreeing and authorizing the described Work to proceed immediately on the basis of the unit prices and an estimate mutually agreed upon. Upon completion of the changes involved, the Engineer will complete the Field Order entering the final total cost for the Work based on agreed confirmed unit prices and actual measured quantities support data submitted for the Owner's signature to adjust the Contract Price and Completion Date as applicable.

.3 Force Account/Time and Material Change Orders and Field Orders

.1 When a change in the Work cannot be agreed upon by the Lump Sum and Unit Price methods, the Engineer may authorize the Work to be carried out on a Force Account/Time and Material basis.

.2 The Contractor's Labour and Equipment Rate Table provided with the Tender will be used to assess the cost of performing changes in the Work.

.3 The Engineer will provide the Contractor with a Field Order, signed by the Owner agreeing and authorizing the described extra work to proceed immediately on a Force Account/Time and Material basis as reviewed on the Work Site.

.4 The Contractor shall support claims for changes determined by this method via numbered Daily Time Sheets (DTS) submitted the day following the Work with dates and times the Work was performed and by whom; time record, summary of hours worked and hourly rates paid; receipts and invoices for equipment used, listing dates and times of use; materials and products used, listings quantities; subcontracts.

.5 Submit claims on standard form.

.6 Upon completion of the changes, the Engineer will complete the Field Order entering the final approved total cost for the extra work involved, based on agreed confirmed time and material support data, invoices, time sheets and records submitted for the Owner's signature to adjust the Contract Price and Completion Date as applicable.

.7 The percentage mark-up permitted for changes in the Work done on a Force Account basis is specified in the General Conditions.

.4 Quotations for changes in the Work shall show credits for work deleted from the Contract as a result of the change in the Work, if applicable.

.5 The mark-up on each change shall be applied to the net difference between credits and extras except in the case where the change results in a net credit to the Contract Price, in which case the Contractor is not entitled to charge mark-up on the net credit.

.6 Any dispute arising under this Section shall be governed by Part 8 Dispute Resolution – General Conditions (CCDC 2).

2. PRODUCTS

Not applicable.

3. EXECUTION

3.1 DIVISION 0 – CONTRACT REQUIREMENTS

.1 Item 1.1 – Bonding and Insurance

.1 This item shall include all costs for bonds, insurance, permits and licenses necessary for the Work. Payment is subject to the submission and approval of contractually required bonds, insurance, permits and licenses.

.2 Payment will be made on the percentage complete applied to the lump sum price.

3.2 DIVISION 1 – GENERAL REQUIREMENTS

.1 Item 2.1 – Mobilization and Demobilization

.1 Mobilization shall include all costs associated with moving personnel, materials and equipment to the site, setting up temporary facilities and all preparation for performing the Work pursuant to Section 01505 – Mobilization and Demobilization.

.2 Demobilization shall include all costs associated with removal of all personnel, materials and equipment, and cleanup of the site.

.3 The cost for mobilization and demobilization shall not exceed 5% of the Total Stipulated Contract Price.

.4 Payment will be made as follows:

.1 60% of the lump sum price will be included in the first progress payment certificate.

.2 40% of the lump sum price will be included in the final progress payment certificate.

.2 Item 2.2 – Record Drawings

.1 This item shall include all costs associated with the preparation and submission of Operation and Maintenance (O&M) Manuals and Contractor red-line ("As-built") Drawings pursuant to Section 01330 – Submittals.

.2 Payment will be made on receipt and acceptance of final O&M Manuals and Record Drawings from the Contractor and Equipment Manufacturers.

3.3 DIVISION 2 – SITEWORKS

.1 Item 3.1 – Demolition and Removal

.1 This item shall include all costs associated with the demolition, removal and disposal of all material and items required to complete the Work as per the Drawings and Specifications.

.2 Payment will be made on the percentage complete applied to the lump sum price.

.2 Item 3.2 – Clearing and Grubbing

.1 This item shall include all costs associated with clearing and grubbing necessary to prepare the site for the Work pursuant to Section 02231 – Clearing and Grubbing, the Drawings and other relevant Specifications.

.2 Payment will be made on the percentage complete applied to the lump sum price.

.3 Item 3.3 – Excavating, Trenching and Backfilling

.1 This item shall include all costs associated with excavating, trenching and backfilling for the Work pursuant to Section 02315 – Excavating, Trenching and Backfilling, the Drawings and other relevant Specifications.

.2 Include in the lump sum Item 3.3 the cost of over-excavating an additional quantity of material as directed by the Engineer and replacement with an equivalent amount of imported Type 3 granular material as per Item 3.3a of the Schedule of Quantities and Prices, inclusive of all costs associated with excavation, transport, placement and disposal.

.3 Payment will be made on the percentage complete applied to the lump sum price and at the unit price for the over-excavation as per Item 3.3a of the Schedule of Quantities and Prices.

.4 Item 3.4 – Dewatering

.1 This item shall include all costs associated with dewatering the Project Site during construction pursuant to Section 02401 – Dewatering, the Drawings and other relevant Specifications.

.2 Payment will be made on the percentage complete of the Contractor's dewatering plan applied to the lump sum price.

.5 Item 3.5 – Yard Piping

.1 This item shall include all costs associated with the supply, excavation, bedding, installation, backfill and testing of all underground piping and services, including fittings, valves and appurtenances pursuant to Section 02510 – Yard Piping, the Drawings and other relevant Specifications.

.2 Payment will be made on the percent complete or quantities of installed items applied to the unit prices in the Schedule of Quantities and Prices.

.6 Item 3.6 – Morningstar Creek Culvert and Creek Crossing Work

.1 This item shall include all costs associated with the excavation, installation and engineered backfill of the arch culvert, MSE wall and related creek crossing items pursuant to the Drawings and other applicable Specifications.

.2 Payment will be made on the percent complete or quantities of installed items applied to the unit prices in the Schedule of Quantities and Prices.

.7 Item 3.7 – Site Grading and Gravel Roadway

.1 This item shall include all costs associated with site grading and gravel roadway construction pursuant to Section 02231 – Grading and as per the Drawings, including all labour, material and equipment required to complete the Work.

.2 Payment will be made on the percent complete or quantities of installed items applied to the unit prices in the Schedule of Quantities and Prices.

.8 Item 3.8 – Asphalt Paving

.1 This item shall include all costs associated with asphalt paving including asphalt removal, disposal, imported granular sub-base and base materials, asphalt paving and concrete curbing pursuant to Section 02741 – Hot Mix Asphalt Concrete and as per the Drawings and other applicable Specifications.

.2 Payment will be made on the percent complete or quantities of installed items applied to the unit prices in the Schedule of Quantities and Prices.

.9 Item 3.9 – Fencing and Gates

.1 This item shall include all costs associated with the supply and installation of the fencing, gates and appurtenances pursuant to Section 02821 – Chain Link Fences and Gates, the Drawings and relevant Specifications.

.2 Payment will be made on the percentage complete applied to the lump sum price.

.10 Item 3.10 – Temporary Measures, Works and Restoration

.1 This item shall include all costs associated with temporary measures, works and site restoration including excavation support systems, bulkheads, bypass pumping systems, facilities and all other means and methods required to complete the Work as per the Drawings and Specifications.

.2 Payment will be made on the percentage complete applied to the lump sum price.

.11 Item 3.11 – Landscaping

.1 This item shall include all costs associated with finish grading and landscaping as per the Drawings and Specifications.

.2 Payment will be made on the percentage complete applied to the lump sum price.

.12 Item 3.12 – All Other Sitework

.1 This item shall include any sitework not covered in the previous items.

.2 Payment will be made on the percentage complete applied to the lump sum price.

3.4 DIVISION 16 – ELECTRICAL

.1 Item 17.1 – U/G Conduit and Wiring

.1 This item shall include all costs associated with the supply and installation of all underground electrical conduit and wiring required to complete the Work as per the Drawings and Specifications.

.2 Payment will be made on the percentage complete applied to the lump sum price.

END OF SECTION

TRAFFIC CONTROL, VEHICLE ACCESS AND PARKING

1. GENERAL

1.1 General

.1 This Section addresses general requirements for temporary vehicle movement, site access and parking during construction both on and off site.

.2 During progress of the Work, make adequate provision to accommodate normal traffic along streets immediately adjacent to or crossing the Work so as to minimize inconvenience to the general public.

.3 Inform all owners or occupants of properties where access is affected in the advance of proposed road and/or sidewalk closures.

.4 The main entrance to the French Creek Pollution Control Centre is off of Lee Road.

.5 The contractor will construct a new entrance from the Island Highway and will use that entrance for construction vehicle access.

1.2 Reference

.1 Regulate traffic in accordance with the Traffic Control Manual for Work on Roadways, Province of B.C., Ministry of Transportation and Infrastructure and the requirements of WorkSafeBC.

1.3 Administrative Requirements

.1 Coordinate with Regional District of Nanaimo, Ministry of Transportation and Infrastructure, Engineer and Owner on managing traffic during the Work.

1.4 Submittals

.1 Provide traffic management plan with the following:

.1 Traffic routing plan: show sequences of construction affecting use of roadways, time required for each phase of the work, plans for signage, barricading and striping to provide protection or passage for pedestrians and vehicles.

.2 Truck access routing plan: provide haul routes for Contractor's trucks. Include cleaning activities, daytime parking and methods to minimize impacts along existing roadways.

1.5 Protection of Public Control

.1 Comply with requirements of Acts, regulations and bylaws in force for regulation of traffic or use of roadways upon or over which it is necessary to carry out work or haul material or equipment.

.2 Working on travelled way:

.1 Place equipment in position to present minimum interference and hazard to travelling public. Do not use public roads as a holding/staging or cleaning area for vehicles.

.2 Keep equipment units as close together as working conditions will permit on same side of travelled way.

.3 Do not close any lanes of road with approval of the Engineer. Before re-routing traffic erect suitable signs and devices in accordance with applicable regulations.

.1 Keep travelled way well graded, free of potholes and of sufficient width that required number of lanes of traffic may pass.

.2 Provide and maintain reasonable road access and egress to property fronting along or in vicinity of the Work unless other reasonable means of road access exists.

1.6 Information and Warning Devices

.1 Provide and maintain signs and other devices required to indicate construction activities or other temporary and unusual conditions resulting from the Work which may impact normal road usage.

.2 Supply and erect signs, delineators, barricades and miscellaneous warning devices as specified in applicable regulations.

.3 Place signs and other devices in locations recommended in said regulations.

.4 Continually maintain traffic control devices in use by:

.1 Checking signs daily for legibility, damage, suitability and location. Clean, repair or replace to ensure clarity and reflectance.

1.7 Control of Public Traffic

.1 Provide competent flag persons, properly equipped as specified in applicable regulations in the following situations:

.1 When public traffic is required to pass working vehicles or equipment which may block all or part of travelled roadway.

.2 When it is necessary to institute one-way traffic system through the Work Site or other blockage where traffic volumes are heavy, approach speeds are high or traffic signal system is not in use.

.3 When workers or equipment are employed on travelled way at other locations where oncoming traffic would not otherwise have adequate warning.

.4 Where temporary protection is required while other traffic control devices are being erected or taken down.

.5 For emergency protection when other traffic control devices are not readily available.

.6 In situations where complete protection for workers, working equipment and public traffic is not provided by other traffic control devices.

1.8 Roadways

.1 If authorized to use existing roads for access to Site, maintain such roads for duration of Contract and make good damage resulting from contractors' use of roads.

.2 Prior to final inspection, obtain and submit to Owner written signed releases from owners of all roads used for Site access, verifying that roads have been adequately restored and left in a satisfactory condition.

.3 Trim loads of trucks hauling excavated material, cement, sand, stone, gravel, debris or other loose material before leaving the site, and ensure that the bodies of such vehicles are tight so that no spillage of loads occurs.

1.9 Access to Utility Installations

.1 Do not obstruct hydrants, valve or control pit covers, valve boxes, curb stop boxes, fire or police call boxes, and all other utility controls, warning systems, and appurtenances.

1.10 Construction Parking

.1 Parking will be permitted on Site in designated areas and provided it does not disrupt the performance of Work or FCPCC Operations.

.2 Exiting parking spaces at the French Creek Pollution Control Centre are for staff and visitors and may not be used by the Contractor.

2. PRODUCTS

Not Applicable.

3. EXECUTION

Not Applicable.

END OF SECTION

ENVIRONMENTAL PROTECTION

1. GENERAL

1.1 General

.1 This Section covers the work for the protection of the environment during construction. The provisions of this Section are in addition to the provisions of other Sections of this Contract.

1.2 Submittals

.1 Submit the following prior to construction:

.1 Construction Environmental Management Plan

.2 Spill Contingency Plan

1.3 Environmental Management Plan

.1 Prepare a Construction Environmental Management Plan that as a minimum follows the recommendations contained in the Construction EIS.

.2 Refer to the Regional District of Nanaimo's Environmental Management System. Incorporate all requirements and recommendations from this document into the Construction Environmental Management Plan.

.3 Submit in accordance with Section 01330.

.4 Follow the approved Construction Environmental Management Plan throughout the performance of the Work.

1.4 Site Working Areas

.1 Confine operations to limits of the site working area shown on Drawings.

.2 Provide access roads to the site working area and on the site in locations shown or otherwise acceptable to the Engineer.

.3 Install fencing to clearly define the working limits to the site working area, haul routes, parking areas, access routes and maintenance areas to ensure all activity is confined to these areas.

1.5 Construction Practices

.1 Notwithstanding the above general concerns, the following environmental construction practices are specific to this Contract:

.1 No channel construction or work shall be carried out that will interfere with the migration of fish.

.2 Control measures shall be provided to prevent silt-laden water from entering natural watercourses in accordance with the requirements of the Ministry of Environment.

.3 The velocity of discharge water shall be controlled to prevent unnecessary disturbance of natural watercourses.

.4 All equipment maintenance and refuelling shall be carried out so as to prevent the entry of petroleum products into the ground or watercourses at all times.

.5 The Contractor shall ensure the immediate availability of the products with which to affect temporary repair to broken pipelines and other services so the spill or other emission of a pollutant is immediately controlled and stopped and to mitigate the damages.

.6 Maintain temporary erosion and pollution control features installed under this contract or by any previous contractor during the clearing and grubbing work.

.7 Control noise emission from equipment and plant to local authorities' noise emission requirements.

.8 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.6 Site Restoration

.1 In general, the Contractor shall restore the site to conditions equal to or, if specified elsewhere, to a condition better than existing conditions.

.2 The Contractor shall restore lands outside of the limits of the Work which are disturbed by the Work to their original condition.

1.7 Spills Reporting

.1 In the event of a spill or other emission of a pollutant into the natural environment, every person responsible for the emission of who causes or permits it must forthwith notify:

.1 The Ministry of Environment

.2 The municipality or the regional municipality within the boundaries of which the spill occurred.

.3 The owner of the pollutant, if known.

.4 The person having control of the pollutant, if known.

.5 The Engineer: Of the spill, of the circumstances thereof, and of the action taken or intended to be taken with respect thereto.

1.8 Contingency Plan

.1 Prior to commencing construction, the Contractor shall prepare a contingency plan for the control and clean up of a spill. The Contractor shall submit for the Engineer's review and the review of other responsible Parties a copy of the Contingency Plan and make appropriate

changes to it based on review comments received. The plans shall be reviewed at the pre-construction meeting. The contingency plan shall include:

.1 The names and the telephone numbers of the persons in the local municipalities to be notified forthwith of a spill.

.2 The names and the telephone numbers of the representatives of the fire, the police and the health departments of the local municipalities who are responsible to respond to emergency situations.

.3 The Contractor's proposal for the immediate containment and control of the spill, the cleanup procedures to be initiated immediately and any other action to be taken to mitigate the potential environmental damage while awaiting additional assistance.

.4 The name and the office and home telephone number of the Contractor's representative responsible for preparing, implementing, directing and supervising the contingency plan.

1.9 Disposal of Wastes

.1 Fires and burning of rubbish on site are not permitted.

.2 Do not bury rubbish and waste materials on site.

.3 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.10 Site Clearing and Plant Protection

.1 Protect trees and plants on site and adjacent properties where indicated.

.2 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.

.3 Minimize stripping of topsoil and vegetation.

.4 Restrict tree removal to areas indicated or designated by Engineer.

2. PRODUCTS

Not Applicable.

3. EXECUTION

Not Applicable.

END OF SECTION

PRODUCTS AND WORKMANSHIP

1. GENERAL

1.1 Quality of Products

.1 Provide new materials, equipment and articles incorporated in the Work, not damaged or defective and of the best quality (compatible with specifications) for the purpose intended. If requested furnish evidence as to type, source and quality of products provided.

.2 Defective materials, equipment and articles whenever found may be rejected regardless of previous inspection. Inspection by the Engineer or his Representative does not relieve the Contractor of his responsibility but is merely a precaution against oversight or error. Remove and replace defective materials at own expense and be responsible for all delays and expenses caused by rejection.

.3 Should any dispute arise as to the quality or fitness of materials, equipment or articles, the decision rests strictly with the Engineer based upon the requirements of the Contract Documents.

.4 Unless otherwise indicated in the specifications, maintain uniformity of manufacturer for any particular or like item throughout the building and other areas of the Work.

.5 Permanent labels, trademarks and nameplates on materials, equipment and articles are not acceptable in prominent locations except where required for operating instructions and when located in mechanical or electrical rooms.

1.2 Availability of Products

.1 Immediately upon signing the Contract, review Product requirements and anticipate foreseeable delivery delays in any items. If delays in deliveries of materials, equipment or articles are foreseeable, propose substitutions or other remedial action in ample time to prevent delay in performance of the Work.

.2 To receive approval, proposed substitutes must equal or exceed the quality, finish and performance of those specified and/or shown, and must not exceed the space requirements allotted on the drawings.

.3 If such proposal is not given to the Engineer, the Engineer reserves the right to substitute more readily available Products later in order to prevent delays at no additional cost to the Owner.

.4 No substitution of any item will be permitted unless the item cannot be delivered to the job site in time to comply with the Schedule.

.5 Provide documentary proof of equality, difference in price (if any) and delivery dates in the form of certified quotations from suppliers of both specified items and proposed substitutions.

.6 Include all costs in the difference in price (if any) for any required revisions to other structures and products to accommodate such substitutions.

1.3 Storage, Handling, and Protection of Products

.1 Handle and store products in a manner to prevent damage, contamination, deterioration and soiling and in accordance with manufacturer's recommendations when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturers' seals and labels intact. Do not remove from packaging or bundling until required in the Work.

.3 Products subject to damage from weather are to be stored in weatherproof enclosures. These enclosures are to be supplied and installed by the Contractor.

.4 Store cementitious materials clear of earth or concrete floors and away from walls.

.5 When used for grout or mortar materials, keep sand clean and dry. Store sand on polyethylene and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet material, lumber and steel trusses, joists and members on flat, solid supports and keep clear of ground.

.7 Store and mix paints in a room assigned for this purpose. Keep room under lock and key at all times. Remove oily rags and any other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense.

1.4 Manufacturers' Directions

.1 Unless otherwise specified, install or erect all products in accordance with manufacturers' recommendations. Do not rely on labels or enclosures provided with products. Obtain instructions directly from manufacturers.

.2 Notify the Engineer, in writing, of any conflicts between the specifications and manufacturers' instructions so that the Engineer may establish the course of action to follow.

.3 Improper installation or erection of products due to failure in complying with these requirements authorizes the Engineer to require any removal and re-installation that may be considered necessary, at no increase in Contract Price.

1.5 Protective Coating

.1 Unless otherwise specified, ship each item of equipment to the Work Site with the manufacturer's shop applied prime coating as specified.

1.6 General Workmanship Requirements

.1 Workmanship is to be of the best quality executed by workers fully experienced and skilled in their respective trades.

.2 At all times enforce discipline and good order among workers. Do not employ any unfit person or anyone unskilled in the duties assigned to him. The Engineer reserves the right to require the removal from site of workers deemed incompetent, careless, insubordinate or otherwise objectionable.

.3 Decisions as to the quality of or fitness of workmanship in cases of any dispute rests solely with the Engineer whose decision is final.

1.7 Coordination

.1 Coordinate the work of all Subcontractors.

.2 Ensure that all Subcontractors examine the drawings and specifications for other parts of the Work which may affect the performance of their work.

.3 Ensure that sleeves, openings and miscellaneous foundations are provided as required for the Work.

.4 Ensure that items to be built in are supplied when required with all necessary templates, measurements and shop drawings.

1.8 Concealment

.1 In finished areas conceal all pipes, ducts and wiring except where indicated otherwise on drawings or in specifications.

.2 Before installation inform the Engineer if there is a contradictory situation. Install as directed.

1.9 Location of Items

.1 Consider the location of items indicated on drawings as approximate. The actual location of these items is to be as required or directed to site conditions at the time of installation and as is reasonable.

.2 Before installation inform the Engineer if there is a contradictory situation. Install as directed.

1.10 Cutting and Remedial Work

.1 Perform all cutting and remedial work that may be required to make the several parts of the Work come together properly. Coordinate and schedule the Work to ensure that cutting and remedial work are kept to a minimum.

.2 Remove and replace defective and non-conforming work.

.3 Where new work connects with existing work and where existing work is altered, cut, patch and make good to match existing work.

.4 Do all cutting with power saws or core drilling equipment. Do not use pneumatic or impact tools. Make all cuts with clean, true, smooth edges.

.5 Do not cut, bore or sleeve any load bearing structure without the written consent of the Engineer, unless specifically detailed on the Drawings. Submit details with each request for consent.

.6 Provide openings in non-structural elements of the Work for penetrations of mechanical and electrical work. Coordinate size and location of such openings with the trade involved.

.7 Fit construction tightly to ducts, pipes, conduits and similar products, to stop air movement completely. Where such work penetrates a fire separation element or wall of the building, pack the penetration around the duct, pipe, conduit or similar for the length of the openings with ULC listed fire stopping packing Product as part of the Work specified.

.8 Prepare the surfaces to receive patching and finishing.

.9 Refinish the surfaces to match the adjacent finishes. For continuous surfaces refinish to the nearest intersection, and for an assembly, refinish the entire unit.

.10 Employ specialists familiar with the materials affected in performing cutting and remedial work. Perform in a manner to neither damage nor endanger any portion of the Work.

1.11 Fastenings

.1 Provide the fasteners, anchors, braces and supports required to maintain installations attached to the structure or to finished floors, walls and ceilings in a secure and rigid manner capable of withstanding the dead loads, live loads, superimposed dead loads, and any vibration of the installed Products.

.2 Use fasteners compatible with the structural requirements, finishes and types of Products to be connected. Do not mix products subject to electrolytic action or corrosion where conditions are liable to cause such action.

.3 Where hangers are suspended from concrete slabs, install inserts before concrete is placed using inserts designed for the specific purpose.

.4 Where built-in inserts are inaccessible due to subsequent installation of ducts, pipes or other installations, use anchors appropriate to the load requirements. Locate anchors to avoid damage to reinforcing bars.

.5 Verify that the fasteners, anchors, braces and supports for suspended installations, and the structure to which they are to be secured are designed to support the load requirements, including safety factor.

.6 Where a fastener installation is suspect, have on-site tests of installed fasteners, performed by an independent testing laboratory acceptable to the Engineer, using properly engineered and calibrated force measuring meters.

.7 Where the floor, wall or ceiling construction is not suitable to support the loads, provide additional framing or special fasteners to ensure proper securement to the structure that is to support the Products.

.8 Provide reinforcing or connecting supports, where required, to distribute the loads on the structural components.

.9 Do not use wood plugs or hammer-impact fasteners. Anchoring to floor topping fills is not acceptable. Secure the anchors in floors to the floor structure.

.10 Where a performance requirement is specified, submit engineering calculations and written verification signed by a Registered Professional Engineer that the installation has been inspected and is structurally sound and in accordance with design requirements.

.11 Fastenings which cause spalling or cracking of the structure or Products to which anchorage is made are not acceptable.

.12 Obtain the Engineer's consent for use of explosive-actuated fastening devices. If consent is given, comply with CSA Z166.

.13 Space the anchors within limits of load bearing or shear capacity and ensure they provide positive permanent anchorage.

.14 Provide metal fastenings and accessories in same texture, colour and finish as adjacent material unless otherwise specified.

.15 Prevent electrolytic action between dissimilar metals and materials.

.16 Use non-corrosive, non-staining fasteners and anchors for securing exterior work unless otherwise specified.

.17 Space anchors within their load limit or shear capacity and ensure that they provide positive permanent anchorage.

.18 Keep exposed fastenings to a minimum, space evenly and lay out neatly.

1.12 Protection of Work in Progress

.1 Adequately protect all work completed and in progress. Repair or replace all damaged work.

.2 Prevent overloading of any part of the Work.

1.13 Cleaning

.1 Remove waste materials and debris from the site at regular intervals. Do not burn waste materials and debris on site.

1.14 Local Workforce

.1 Give preference to the hiring of local workers, provided they are available and physically fit and qualified by training and experience to perform the Work. The foregoing does not apply to superintendent, timekeeper, foreman and construction equipment and machine operators, nor until ten days after the commencement of the Work. Make available at all reasonable times for examination by the Owner, the labour rolls for the determination of the domicile of the workers.

1.15 Metric Measurement

.1 Unless otherwise noted, this Project has been designed and is to be constructed in the S.I. metric system of measurements.

.2 During construction, when specified metric elements are unattainable at the time they are required to meet the Construction Schedule, the Contractor shall notify the Engineer in writing and suggest alternative substitutions. Costs due to these substitutions shall be borne by the Contractor.

2. PRODUCT

Not Applicable.

3. EXECUTION

Not Applicable.

END OF SECTION

CLOSEOUT PROCEDURES

1. GENERAL

1.1 Description

.1 This section describes administrative procedures preceding preliminary and final inspections of Work.

1.2 Inspection and Declaration

.1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify Engineer in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request Engineer Inspection.

.2 Engineer Inspection: Engineer and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, commissioned, and are fully operational.

.4 Certificates required by regulatory authorities have been submitted.

.5 Operation of systems have been demonstrated to Owner's personnel.

.6 Work is complete and ready for Final Inspection.

.4 Final Inspection: when items noted above are completed, request final inspection of Work by Owner, Engineer, and Contractor. If Work is deemed incomplete by Engineer, complete outstanding items and request reinspection.

.5 Declaration of Substantial Performance: when Owner and Engineer consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance. Refer to General Conditions Clause 5.4 - Substantial Performance of the Work and Section 00800 Supplementary Conditions.

.6 Commencement of Lien Period: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement of lien period.

.7 Commencement of Warranty Period: date of completion of all acceptance tests (Total Performance) shall be date for commencement of warranty period.

.8 Final Payment: When Owner and Engineer consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. Refer to General Conditions Clause 5.7 for specifics to application. If Work is deemed incomplete by Owner and Engineer, complete outstanding items and request reinspection.

.9 Payment of Holdback: After issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback amount in accordance with General Conditions Clause 5.5.

1.3 Warranty Inspection

.1 The Engineer will arrange and conduct with the Owner and the Contractor a warranty inspection at the site prior to expiration of the warranty period.

2. PRODUCTS

Not Applicable.

3. EXECUTION

Not Applicable.

END OF SECTION

SITEWORK DEMOLITION AND REMOVAL

1. GENERAL

1.1 References

.1 Canadian Federal Legislation.

.2 Canadian Environmental Protection Act (CEPA).

.3 Canadian Environmental Assessment Act (CEAA).

.4 Transportation of Dangerous Goods Act (TDGA).

.5 Motor Vehicle Safety Act (MVSA).

1.2 Description of Work

.1 Refer to Drawings and Specifications for location and scope of demolition work.

.2 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.

1.3 Protection

.1 Perform all work in accordance with Section 01561 - Environmental Protection.

.2 Protect in accordance with Section 02315 - Excavating, Trenching and Backfilling.

.3 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of the Engineer and at no cost to the Owner.

.4 In all circumstances, ensure that demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.

2. PRODUCTS

Not Applicable

3. EXECUTION

3.1 Preparation

.1 Inspect the site with the Engineer and verify extent and location of items designated for removal, disposal and salvage.

.2 Locate utilities to be disconnected before start of work.

.3 Notify, coordinate with, and obtain approval of utility companies before starting demolition.

3.2 Sequences of Operation

.1 Remove items as indicated.

.2 Disposal of Material:

.1 Dispose of materials not designated for salvage off-site.

.2 Do not disturb items designated to remain in place.

3.3 Restoration

.1 Restore areas and existing works outside areas of demolition to match condition of adjacent, undisturbed areas.

3.4 Cleanup

.1 Upon completion of work, remove debris, trim surfaces and leave site clean.

END OF SECTION

REMOVAL OF EXISTING ASPHALT PAVEMENT

1. GENERAL

1.1 Protection

.1 Protect existing pavement not designated for removal, light units and structures from damage. In the event of damage, immediately replace or make repairs to the approval of the Engineer at no additional cost.

2. PRODUCTS

Not Applicable.

3. EXECUTION

3.1 Preparation

.1 Prior to commencing removal operation, inspect and verify with the Engineer areas, depths and lines of asphalt pavement to be removed.

3.2 Removal

.1 Saw-cut all asphalt in roadway, parking lot and for road crossings.

.2 Remove existing asphalt pavement to lines and grades indicated.

.3 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement.

.4 Prevent contamination of removed asphalt pavement by topsoil, underlying gravel or other materials.

.5 Provide for suppression of dust generated by removal process.

3.3 Removed Material

.1 Dispose of removed asphalt pavement off-site.

END OF SECTION

CLEARING AND GRUBBING

1. GENERAL

1.1 Definitions

.1 Clearing consists of cutting off trees and brush vegetative growth to not more than a specified height above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.

.2 Grubbing consists of excavation and disposal of stumps and roots, boulders and rock fragments of specified size to not less than a specified depth below existing ground surface.

1.2 Protection

.1 Prevent damage to fencing, trees, landscaping, natural features, benchmarks, existing buildings, existing pavement, utility lines, Work Site appurtenances, water courses and root systems of trees which are to remain.

.2 Do not commence tree cutting until the Owner confirms that any required permits have been received.

.3 Repair any damaged items to approval of Engineer.

.4 Replace any trees designated to remain, if damaged, as directed by Engineer.

2. PRODUCTS

Not Applicable.

3. EXECUTION

3.1 Preparation

.1 Inspect Work Site and verify with Engineer, items designated to remain.

.2 Locate and protect utility lines. Preserve in operating condition active utilities traversing Work Site.

.3 Notify utility authorities before starting clearing and grubbing.

3.2 Clearing

.1 Clear as indicated or as directed by Engineer, by cutting at a height of not more than 300 mm above ground. In areas to be subsequently grubbed, height of stumps left from clearing operations to be not more than 1000 mm above ground surface.

.2 Cut off branches, down trees overhanging area cleared as directed by Engineer.

.3 Cut off unsound branches on trees designated to remain as directed by Engineer.

3.3 Grubbing

.1 Grub out stumps and roots to not less than 200 mm below ground surface.

.2 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.5 m^3.

3.4 Removal and Disposal

.1 Remove and dispose cleared and grubbed materials off-site.

3.5 Finished Surface

.1 Leave ground surface in condition suitable for immediate grading operations or stripping of topsoil.

END OF SECTION

SITE GRADING

1. GENERAL

1.1 Protection

.1 Protect and/or transplant existing fencing trees, landscaping, natural features, benchmarks, buildings, pavement, surface or underground utility lines which are to remain as directed by the Engineer. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

1.2 Measurement and Payment

.1 Measurement for site grading will be incidental to the Work under the Contract and not paid for separately.

2. PRODUCTS

2.1 Materials

.1 Fill material: In accordance with of Section 02701 – Aggregates and Fill Materials.

.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by the Engineer.

3. EXECUTION

3.1 Stripping of Topsoil

.1 Do not handle topsoil while in wet or frozen condition or in any manner which soil structure is adversely affected as determined by the Engineer.

.2 Commence topsoil stripping after area has been cleared of brush, weeds and grasses and removed from site.

.3 Strip topsoil where indicated and avoid mixing topsoil with subsoil.

.4 Stockpile and keep separated from other excavated material if to remain on site. Provide vegetative or man-made cover over stockpile as directed by the Engineer.

3.2 Grading

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Slope rough grade away from building as directed.

.3 Grade ditches to depth as directed.

.4 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.5 Compact filled and disturbed areas to corrected maximum dry density to ASTM D698, as follows:

.1 85% under landscaped areas

.2 95% under paved and walk areas

.6 Do not disturb soil within branch spread of trees or shrubs to remain.

3.3 Surplus Material

.1 Remove and dispose of surplus material and material unsuitable for fill, grading or landscaping off site.

END OF SECTION

EXCAVATING, TRENCHING AND BACKFILLING

1. GENERAL

1.1 Definitions

.1 Rock is defined as all solid rock in the form of bedrock, masses, ledges, seams or layers and includes igneous rock of any sort, conglomerate, sandstone or shale, that requires breaking by continuous drilling and blasting before excavation and removal. Rock also includes rocks having individual volumes in excess of 1.0 m^3, removed by blasting or other methods.

.2 Common excavation: Excavation of materials of whatever nature, which are not included under definitions of rock excavation.

.3 Unclassified excavation: Excavation of deposits of whatever character encountered in work.

.4 Topsoil: Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.

.5 Waste material: Excavated material unsuitable for use in work or surplus to requirements.

.6 Borrow material: Material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of work.

.7 Unsuitable materials:

.1 Weak and compressible materials under excavated areas.

.2 Frost susceptible materials under excavated areas.

.3 Frost susceptible materials:

.1 Fine grained soils with plasticity index less than 10 when tested to ASTM D 4318, and gradation within limits specified when tested to ASTM D 422 and ASTM C 136: Sieve sizes to CAN/CGSB-8.1.

.2 Table:

Sieve Designation	% Passing
2.00 mm	100
0.10 mm	45-100
0.02 mm	10-80
0.005 mm	0-45

.3 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.

.8 Unshrinkable fill: Weak mixture of Portland cement, concrete aggregates and water that resists settlement when placed in utility trenches, and capable of being readily excavated.

1.2 Related Work

.1 Section 02510: Yard Piping.

.2 Section 02631: Manholes and Catch Basins.

.3 Section 02701: Aggregates and Fill Materials.

.4 Section 02721: Granular Base

.5 Section 02723: Granular Sub-Base

1.3 Protection of Existing Features

.1 Existing buried utilities and structures:

.1 Size, depth and location of existing the utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.

.2 Prior to commencing excavation work, notify applicable authorities having jurisdiction, establish location and state of use of buried utilities and structures. The authorities having jurisdiction are to clearly mark such locations to prevent disturbance during work.

.3 Confirm locations of buried utilities by careful test excavations.

.4 Maintain and protect from damage, water, sewer, gas, electric, telephone, and other utilities and structures encountered as indicated.

.5 Where utility lines or structures exist in area of excavation, obtain direction of the Engineer before excavating.

.6 Record location of maintained, re-routed and abandoned underground lines.

.2 Existing buildings and surface features:

.1 Conduct, with the Engineer, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, pavement, survey bench marks and monuments which may be affected by work.

.2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair to the approval of the Engineer.

.3 Where required for excavation, cut roots or branches as approved by the Engineer.

1.4 Shoring, Bracing and Underpinning

.1 Comply with applicable local regulations and protect existing features.

.2 Refer to Section 02160 – Excavation Support Systems.

.3 Where required by Workers' Compensation Board, engage services of qualified professional engineer who is registered in the Province of British Columbia to design and inspect shoring, bracing, underpinning and temporary excavation slopes required for Work.

.4 At least 5 days prior to commencing Work, submit design and supporting data.

.5 Design and supporting data submitted to bear the stamp and signature of qualified professional engineer registered in the Province of British Columbia.

.6 Professional engineer responsible for design of temporary structures to submit proof of insurance coverage for professional liability except where engineer is employee of Contractor, in which case Contractor shall submit proof that work by professional engineer is included in Contractor's insurance coverage.

1.5 Samples

.1 At least 5 days prior to commencing Work submit to the Engineer gradation of the proposed fill materials.

.2 Submit samples in accordance with Section 01330 – Submittals.

1.6 Testing

.1 Refer to Section 01450 – Quality Control.

.2 Test rates and frequencies shall be at the following minimum frequencies

.1 Pipe Zone (Bedding / Surround)

.1 Compaction: 1 test / 25 lm of trench (at top of pipe zone).

.2 Backfilling

.1 Compaction: 2 tests / 50 lineal metres / 1.0 m depth of fill.

.2 Sieve: 1 test / material source / 1000 m^3.

.3 Granular Base

.1 Compaction: 1 test / 150 m^2 (approximately 50 m length).

.2 Sieve: 1 test / material source / 1000 m^3.

.4 Granular Subbase

.1 Compaction: 1 test / 150 m^2 (approximately 50 m length).

.2 Sieve: 1 test / material source / 1000 m^3.

2. PRODUCTS

No applicable.

3. EXECUTION

3.1 Site Preparation

.1 Remove obstructions, ice, and snow from surfaces to be excavated within limits indicated.

.2 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

.3 Strip topsoil from within limits of the excavation and stockpile separately, for re-use.

.4 Dispose of unused topsoil as directed by Engineer.

3.2 Stockpiling

.1 Stockpile fill materials in areas designated by the Engineer. Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

3.3 Shoring, Bracing and Underpinning

.1 Construct temporary works to depths, heights and locations as indicated.

.2 During backfill operation:

.1 Unless otherwise indicated or directed by the Engineer, remove sheeting and shoring from excavations.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.

.3 When sheeting is required to remain in place, cut off tops at elevations as indicated.

.4 Upon completion of substructure construction:

.1 Remove shoring and bracing.

.2 Remove excess materials from site as directed by the Engineer.

3.4 Dewatering

.1 Refer to Section 02401 - Dewatering.

.2 Dispose of water in accordance with Section 01561 - Environmental Protection and in manner not detrimental to public and private property, or any portion of work completed or under construction.

3.5 Excavation

.1 Advise the Engineer at least 7 days in advance of excavation operations.

.2 Excavate to lines, grades, elevations and dimensions required for construction.

.3 Excavation must not interfere with normal 45 degrees splay of bearing from bottom of any footing.

.4 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.5 For trench excavation, unless otherwise authorized by the Engineer in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.6 Dispose of surplus and unsuitable excavated material.

.7 Do not obstruct flow of surface drainage or natural watercourses.

.8 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.9 Notify the Engineer when bottom of excavation is reached.

.10 Obtain the Engineer's approval of completed excavation.

.11 Remove unsuitable material from trench bottom to extent and depth as directed by the Engineer.

.12 Correct unauthorized over-excavation as follows:

.1 Fill under bearing surfaces and footings with Type 1 fill compacted to 100% of Standard Proctor Density, or with lean mix fill concrete.

.2 Fill under other areas with Type 2 fill compacted to not less than 95% of Standard Proctor Density.

.3 Where over-excavation is authorized, provide estimated fill quantities to the Engineer prior to work. Payment to be made on an agreed-to unit price basis.

.13 Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of the Engineer.

3.6 Fill Types and Compaction

.1 Use fill of types as indicated or specified below. Compaction densities are percentages of maximum densities obtained from corrected maximum dry density.

.1 Exterior side of perimeter walls: Use Type 3 fill to subgrade level. Compact to 95% of Standard Proctor Density.

.2 Within building area: use Type 2 to underside of base course for floor slabs or as indicated. Compact to 100% of Standard Proctor Density.

.3 Trench backfill in untraveled areas: use Type 3 fill to underside of granular sub-base.

.4 Trench backfill in areas within paved road surface: use Type 2 fill to underside of granular sub-base.

.5 Compaction of trench backfill: compact bedding and immediate protective cover to 95% of Standard Proctor Density. Compact Type 2 fill to minimum 98% of Standard

Proctor Density. In untraveled areas, compact Type 3 fill to at least 90% of Standard Proctor Density.

3.7 Bedding and Surround of Underground Services

.1 Place and compact granular material for bedding and surround of underground services as indicated.

.2 Place bedding and surround material in unfrozen condition.

3.8 Backfilling

.1 Do not proceed with backfilling operations until the Engineer has inspected and approved installations.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer. Within 1000 mm of structures, use light compacting equipment.

.5 Backfill around installations.

.1 Do not backfill around or over cast-in-place concrete within 48 hours after placing of concrete.

.2 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 1 m.

.3 Where temporary unbalanced earth pressures are liable to develop on walls or other structures:

.1 Permit concrete to cure for minimum 7 days at a minimum temperature of 10 °C or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from the Engineer.

.2 If approved by the Engineer, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by the Engineer.

3.9 Inspection and Testing

.1 Testing of materials and compaction will be the responsibility of the Contractor.

.2 Refer to Section 01450 – Quality Control.

3.10 Restoration

.1 Upon completion of work, remove waste materials and debris, trim slopes, and correct defects.

.2 Replace topsoil. Refer to Section 02911- Planting Soil and Finish Grading.

.3 Reinstate pavement, curbs and lawn to elevation which existed before excavation.

.4 Clean and reinstate areas affected by work as directed by the Engineer.

.5 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

END OF SECTION

DEWATERING

1. GENERAL

1.1 Scope of Work

.1 Provide all labour, materials, tools and equipment to supply and install a dewatering system as required which will permit safe and proper execution of work and will result in obtaining a stable substantially dry sub-grade for execution of subsequent operations.

.2 Design dewatering system which will prevent erosion and loss of soil and settlement of structures.

.3 Install dewatering system to effect efficient construction of excavations.

.4 Obtain any required permits to install and operate dewatering system. Comply with all applicable regulations and environmental requirements.

.5 Install all necessary sediment control ponds and other sediment control devices associated with the discharge of water from the dewatering system.

1.2 Reference

.1 Refer to the Geotechnical Report in Appendix B of the Contract Documents

1.3 Related Work

.1 Section 01561: Environmental Protection

.2 Section 02315: Excavation, Trenching and Backfilling

1.4 Submittals

.1 Submit dewatering plan in accordance with Section 01330 – Submittals.

1.5 Qualifications of Subcontractors

.1 Work of this Section shall be executed only by a Contractor or Subcontractor who has adequate equipment and skilled tradesperson with proven experience in this type of work.

1.6 Protection

.1 Protect existing installations, including buildings, structures, sewers, water lines, fences, service poles, wires, underground services or paving located on this or adjoining properties from damage while work of this Section is in progress. Make good all damage resulting thereto to the satisfaction of the Engineer.

2. PRODUCTS

2.1 Material

.1 All equipment and materials used in the dewatering system and in its construction, shall be in good condition and capable of trouble-free continuous operation. No marginal design or equipment showing excessive wear will be accepted.

3. EXECUTION

3.1 Examination

.1 Examine the site and determine the nature and extent of material which will be dewatered and other pertinent site conditions. Review site survey and geotechnical subsoil investigation reports.

.2 No allowances will be made by the Owner for difficulties encountered or expenses incurred due to any site condition visible or known to exist prior to tender closing.

3.2 Design and Installation of Dewatering System

.1 The dewatering system shall be capable of controlling the water level below the ground surface, by any means required, with all wells, connecting pipes, sumps, pumps and other equipment necessary to meet the dewatering requirements specified herein.

.2 The dewatering system shall be capable of lowering the water level in advance of excavation to a minimum of 1.0 m below the excavation level at all times.

.3 Accomplish method and operation of dewatering system in a manner which will preserve the strength of the foundation soils and structures, will not cause instability of the excavation slopes, prevent seepage boils, softening of the soil strata and will not result in damage to existing structures.

.4 Should any damage to the work, in the opinion of the Engineer, be due to the inadequacy or failure of the dewatering system in part or in total, then supply of all labour, materials, and the performance of all work necessary to carry out additional or remedial work resulting from such damage shall be undertaken at no additional cost to the Owner.

.5 Install dewatering system so that there will be no loss of fines from the soil strata.

.6 Provide all necessary piezometers and observation wells suitable for accurately monitoring ground water levels during dewatering operations. Piezometers shall be capable of monitoring ground water levels at least 1.5 m below the design low ground water level during dewatering.

.7 Dispose of water in such a manner so as not to be detrimental to public health, environment, public and private property, or any portion of work completed or under construction.

.8 Insulate piping and fittings and provide shelter and heating as necessary to maintain dewatering system in operation during cold weather.

3.3 Discharge and Control of Water

.1 Water shall be disposed of so as not to be injurious to public health or safety, to property, to the environment or to any part of the work completed or under construction. Pumped water shall not be discharged directly to Morningstar Creek or local drainage channels. The pumped water shall be directed to a sediment control pond prior to discharge.

.1 Refer to the *Construction Environmental Impact Study* (AECOM, 2021) for dewatering and water quality guidelines.

.2 Refer to Section 01561. The Contractor's *Construction Environmental Management Plan* must identify how discharge, control of water, and environmental monitoring will be performed.

.2 Settling ponds, sediment basins and other sediment control devices shall be constructed and maintained in an effective, functioning and stable condition in accordance with local requirements.

3.4 Records

.1 Keep accurate records of the construction of the dewatering system.

.2 Keep records of piezometer water levels, quantity of water being pumped and number of pumps operating on a daily basis.

3.5 Maintenance and Removal of Dewatering System

.1 Maintain the dewatering system in good repair to perform its function at design capacity until the structure and related piping is complete to the satisfaction of the Engineer.

.2 Repair of damage done to structure or pipes and corrective measures necessary due to failure of the dewatering system or premature removal of the dewatering system shall be at the Contractors expense.

3.6 Cleaning

.1 Promptly as work proceeds and upon completion of work, remove all surplus materials, tools, equipment, and debris and leave place of work in a clean and tidy condition to complete satisfaction of Engineer.

END OF SECTION

YARD PIPING

1. GENERAL

1.1 Material Certification

.1 Submit manufacturer's test data and certification that pipe materials meet requirements of this Section at least 5 days prior to commencing Work. Include manufacturer's drawings, information and shop Drawings where pertinent.

1.2 Shop Drawings

.1 Submit shop Drawings in accordance with Section 01330 - Submittals.

.2 Provide data to produce record Drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of valves, hydrant details, maintenance and operating instructions in accordance with Section 01735 – Operating and Maintenance Data.

1.3 Scheduling of Work

.1 Schedule work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions to Engineer and Owner for approval and adhere to interruption schedule as approved by Engineer.

.3 Notify Engineer and Owner minimum of 24 h in advance of any interruption in service.

.4 Advise Owner and local police department of anticipated interference with movement of traffic.

1.4 Related Work

.1 Section 01561: Environmental Protection.

.2 Section 02315: Excavating, Trenching and Backfilling.

.3 Section 02401: Dewatering.

.4 Section 03300: Cast-in-Place Concrete.

2. PRODUCTS

2.1 Piping Identification

.1 The drawings designate the size and line service specification of all pipe and fittings to be supplied by the Contractor in the following manner.

.1 Line Identification is place on each line in the following manner:

1050 – SE – ST
Line Size: 1050 mm diameter
Commodity: SE
Pipe Material: ST

e.g. 750 mm line size, secondary clarifier effluent line, steel pipe.

.2 Commodity Symbols for Line Identification:

SYMBOL	COMMODITY
CULV	Culvert
DUF	Drain
DS	Digested Sludge
DW	Domestic Water
FE	Final Effluent
PE	Primary Effluent
PSW	Plant Service Water
PWD	Process Waste Drainage
PW	Potable Water
RSW	Reclaimed Service Water
SAN	Sanitary Drainage
SE	Secondary Effluent
STM	Storm Water
TWAS	Treated Waste Activated Sludge

.3 Pipe Material Symbols for Line Identification:

SYMBOL	PIPE MATERIAL
CSP	Corrugated Steel Pipe
PE	Polyethylene / HDPE
SPCSP	Structural Plate Corrugated Steel pipe

2.2 Piping Material, Joints and Fittings

.1 HDPE Pipe

.1 Commodity: as shown on Drawings

.2 Size and Location: as shown on Drawings.

.3 Material Specifications: ASTM D3350, F412, F714, D3035, D2321, F1668, F2620, D2657, D3261, F2206 and CSA 137.

.4 Pipe Rating: HDPE – DR17 (to PE4710 rating / ASTM F714)

.5 Fusion weld pipe segments to ASTM F2620.

.6 Fittings: DR 17 Fabricated fittings:

.1 90 deg. Elbows: Mitred five segment fittings

.2 45 deg. Elbows: Mitred three segment fittings

.3 22.5 deg. Elbows: Mitred two segment fittings

.4 Reducing Tees: Fabricated

.2 CSP Corrugated Steel Pipe (CSP)

.1 Commodity STM

.2 Size and Location: as shown on Drawings.

.3 Material: Pipe shall be in accordance with CSA G401

.4 Fittings: shall be in accordance with CSA G401

.5 Joints: bolted.

.3 Structural Plate Corrugated Steel pipe (SCCSP)

.1 Commodity STM

.2 Size and Location: as shown on Drawings.

.3 Material: Arch culvert system, including footings shall be in accordance with CSA G401. To be designed by pipe suppliers professional engineer registered with EGBC

.4 Fittings: shall be in accordance with CSA G401

.5 Joints: Bolted.

2.3 Pipe Bedding and Surround Material

.1 Refer to Section 02701 – Aggregates and Fill Materials.

.2 Concrete mixes and materials required for bedding cradles, encasement, supports, trench dams, thrust blocks: to Section 03300 - Cast-in-Place Concrete.

2.4 Backfill Material

.1 Refer to Section 02701 – Aggregates and Fill Materials.

2.5 MSE Headwalls

.1 To be designed by SCCSP pipe suppliers professional engineer registered with EGBC

2.6 Couplings

.1 Flexible coupling plain end: Dresser style 38, Robar or approved equal.

.2 Flange/flexible coupling: Dresser style 128, Robar or approved equal.

.3 Coat couplings with petroleum tape, mastic and paste.

.4 Stainless steel fasteners.

2.7 Joint Harnesses

.1 Dresser style 440 or approved equal.

.2 Provide number of joint harnesses as specified based on pipe diameter, bolt size and working pressure.

.3 Each joint harness to include: two lugs (minimum) welded to pipe, one deflection ring, steel tie-bolt and two nuts.

2.8 Coatings

.1 Refer to Paragraph 2.2 for interior and exterior coatings for pipe material.

2.9 Direct Bury Valve and Valve Box (≤150 mm diameter)

.1 Valves to open counter clockwise.

.2 Gate Valves:

.1 Material: to ANSI/AWWA C504, direct bury, short body, manual gear box, with combination handwheel, 50 mm square operating nuts, end flanges suitable to mating to ANSI B16.5 Class 150 flange joints.

.2 Manufacturer: Pratt, Clow or approved alternate.

.3 Size: as specified

.3 Valve Boxes

.1 Cast iron to City's standard..

2.10 Bolts and Nuts

.1 Bolts and nuts to ASTM A307, Grade B Steel, hex head style zinc plated to ASTM B633 unless specified otherwise. Coat exposed fasteners with petroleum tape, mastic and paste.

2.11 Pipe Disinfection

.1 Sodium hypochlorite or calcium hypochlorite to ANSI/AWWA B300 to disinfect water mains.

.2 All material that will come in contact with the potable water will be inspected and approved by the Owner.

3. EXECUTION

3.1 Preparation

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation. Carefully inspect Materials for defects to approval of Engineer. Remove defective Materials from Work Site as directed by Engineer.

3.2 Trenching

.1 Do trenching work in accordance with Section 02315 - Excavating, Trenching and Backfilling.

.2 Trench depth to provide cover over pipe of not less than 0.9 m from finished grade or as indicated.

.3 Trench alignment and depth require Engineer's approval prior to placing bedding material and pipe.

3.3 Granular Bedding

.1 Refer to Section 02701 – Aggregates and Fill Materials for granular bedding material.

.2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

.3 Do not place material in frozen condition.

.4 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.5 Shape transverse depressions in bedding as required to suit joints.

.6 Compact each layer full width of bed to minimum 95% Standard Proctor density in compliance with ASTM D698.

.7 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 02315 - Excavating, Trenching and Backfilling.

3.4 Pipe Surround

.1 Refer to Section 02701 – Aggregates and Fill Materials for granular pipe surround material.

.2 Upon completion of pipe laying and after Engineer has inspected Work in place, surround and cover pipes as indicated.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material within 2 m of pipe.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Do not place material in frozen condition.

.6 Compact each layer from pipe invert to mid height of pipe to minimum 95% Standard Proctor Density in compliance with ASTM D698.

.7 Compact each layer from mid height of pipe to underside of backfill to minimum 95% Standard Proctor Density in compliance with ASTM D698.

3.5 Pipe Installation

.1 Handle pipe in accordance with manufacturer's recommendations. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.

.2 Lay and join pipes to manufacturer's instructions and specifications except as noted otherwise herein.

.3 Horizontal tolerances: plus or minus 50 mm from specified alignment. Vertical tolerances: plus or minus 10 mm from specified grade. Reverse grade is not acceptable.

.4 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.5 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.6 Pipes on curved alignments:

.1 Concrete pipe and ribbed profile PVC plastic pipe. Do not exceed permissible joint deflection recommended by pipe manufacturer.

.7 Keep jointing material installed pipe free of dirt, water and other foreign materials. Whenever work is stopped, install removable watertight bulkhead at open end of last pipe laid to prevent entry of water and foreign materials.

.8 Cut pipes as required, as recommended by pipe manufacturer, without damaging pipe and leave smooth end at right angles to axis of pipe.

.9 Joints:

.1 Install gaskets as recommended by manufacturer.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Align pipes carefully before joining.

.4 Maintain pipe joints free from mud, silt, gravel and other foreign material.

.5 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.10 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as specified otherwise.

.11 When any stoppage of work occurs, restrain pipes in an approved manner to prevent "creep" during down time.

.12 Plug lifting holes with approved prefabricated plugs, to pipe supplier's recommendations for sealing methods.

.13 Make watertight connections to manholes. Use shrinkage compensating grout when suitable gaskets are not available. Core neat circular holes in walls of existing manholes. Do not hammer or chip except as approved by Engineer.

3.6 Connections to Existing Mainline Pipes

.1 Use prefabricated saddles or approved field connection materials and techniques to connect service pipes to existing mainline sewer pipes. Ensure joint structurally sound and watertight without encroachment into inner circle of mainline sewer pipe.

.2 Where feasible, make connections to existing non-reinforced or reinforced concrete mainline pipe by coring or sawing circular holes in existing pipe walls. Where not feasible, make as follows:

.1 Break in to pipe by drilling small diameter holes, spaced at approximately 50 mm along pipe axis, using a drill or chipping gun. Use hammer to strike concrete adjacent to centre holes to create small core, and similarly expand core to suit outside dimensions of stub.

.2 Core dimensions to allow maximum 20 mm clearance around stub at any point.

.3 Trim stub to conform closely to shape of pipe interior when installed.

.4 Insert stub into core, ensuring that no portion of stub protrudes beyond interior of pipe.

.5 Prepare non-shrink, fast-setting cementitious grout to "dry pack" consistency. Pack grout tightly into void between stub and pipe.

.6 Hand finish interior and exterior grout surfaces to smooth surface.

.7 Allow sufficient time for strength development of grout prior to installation of connecting pipe or trench backfill.

.3 For new connections to existing PVC mainline sewers, drill hole in mainline to exact dimension of new connection. Use saddle or insertable tee for connections more than two sizes smaller than mainline. Insertable tees may be used for all types of gravity mains provided insertable tee designed for applicable pipe thickness is used.

.4 For new connections to existing ribbed PVC pipe mainline sewers use preformed tee or wye fitting when connection is up two sizes smaller than mainline pipe. For these pipes, in-situ installations of tees or wyes involving cutting across pipe ribs not permitted. For connections more than two sizes smaller than mainline pipe, an insertable tee for ribbed PVC pipe is permitted. When an insertable tee is used, hole cut into mainline pipe to cut as few ribs as possible.

3.7 Backfill

.1 Place and compact backfill material in accordance with Section 02315 - Excavating, Trenching and Backfilling.

3.8 Field Testing

.1 Testing of lines to be carried out in presence of Engineer.

.2 Strut and brace caps, bends and tees, to prevent movement when test pressure is applied.

.3 Expel air from lines, by slowly filling lines water. High points to be drilled and tapped and suitable cocks installed to vent air and to be shut when pressure is applied. Remove cocks after satisfactory completion of test and seal holes with tight fitting plugs.

.4 Apply hydrostatic test pressure of 200 kPa for main process pumped lines and 1000 kPa for non-potable water (NPW) and reclaimed water (RW) lines.

.5 No leakage permitted for welded steel lines, non-potable and reclaimed water lines.

.6 Apply air test of 25 kPA per joint for concrete pipe.

.7 Apply pressure for 1 h for pressure test and 2 h for leakage test.

.8 Examine exposed pipe, joints and fittings while system is under pressure.

.9 Remove defective joints, pipe and fittings and replace with new sound material.

.10 Define leakage as amount of water supplied from meter in order to maintain test pressure for 2 h.

.11 Do not exceed allowable leakage as defined in ANSI/AWWA C600.

.12 Locate and repair defects if leakage is greater than amount specified in Article 3.9.10.

.13 Repeat test until leakage is within specified allowance.

.14 Complete backfill.

.15 Repeat test after completing backfill. Locate and repair defects and backfill. Repeat tests, repairs and backfills as needed until leakage is less than amount specified in 3.9.10.

3.9 CCTV Inspection

.1 Undertake CCTV inspection of all yard piping and submit certified report after installation and testing of pipe.

3.10 Cleaning and Flushing

.1 Before flushing and testing, ensure sewer system is completely finished and make arrangements with Engineer for scheduling of testing.

.2 Remove foreign material from pipe and related appurtenances by flushing with water. Main to be flushed at water velocities as high as can be obtained from available water source. Continue flushing at least until flow from most distant point has reached discharge point and until water discharges is clean and clear.

END OF SECTION

AGGREGATES AND FILL MATERIALS

1. GENERAL

1.1 Description

.1 This section covers those portions of the work that are related to the supply and placing of aggregates and geosynthetics.

.2 Aggregates for Portland cement concrete and hot mix asphalt concrete paving are specified elsewhere.

1.2 Related Work

.1 Section 02315: Excavation, Trenching and Backfilling

.2 Section 02510: Yard Piping

.3 Section 02721: Granular Base

.4 Section 02723: Granular Sub-Base

1.3 Standards

.1 ASTM D2276/D4718 Practice for the Correction of the Unit Weight and Water Content for Soils Containing Oversize Particles.

.2 ASTM C136-06, Method of Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-63 (2007), Method of Particle-Size Analysis of Soils.

.4 ASTM C88, Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulphate.

.5 ASTM D4354 Standard Practice for Sampling of Geosynthetics.

1.4 Submittals

.1 Submit sieve analysis test results for all aggregates and fill materials.

2. PRODUCTS

2.1 Materials – General

.1 Gravel to be composed of inert, durable material, reasonably uniform in quality and free from soft or disintegrated particles. In absence of satisfactory performance records over a five year period for particular source of material, soundness to be tested according to ASTM C88 or latest revised issue. Maximum weight average losses of coarse and fine aggregates to be 30% when magnesium sulphate is used after five cycles.

.2 All crushed gravel when tested according to ASTM C136 and ASTM C117, or latest revised issue, to have generally uniform gradation and conform to following gradation limits and 60% of the material passing each sieve must have one or more fractured faces.

Determination of the amount of fractured material shall be in accordance with the Ministry of Transportation and Highways' SpecificationI-11, Fracture Count for Coarse Aggregate, Method "A" which determines fractured faces by count. The Plasticity Index for crushed gravel to not exceed 6.0.

2.2 Native Material

.1 To be any workable soil free of organic or foreign matter; any material obtained within limits of Contract may be deemed native material for use if it is approved by the Engineer. Native material is not acceptable if it is impracticable to control its water content or compact to specified density.

2.3 Pit Run Gravel

.1 Well-graded granular material, substantially free from clay lumps, organic matter and other extraneous material, screened to remove all stones in excess of maximum diameter specified in material description. Materials to be compacted to specified density and conform to the following gradations:

Sieve Designation	Percent Passing
75 mm	100
50 mm	70-100
25 mm	50-100
19 mm	75-100
4.75 mm	22-100
2.36 mm	10-85
0.075 mm	2-8

2.4 Pit Run Sand

.1 Well-graded pit run sand, free from organic materials and conform to the following gradations:

Sieve Designation	Percent Passing
12.5 mm	100
4.75 mm	35-100
2.36 mm	20-70
1.18 mm	13-50
0.60 mm	8-35
0.30 mm	5-25
0.150 mm	2-15
0.075 mm	0-6

2.5 Drain Rock

.1 To consist of clean round stone or crush rock conforming to the following gradations:

Sieve Designation	% Passing	
	Coarse	Fine (Torpedo Gravel)
25 mm	100	-
19 mm	0-100	-
9.5 mm	0-5	100
4.75 mm	0	50-100
2.36 mm	-	10-35
1.18 mm	-	5-15
0.600 mm	-	0-8
0.300 mm	-	0-5
0.150 mm	-	0-2
0.075 mm	-	-

.2 Drain rock to be used only where specified on Drawings or in Specifications. Use of drain rock other than as specified requires approval of Engineer after examination of soils against which drain rock will be placed.

2.6 Granular Pipe Bedding and Surround Material

.1 Crushed or graded gravels conforming to the following gradations:

Sieve Designation	Percent Passing
25 mm	100
19 mm	90-100
12.5 mm	65-85
9.5 mm	50-75
4.75 mm	25-50
2.36 mm	10-35
1.18 mm	6-26
0.600 mm	3-17
0.300 mm	-
0.075 mm	0-5

2.7 Granular Pipe Bedding and Surround Material (for Coated Steel Pipe)

.1 Pit run sand as per Item 2.4.

2.8 Type 1 Material

.1 Crushed, pit run or screened stone, gravel or stand.

Sieve Designation	Percent Passing
25 mm	100
19 mm	75-100
12.5 mm	-
9.5 mm	50-100
4.75 mm	30-70
2.36 mm	20-45
1.18 mm	6-26
0.425 mm	10-25
0.180 mm	-
0.075 mm	3-8

2.9 Backfill

.1 Travelled Roads / Gravel Areas: Type 2 fill – imported granular material (pit run gravel).

.2 Non-Travelled Areas: Type 3 fill – select material from excavation or other sources, approved by the Engineer for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

2.10 Granular Sub-base

.1 To be 75 mm crushed gravel conforming to the following gradations:

Sieve Designation	Percent Passing
75 mm	100
38 mm	60-100
25 mm	-
19 mm	35-80
12.5 mm	-
9.5 mm	26-30
4.75 mm	20-40
2.36 mm	15-30
1.18 mm	10-20
0.600 mm	5-15
0.300 mm	3-10
0.075 mm	0-6

2.11 Granular Base

.1 To be 19 mm crushed gravel conforming to the following gradations:

Sieve Designation	Percent Passing
19 mm	100
12.5 mm	75-100
9.5 mm	60-90
4.75 mm	40-70
2.36 mm	27-55
1.18 mm	16-42
0.600 mm	8-30
0.300 mm	5-20
0.075 mm	2-8

2.12 Unshrinkable Fill (Lean Concrete)

.1 Proportioned and mixed to provide:

.1 Maximum compressive strength of 0.8 MPa at 28 days

.2 Maximum Portland cement content of 25 kg/m

.3 Minimum strength of 0.02 MPa at 24 h

.4 Concrete aggregates: To CAN/CSA-A23.1

.5 Portland cement: Type 10

.6 Slump: 160 to 200 mm

2.13 Geosynthetics

.1 Geofabric intended for use under access roads, or as a trench lining to be placed around the pipe cushion in areas of soft soils will be:

.1 BX 1100 (manufactured by Tensar Corporation).

.2 Filter fabric to prevent the migration of fines, will be:

.1 Geotex 351 (Manufactured by Propex Geosynthetics)

3. EXECUTION

3.1 Handling and Placement

.1 Handle and transport aggregates to avoid segregation contamination and degradation.

.2 Do not use intermixed and contaminated materials.

3.2 Installation of Geosynthetics

.1 The fabric is to be overlapped at joints with a minimum lap length of 600 mm. Tears and punctures are to be repaired by pinning or stapling a square patch of fabric equal in size to the defect plus the minimum lap length of 600 mm on all four sides.

.2 Passage of any vehicles directly over geosynthetic materials is no permitted at any time.

END OF SECTION

GRANULAR BASE

1. GENERAL

1.1 Description

.1 This Section specifies requirements for supplying, producing and placing crushed gravel or quarried stone as granular base to the lines, grades and typical cross-sections as shown or directed by the Engineer.

2. PRODUCTS

2.1 Materials

.1 Refer to Section 02701 – Aggregates and Fill Materials.

3. EXECUTION

3.1 Placing

.1 Construct granular sub-base to depth and grade in areas indicated.

.2 Ensure excavation is free of water prior to and during placement.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow or ice.

.5 Place granular sub-base materials using methods which do not lead to segregation or degradation.

.6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

.7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.8 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 Compaction

.1 Compaction equipment is to be capable of obtaining required material densities.

.2 Compact to a density of not less than 100% Standard Proctor Density in accordance with ASTM D698.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.4 Apply water as necessary during compaction to obtain specified density.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.

.6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 Site Tolerances

.1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

3.4 Protection

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by the Engineer.

END OF SECTION

GRANULAR SUB-BASE

1. GENERAL

1.1 Description

.1 This Section specifies requirements for supplying, producing and placing crushed gravel or quarried stone as granular sub-base to the lines, grades and typical cross-sections as shown or directed by the Engineer.

2. PRODUCTS

2.1 Materials

.1 Refer to Section 02701 Aggregates and Fill Materials.

3. EXECUTION

3.1 Placing

.1 Construct granular sub-base to depth and grade in areas indicated.

.2 Ensure excavation is free of water prior to and during placement.

.3 Ensure no frozen material is placed.

.4 Place material only on clean unfrozen surface, free from snow or ice.

.5 Place granular sub-base materials using methods which do not lead to segregation or degradation.

.6 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. The Engineer may authorize thicker lifts (layers) if specified compaction can be achieved.

.7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.8 Remove and replace portion of layer in which material has become segregated during spreading.

3.2 Compaction

.1 Compaction equipment is to be capable of obtaining required material densities.

.2 Compact to a density of not less than 100% Standard Proctor Density in accordance with ASTM D698.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.

.4 Apply water as necessary during compaction to obtain specified density.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.

.6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

3.3 Site Tolerances

.1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

3.4 Protection

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by the Engineer.

END OF SECTION

HOT MIX ASPHALT CONCRETE

1. GENERAL

1.1 Product Data

.1 Submit viscosity-temperature chart for asphalt cement to be supplied showing either Saybolt Furol viscosity in seconds or Kinematic Viscosity in centistokes, temperature range 105 to 175 °C at least 5 days prior to commencing work.

.2 Submit the manufacturer's test data and certification that asphalt cement meets requirements of this section, upon request.

1.2 Samples

.1 Submit asphalt concrete mix design to Engineer for review prior to commencing work.

1.3 Measurement for Payment

.1 Payment for asphalt concrete is based on placed area.

2. PRODUCTS

2.1 Materials

.1 Asphalt cement: to CGSB 16-GP-3M90, Grade 80-100.

.2 Aggregate material to following requirements:

.1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117.

Sieve Size	% Passing Lower Course	% Passing Upper Course
25 mm	100	-
19 mm	-	100
12.5 mm	70-85	84-99
9.5 mm	-	73-88
4.75 mm	40-65	50-68
2.36 mm	32-53	35-55
1.18 mm	26-44	27-46
0.6 mm	18-36	18-36
0.3 mm	10-26	10-26
0.15 mm	4-17	4-17
0.075 mm	3-8	3-8

.3 Coarse aggregate is aggregate retained on 4.75 mm sieve and fine aggregate is aggregate passing 4.75 mm sieve when tested to ASTM C136.

.4 Do not use aggregates having known polishing characteristics in mixes for surface courses.

.5 Sand equivalent: ASTM D2419-74 (1979). Min: 50.

.6 Magnesium Sulphate soundness: ASTM C88. Max % loss by mass after 5 cycles:

.1 Coarse aggregate: 20.

.2 Fine aggregate: 18.

.7 Los Angeles degradation Gradation B. ASTM C131. Max % loss by mass:

.1 Coarse aggregate: 35.

.8 Absorption: ASTM C127. Max % by mass:

.1 Coarse aggregate: 2.0.

.9 Loss by washing: ASTM C117. Max % passing 0.075 mm sieve:

.1 Coarse aggregate: 1.5.

.10 Lightweight particles: ASTM C123. Max % by mass less than 1.95 relative density:

.1 Coarse Aggregate: 1.5.

.11 Flat and elongated particles: (with length to thickness ratio greater than 5): Max % by mass:

.1 Coarse aggregate: 15.

.12 Crushed fragments: at least 70% of coarse aggregate particles by mass to have at least 2 freshly fractured face.

.13 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.

.3 Mineral filler:

.1 Finely ground particles of limestone, hydrated lime, Portland cement or other approved non-plastic mineral matter, thoroughly dry and free from lumps.

.2 Add mineral filler when necessary to meet job mix aggregate gradation or as directed to improve mix properties.

.3 Mineral filler to be dry and free flowing when added to aggregate.

2.2 Mix Design

.1 Design of mix: by Marshall method to requirements below and as directed by Engineer.

.1 Compaction blows on each face of test specimens: 75.

.2 Mix physical requirements:

.1 Voids in mineral aggregate: 14.

.2 Air voids in compacted pavement: 3-5%.

.3 Marshall load at 60 C:

for 80-100: 7,000
for 150-200: 6,000
for 200-300: 6,000

.4 Index of retained stability: 75% minimum.

.3 Measure physical requirements as follows:

.1 Marshall load and flow value: to ASTM D1559.

.2 Compute void properties on basis of bulk specific gravity of aggregate (to ASTM C127 and ASTM C128). Make allowance for volume of asphalt absorbed into pores of aggregate.

.3 Air voids: to ASTM D3203.

.4 Index of Retained Stability: measure by Marshall Immersion Test.

.4 Do not change job-mix without prior approval of Engineer. Should change in material source be proposed, new job-mix formula to be reviewed by Engineer.

3. EXECUTION

3.1 Equipment

.1 Pavers: To OPSS 310, mechanical self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.

.2 Rollers: Sufficient number of type and weight to obtain specified density of compacted mix.

.3 Vibratory rollers, to OPSS 310:

.1 Minimum drum diameter: 1200 mm.

.2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.

.4 Haul trucks: Sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:

.1 Boxes with tight metal bottoms.

.2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.

.3 In cool weather or for long hauls, insulate entire contact area of each truck box.

.4 Use only trucks which can be weighed in single operation on scales supplied.

.5 Hand tools:

.1 Lutes or rakes with covered teeth for spreading and finishing operations.

.2 Tamping irons having mass not less than 12 kg and bearing area not exceeding 310 cm for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by the Engineer, may be used instead of tamping irons.

.3 Straight edges, 4.5 m in length, to test finished surface.

3.2 Preparation

.1 Reshape granular roadbed base to tolerances required.

.2 When paving over existing asphalt surface, clean pavement surface. When levelling course is not required, patch and correct depressions and other irregularities before beginning paving operations.

.3 Prior to laying mix, clean surfaces of loose and foreign material.

3.3 Transportation of Mix

.1 Transport the mix to the job site in vehicles cleaned of foreign material.

.2 Paint or spray the truck beds with limewater, soap or detergent solution, or non petroleum based commercial product, at least daily or as required. Elevate the truck bed and thoroughly drain. No excess solution to remain in truck bed.

.3 Schedule delivery of material for placing in daylight, unless sufficient (50 lumens minimum) artificial light.

.4 Deposit mix from surge or storage silo to trucks in multiple drops to reduce segregation. Do not dribble mix into trucks.

.5 Deliver material to paver at uniform rate and in an amount within capacity of paving and compacting equipment.

.6 Deliver loads continuously in covered vehicles and immediately spread and compact. Deliver and place mixes at temperature within range compatible with mix design and paving equipment, but not less than 135 °C.

3.4 Placing

.1 Obtain the Engineer’s approval of base and existing surface and prior to placing asphalt.

.2 Place asphalt concrete to thicknesses, grades and lines as indicated.

.3 Place asphalt concrete in compacted lift less than or equal to 50 mm.

.4 Where possible, do tapering and leveling where required in lower lifts. Overlap the joints by not less than 300 mm.

.5 On larger paved areas, commence spreading at high side of pavement or at crown and span crowned centerlines with initial strip.

.6 Spread and strike off mixture with self propelled mechanical finisher.

.1 Construct longitudinal joints and edges true to line markings. Establish lines for paver to follow parallel to centerline of proposed pavement. Position and operate paver to follow established line closely.

.2 When using pavers in echelon, have first paver follow marks or lines, and second paver follow edge of material placed by first paver. Work pavers as close together as possible and in no case permit them to be more than 30 m apart.

.3 Maintain constant head of mix in auger chamber of paver during placing.

.4 If segregation occurs, immediately suspend spreading operation until cause is determined and corrected.

.5 Correct irregularities in alignment left by paver by trimming directly behind machine.

.6 Correct irregularities in surface of pavement course directly behind paver. Remove by shovel or lute excess material forming high spots. Fill and smooth indented areas with hot mix. Do not broadcast material over such areas.

.7 Do not throw surplus material on freshly screeded surfaces.

.7 When hand spreading is used:

.1 Use wood or steel forms, rigidly supported to assure correct grade and cross section. Use measuring blocks and intermediate strips to aid in obtaining required cross-section.

.2 Distribute material uniformly. Do not broadcast material.

.3 During spreading operation, thoroughly loosen and uniformly distribute material by lutes or covered rakes. Reject material that has formed into lumps and does not break down readily.

.4 After placing and before rolling, check surface with templates and straightedges and correct irregularities.

.5 Provide heating equipment to keep hand tools free from asphalt. Control temperature to avoid burning material. Do not use tools at higher temperature than temperature of mix being placed.

3.5 Compacting

.1 Do not change rolling pattern unless mix changes or lift thickness changes.

.2 Roll asphalt continuously to achieve required density of not less than 98% blow Marshall density in accordance with ASTM-D1559.

.3 General:

.1 Provide at least two rollers and as many additional rollers as necessary to achieve specified pavement density. When more than two rollers are required, one roller must be pneumatic tired type.

.2 Start rolling operations as soon as placed mix can bear weight of roller without excess displacement of material or cracking of surface.

.3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/hr. for breakdown and intermediate rolling for static steel-wheeled and pneumatic tired rollers. Do not exceed 9 km/hr. for finish rolling.

.4 Use static compaction for leveling coarse less than 25 mm thick.

.5 For lifts 50 mm thick and greater, adjust speed and vibration frequency of vibratory rollers to produce minimum of 25 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing not to exceed compacted lift thickness.

.6 Overlap successive passes of roller by minimum of 200 mm and vary pass lengths.

.7 Keep wheels of roller slightly moistened with water to prevent pick-up of material, but do not over-water.

.8 Do not stop vibratory rollers on pavement that is being compacted with vibratory mechanism operating.

.9 Do not permit heavy equipment or rollers to stand on finished surface before it has been compacted and has thoroughly cooled.

.10 After traverse and longitudinal joints and outside edge have been compacted, start rolling longitudinally at low side and progress to high side. Ensure that all points across width of pavement receive essentially equal numbers of passes of compactors.

.11 When paving in echelon, leave unrolled 50 to 75 mm of edge which second paver is following and roll when joint between lanes is rolled.

.12 Where rolling causes displacement of material, loosen affected areas at once with lutes or shovels and restore to original grade of loose material before re-rolling.

.4 Breakdown rolling:

.1 Commence breakdown rolling with static steel wheeled roller vibratory roller immediately following rolling of transverse and longitudinal joint and edges.

.2 Operate rollers as close to paver as necessary to obtain adequate density without causing undue displacement.

.3 Operate breakdown roller with drive roll or wheel nearest finishing machine. When working on steep slopes or super-elevated sections use operation approved by the Engineer.

.4 Employ only experienced roller operators.

.5 Finish rolling:

.1 Accomplish finish rolling with two-axle or three-axle tandem steel wheeled rollers while material is still warm enough for removal of roller marks. If necessary to obtain desired surface finish, use pneumatic-tired rollers as directed by the Engineer.

.2 Conduct rolling operations in close sequence.

.6 Dust entire area of sheet asphalt pavements with hydrated lime immediately after rolling to eliminate tendency to pick-up under traffic.

3.6 Joints

.1 General:

.1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.

.2 Construct joints between asphalt concrete pavement and Portland cement concrete pavement as indicated.

.3 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.

.2 Transverse joints:

.1 Offset transverse joint in succeeding lifts by at least 600 mm.

.2 Cut back to full depth vertical face and tack face with thin coat of hot asphalt prior to continuing paving.

.3 Compact transverse joints to provide smooth riding surface. Use methods to prevent rounding of compacted surface at joints.

.3 Longitudinal joints:

.1 Offset longitudinal joints in succeeding lifts by at least 150 mm.

.2 Cold joint is defined as joint where asphalt mix is placed, compacted and left to cool below 100°C prior to paving of adjacent lane.

.1 If cold joint can not be avoided, cut back by saw cutting previously laid lane, by at least 150 mm, to full depth vertical face, and tack face with thin coat of hot asphalt of adjacent lane.

.3 Overlap previously laid strip with spreader by 25 to 50 mm.

.4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with lute or rake.

.5 Roll longitudinal joints directly behind paving operation.

.6 When rolling with static or vibratory rollers, have most of drum width ride on newly placed lane with remaining 150 mm extending onto previously placed and compacted lane.

.4 Construct feather joints so that thinner portion of joint contains fine graded material obtained by changed mix design or by raking out coarse aggregate in mix. Place and compact joint so that joint is smooth and without visible breaks in grade. Location of feather joints as indicated.

.5 Construct butt joints as indicated.

3.7 Finish Tolerances

.1 Finished asphalt surface to be within 5 mm of design elevation but not uniformly high or low.

.2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with 4.5 m straight edge placed in any direction.

3.8 Defective Work

.1 Correct irregularities which develop before completion of rolling by loosening surface mix and removing or adding material as required. If irregularities or defects remain after final compaction, remove surface course promptly and lay new material to form true and even surface and compact immediately to specified density.

.2 Repair areas showing checking, rippling, or segregation.

.3 Adjust roller operation and screed settings on paver to prevent further defects such as rippling and checking of pavement.

END OF SECTION

CHAIN LINK FENCES AND GATES

1. GENERAL

1.1 Description

.1 This section specifies requirements for chain link fences and gates.

1.2 Location

.1 The location of the chain link fences and gates is shown on the Drawings.

1.3 Quality Assurance

.1 Fence erection shall be carried out by experienced fence construction personnel.

.2 Supply materials to CGSB-138.1.

2. PRODUCTS

2.1 Fabric

.1 Fabric height of 2.4 m.

.2 Chain Link 50 mm x 50 mm mesh with 3.5 mm thick wire, galvanized with an average of 490 g of zinc per m^2 of surface area (Grade 1).

.3 Wire to conform to ASTM-A817.

2.2 Wire

.1 Tension wire - 5 mm galvanized.

2.3 Posts and Rails

.1 Terminal posts, line posts, braces and rails to ASTM-A53.

.2 Line Posts - 60 mm O.D. c/w tops.

.3 Terminal Posts - for ends, gates and corners - 90 mm with gate posts as specified in Article 2.5.

.4 Top Rail - 45 mm O.D. standard galvanized pipe.

.5 Bracing - 45 mm O.D. standard galvanized pipe.

.6 Posts heights to be suitable for hole depths specified.

.7 For installation of posts on lock block wall, provide minimum 200 square end plate c/w gussets and hilti connection to block.

2.4 Fittings

.1 Top rail ends, brace bands, tension bars, arms, tops, sleeves, hinges and latches in accordance with Frost fence details.

.2 All fittings to be hot dipped galvanized steel or cast aluminum.

.3 Terminal and gate posts to have dome tops.

.4 Fasteners - 5 mm aluminum or 3 mm steel.

.5 Stretcher Bars - min 5 x 20 steel.

2.5 Gates

.1 Gates to be framed with steel pipe ASTM-A120 standard weight galvanized after welding. Use 45 mm O.D. pipe for outside frame and 35 mm O.D. pipe for bracing.

.2 Gate fabric to be the same as fence fabric.

.3 Gate posts to conform to the following:

Opening	Gate Post O.D.
Single to 3.0 m and Double to 6.0 m	90 mm
Single from 3.0 to 4.2 m double to 8.5 m	114 mm
Single from 4.3 m to 7.6 m and double from 8.5 m to 12 m	170 mm

.4 Gate hardware to include galvanized malleable iron hinges, lockable hatch and latch catch.

.5 Double gates to have centre rest with drop bolt for closed position and chain hold - open for open position.

.6 Gate braces to be 45 mm O.D. galvanized steel.

2.6 Security Gate

.1 Refer to Section 02825 – Cantilevered Access Gate.

2.7 Concrete

.1 Compressive strength 20 MPa at 28 days.

.2 Use type 10 normal cement.

3. EXECUTION

3.1 General

.1 Install fence to CGSB-138.3.

3.2 Grading

.1 Remove debris and grade between posts to provide ground clearance between 40 mm and 70 mm.

3.3 Post Setting

.1 Line post holes to be 1000 mm deep, 250 mm diameter.

.2 Terminal post holes to be 1200 mm deep, 300 mm diameter.

.3 Line posts to be spaced maximum 3.0 m.

.4 Set posts in line and plumb so that the fence forms a straight line between corner posts.

.5 Set posts in concrete and extend concrete above grade for drainage.

.6 Install straining posts where required.

.7 Refer to site conditions for drilling and anchoring posts into rock. Drill holes into rock and set posts with not-shrink grout.

3.4 Fence Erection

.1 Allow concrete to cure sufficiently before erecting fence - minimum 5 days.

.2 Set braces between end posts, gate posts and line posts.

.3 Set fittings in place and stretch fabric in place.

.4 Install top rail and fasten to posts with caps.

.5 Secure fabric with tie wires at 450 mm intervals.

3.5 Gate Installation

.1 Locations and sizes of gates are shown on the Drawings.

.2 Set gate bottom 40 mm above ground surface.

3.6 Cleanup

.1 Touch up damaged galvanized by cleaning with a wire brush and applying two (2) coats of touch up paint for galvanized metal.

.2 Clean up debris and earth removed from posts holes and trim areas disturbed.

END OF SECTION

HYDRAULIC SEEDING

1. GENERAL

1.1 Scope of Work

.1 Furnish all labour, products and equipment required for grass hydro seeding of disturbed and finished project area.

1.2 Related Work

.1 Section 02311: Site Grading.

.2 Section 02911: Planting Soil and Finish Grading.

1.3 Scheduling

.1 Schedule hydro seeding to coincide with preparation of soil surface and as designated by the Engineer.

1.4 Delivery, Storage and Protection

.1 Protect all seeded areas against trespassing and from damage at all times. Repair seeded areas that are damaged, as required by the Owner.

.2 Protect existing Work Site features against damage or contamination due to Work of this Section. Make good damage or contamination which occurs.

.3 Deliver seeds, mulch, fertilizers, tackifier and other products to the Work Site in manufacturer's original containers, clearly identified.

.4 Store in weatherproof storage areas. Protect from water damage.

.5 Repair any damage to the satisfaction of the Engineer.

2. PRODUCTS

2.1 Materials

.1 Granular Fertilizer: standard approved brands delivered in original containers, bearing manufacturer's guaranteed analysis, dry and free-flowing, organic base, conforming to the applicable Provincial Fertilizer Laws, not less than 3% Nitrogen, 15% Phosphoric Acid and 6% Potash (3-15-6).

.2 Slow-Release Turf Starter Fertilizer: Not less than 16% Nitrogen, 32% Phosphate, 6% Potash. (16-32-6). Recommended - Pro (16-32-6) 50% P.S.C.U.

.3 Slow Release Maintenance Fertilizer: Not less than 23% Nitrogen, 3% Phosphate, and 23% Potash. (23-3-23).

.4 Grass Seed: Mixed and supplied by a recognized seed house and delivered in original containers clearly showing:

.1 Name of supplier.

.2 Analysis of seed mixture.

.3 Percentage of pure seed.

.4 Year of production.

.5 Net weight (mass).

.6 Date and location of bagging.

.5 Seed to be in accordance with Federal and Provincial seed laws having a minimum germination of 75% and minimum purity of 97%.

.6 Grass Seed Mix for Landscaped Areas:

.1 5% Highland Bentgrass.

.2 20% Kentucky Bluegrass.

.3 45% Creeping Red fescue.

.4 30% Annual Ryegrass.

Apply at rate of 2.4 kg seed per 100 m^2.

.7 The Engineer may test seed for purity and germination.

.8 Hydro seeded areas into which any other varieties of grass have been introduced will not be accepted.

.9 Hydro seeding Mulch: Provide hydro seeding solution containing a mulch of wood cellulose fibre specifically designed for hydraulic seeding containing no growth or germination inhibiting factors, and dyed green for visual metering during application.

.10 Tackifier: Provide a dry powdered muciloid designed for hydro seeding.

.11 Dolomite Lime: Provide finely ground dolomite lime, containing not less than 90% calcium carbonate.

3. EXECUTION

3.1 Soil Preparation

.1 Grades:

.1 Complete Work Site grading in accordance with Section 02911 – Planting Soil and Finish Grading and approval of Engineer prior to hydro seeding.

.2 Restore all areas to be seeded which are misshapen or eroded to specified condition, grade, slope as directed just prior to seeding. Minor adjustment and refinement of finish grade to be made as directed by the Engineer.

.3 Obtain approval of the Engineer of finish grading prior to proceeding.

.2 Clearing:

.1 Remove all weeds, briars, debris and other material detrimental to the growth of the grass.

3.2 Application

.1 Scheduling: Carry out seeding of grass during periods which are most favourable for the establishment of a healthy stand of grass.

.2 All seeding to be done during calm weather and on soil that is free of frost, snow, and standing water.

.3 One week prior to seeding, apply dolomite lime uniformly over the area at a rate necessary to bring the pH to a minimum level of 6.5. Work well into top 50 mm of soil.

.4 Seeding Procedure:

.1 Apply with equipment designed for hydraulic seeding, a uniform solution in water of:

.1 Grass seed rate:

.1 224 kg/ha (2.24 kg/100 m^2).

.2 Fertilizer rate:

.1 448 kg/ha (4.48 kg/100 m^2).

.3 Fibre Mulch rate:

.1 2240 kg/ha (22.4 kg/100 m^2).

.4 Tackifier rate:

.1 134 kg/ha (1.34 kg/100 m^2).

.5 Ensure uniform distribution of the solution over the area.

.5 Germination:

.1 Follow up hydro seeding with all maintenance procedures as required to maintain the approved grades and obtain uniform germination. These shall include:

.2 Spray as required by weather conditions to maintain seed and mulch in a moist condition.

.3 Reseed areas damaged or having inadequate germination.

.6 Clean up:

.1 Remove from the Work Site all surplus material and other debris resulting from seeding operations.

.2 Flush all walks and paved areas clean to the satisfaction of the Engineer.

3.3 Maintenance during Establishment Period

.1 Perform following operations from time of seed application until acceptance by Engineer:

.1 Grass Mixture:

.1 Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.

.2 Mow grass to 40 mm whenever it reaches height of 60 mm. Remove clippings which will smother grass.

.3 Fertilize seeded areas after first cutting 10 weeks after germination provided plants have mature true leafs in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles.

.4 Eliminate weeds by manual, mechanical or chemical means.

.1 Comply with Federal, Provincial and Municipal control regulations if chemical means are used.

.5 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.

3.4 Acceptance

.1 Seeded areas will be accepted by Engineer provided that:

.1 Seeded areas are free of rutted, eroded, bare or dead spots and free of weeds.

.2 Areas have been fertilized.

.2 Areas seeded in fall will be accepted in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

END OF SECTION

DUCT BANKS AND MANHOLES

1. GENERAL

1.1 Description

.1 This section specifies the supply and installation of concrete duct banks and its general requirements.

1.2 Related Work

.1 Section 02315 – Excavating, Trenching and Backfilling

.2 Section 03100 – Concrete Formwork

.3 Section 03200 – Concrete Reinforcement

.4 Section 03300 – Cast-in-Place Concrete

.5 Section 04100 – Mortar and Grout for Masonry

1.3 Shop Drawings and Product Data

.1 Submit shop drawings for precast manholes in accordance with Section 01330 - Submittals.

2. PRODUCTS

2.1 PVC Ducts

.1 PVC ducts, type DB2, encased in reinforced red concrete.

2.2 PVC Duct Fittings

.1 Rigid PVC opaque solvent welded type couplings, bell end fittings, plugs, caps, adaptors as required to make complete installation.

.2 Expansion joints.

.3 Rigid PVC 5° angle couplings.

2.3 Pre-Cast Concrete Manholes

.1 Precast concrete manholes and auxiliary sections fabricated in steel forms.

.2 Aggregates: to CAN3-A23.1.

.3 Cement: to CAN3-A5, Type 30.

.4 Steel welded wire fabric mesh reinforcing: to CSA G30.3. Openings and critical areas trimmed with steel reinforcing bars: to CSA G30.12.

.5 Pulling inserts and bolts for racks integrally cast in concrete: to ANSI/ACI-347-78.

.6 Neoprene gasket seals between manhole sections: to ASTM D1056-85.

.7 Standard of Acceptance: Con-Force vault 8-0004.

2.4 Drainage

.1 Floor drain fittings in each manhole consisting of floor drain, back water valve, trap and pipe connection to dry sump.

2.5 Manhole Necks

.1 Concrete manhole neck to bring cover flush with finished grade in paved areas and 40 mm above grade in unpaved areas.

.2 Build up neck with concrete brick and mortar to achieve above if necessary.

2.6 Manhole Frames and Covers

.1 Bolted on covers to prevent unauthorized entry.

2.7 Grounding

.1 Ground rods: 3 m x 19 mm copper clad complete with 3/0 AWG conductor for cable rack grounding.

2.8 Cable Racks

.1 Hot dipped galvanized cable racks and supports.

.2 12 x 100 mm preset inserts for rack mounting.

2.9 Cable Pulling Equipment

.1 Pulling iron made of galvanized steel rods, size and shape as indicated.

.2 6 mm stranded nylon pull rope tensile strength 5 kN continuous throughout each duct run with 3 m spare rope at each end.

2.10 Markers

.1 Concrete type cable markers: 100 x 600 x 100 mm, with words; "cable", "joint" or "conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.

3. EXECUTION

3.1 Installation

.1 Install underground duct banks and manholes including formwork.

.2 Install ducts at depths indicated.

.3 Encase PVC ducts with 75 mm thick concrete cover. Use rigid aluminum conduit for sections extending above finished grade level.

.4 Build duct bank and manholes on undisturbed soil or on well compacted granular fill not less than 150 mm thick, compacted to ninety-five (95%) percent or maximum proctor dry density.

.5 Open trench completely between manholes to be connected before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.

.6 Prior to laying ducts, construct "mud slab" not less than 75 mm thick if unstable soil conditions are found. Confirm this requirement with Structural Engineer prior to constructing "mud slab".

.7 Install ducts at elevations and with slope as indicated and minimum slope of one (1) to four hundred (400).

.8 Install base spacers at maximum intervals of 1.5 m levelled to grades indicated for bottom layer of ducts.

.9 Lay PVC ducts with configuration and reinforcing as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts at not less than 75 mm horizontally and vertically. Stagger joints in adjacent layers at least 150 mm and make joints watertight. Encase duct bank with 75 mm thick concrete cover. Use galvanized steel conduit for sections extending above finished grade level or as specified on drawings.

.10 Make transpositions, offsets and changes in direction using 5º bend sections. Do not exceed a total of 20º with duct offset.

.11 Use bell ends at duct terminations in manholes or buildings and generator, CDP, MCC and ATS sections.

.12 Use conduit to duct adapters when connecting to conduits.

.13 Terminate duct runs with duct coupling set flush with the end of concrete envelope when dead ending duct bank for future extension.

.14 Cut, ream and taper end of ducts in field in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.

.15 Allow concrete to attain fifty (50%) percent of its specified strength before backfilling.

.16 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during placing of concrete. Tie ducts to spacers with twine or other non-metallic material. Remove weights or wood braces before concrete has set and fill voids.

.17 Clean ducts before laying. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.

.18 Immediately after placing of concrete, pull through each duct a steel or wooden mandrel not less than 300 mm long and of a diameter 6mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Pull stiff bristle brush through each duct immediately before pulling-in cables.

.19 In each duct install 6 mm nylon pull rope continuous throughout each duct run with 3 m spare rope at each end.

3.2 Manholes

.1 Install precast manholes.

.2 Provide 115 mm deep window to facilitate cable bends in wall at each duct connection. Terminate ducts in bell-end fitting flush with window face. Provide four 10 m steel dowels at each duct run connection to anchor duct run. On runs of sixteen (16) ducts and over, support concrete duct encasement on a 700 mm wide by 75 mm thick concrete pier poured against the manhole wall between slab and bottom of duct run, provide dowels for anchoring.

.3 Alternately connect large duct runs by leaving a square opening in wall, later pouring duct run and wall opening in one pour, and install 10 m x 3 m reinforcing rods in duct run at manhole connection.

.4 Install manhole frames and covers for each manhole. Set frames in concrete grout onto the manhole neck.

.5 Drain floor towards sump with one (1) to forty-eight (48) slope minimum and install drainage fittings as indicated.

.6 Install cable racks, anchor bolts and pulling irons as indicated.

.7 Grout frames of manholes. Cement grout to consist of two parts sand and one part cement and sufficient water to form a plastic slurry.

.8 Ensure filling of voids in joint being sealed. Plaster with cement grout, walls, ceiling and neck.

.9 Spray paint an "X" on ceiling of manhole above floor drain or sump pit.

3.3 Markers

.1 Mark location of duct runs under hard surfaced areas not terminating in manhole with railway spike driven flush in edge of pavement, directly over run. Place concrete duct marker at ends of such duct runs. Construct markers and install flush with grade.

.2 Mark ducts every 150 m along straight runs and changes in direction.

.3 Where markers are removed to permit installation of additional duct, reinstall existing markers.

.4 Lay concrete markers flat and centered over duct with top 25 mm above earth surface.

.5 Provide drawings showing locations of markers.

3.4 Inspections

.1 Advise Engineer so that he may inspect ducts prior to placing and be present during placement of concrete and clean-out.

END OF SECTION

1. GENERAL

1.1 General Requirements

.1 This section specifies requirements for the provision and installation of Copper and Fibre Optic based communications infrastructure system.

.2 Submit product data in accordance with Division 1 and Division 16.

1.2 Related Work

.1 Section 16010 – General Electrical Requirements

.2 Section 16741 – Telecommunication Raceway System

.3 Section 17123 – Fibre Optic Systems

.4 Section 17127 – Industrial Ethernet

1.3 Inspection

.1 Provide adequate notice to the Engineer so that all cable installations can be inspected prior to connecting equipment.

1.4 Standards

.1 Products, workmanship and installation: conform to the current guidelines contained in the following:

.1 ANSI/TIA/EIA-568-B.1, (or CAN/CSA T529) Commercial Building Telecommunications Cabling Standard. Part 1: General Requirements.

.2 ANSI/TIA/EIA-568-B.2, Commercial Building Telecommunications Cabling Standard. Part 2 : Balanced Twisted-Pair Cabling Components.

.3 ANSI/TIA/EIA-568-B.3, Commercial Building Telecommunications Cabling Standard. Part 3: Optical Fibre Cabling Components Standard

.4 ANSI/EIA/TIA-569 (or CAN/CSA T530-M), Commercial Building Standard for Telecommunications Pathways and Spaces

.5 ANSI/EIA/TIA-606 (or CAN/CSA T528-M), Administration Standard for Telecommunications Infrastructure of Commercial Buildings.

.6 ANSI/EIA/TIA-607 (or CAN/CSA T527), Commercial Building Grounding and Bonding Requirements for Telecommunications.

.7 ANSI/TIA-472E000 - Sectional Specification (Adopted ICEA S-104-696-2001) Standard for Indoor-Outdoor Optical Fiber Cable

.8 ANSI/TIA-526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

.9 ANSI/TIA-598 - Optical Fiber Cable Color Coding.

.10 Corning AEN-137 - Maximum Vertical Rise for Fiber Optic Cables

.11 Corning SRP 005-014 - Indoor Installation of Corning Cable Systems

.12 TIA-604-2-B - FOCIS-2 Fiber Optic Connector Intermateability Standard, Type ST

.13 TIA-604-10-B - FOCIS 10B Fiber Optic Connector Intermateability Standard-Type LC

.14 UL 1666 - UL Standard for Safety Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

.15 CAN/CSA C22.1 Canadian Electrical Code, Part 1 and all the Local Amendments.

.16 CAN/CSA C22.2 Canadian Electrical Code, Part 2.

.17 CAN/CSA C22.2 No. 232-M Optical Fibre Cables

.18 CRTC Canadian Radio and Telecommunications Commission, Standards and Guidelines.

.19 TIA/EIA 455-160-A Fibre Optic Test Procedures

.20 ODVA Pub. 00148RO - Ethernet/IP Media Planning and Installation Manual

.21 ISO 11801 Class D specifications

.22 National Building Code (NBC)

.23 IEEE 802.3 Ethernet Standards.

.24 Building Industry Consulting Service International (BICSI) TDMM Manual latest editions, at the time of tender.

.2 All wires and cables to have permanently imprinted on outer jacket, evidence of CSA approval and cable characteristics.

1.5 Acceptable Manufacturer and Installer Qualifications

.1 Items described herein are not be substituted without the written consent of the Engineer, and/or the Owner (RDN) representative.

.2 The Contractor is responsible to respect, maintain and protect the privacy and confidentiality of the Owner, including tender documents, drawings, products, etc. of this project.

.3 All products include cabling are to be by a single manufacturer, commercial/ industrial grade, unless otherwise stated.

.4 All materials are to be new and unused.

.5 Acceptable manufacturer for riser and horizontal cabling and passive hardware components: BELDEN/CDT, Corning or Engineer approved equal. For all other equipment/hardware refer to other sections and specific descriptions as noted above.

.6 The eligible Electrical Contractor, and all personnel installing communications cabling, must be trained and authorized by Belden/CDT, certified and must have the authority to certify the cabling installation and materials for twenty-five (25) years respectively to cover system applications and performance prior to start any work. Communications contractor is subject to approval by the Engineer and RDN Representative.

.7 The Contractor must provide an original manufacturer's Letter of Certification and all related assurance documents within two weeks following the completion of the project.

.8 The Contractor to inspect all material, like: cable reel/boxes, patch panels, connectors, etc. for visible damage of goods incurred during shipping and transportation. It is the responsibility of the installer to return any damaged components to the supplier/manufacturer, and replace at no cost prior to installation.

.9 Maintain manufacturer performance data/specifications supplied with components shipped and submit upon request to the RDN/Engineer.

.10 The Contractor to submit and provide a minimum two (2) year warranty on installation and workmanship to RDN and separate of the manufacturer warranty according to the requirements in Division 1.

.11 The Contractor is responsible to comply with all local, provincial and federal law and/or regulations applicable to the work to be performed, although said law; rule standard or regulation is not identified herein.

.12 The Contractor must inform, in writing to the Construction Manager, RDN and/or Engineer about the intention to use sub-Contractor on this project. The use of sub-Contractors must be approved, in writing, by the Engineer, prior to start any work.

.13 The Contractor to submit (name and telephone number); and designate a qualified project manager (foreman) on site, as the single point of contact and to oversee this project to ensure a quality installation.

.14 The Contractor is responsible to coordinate their work with other trades, and the Owner designated project manager.

.15 The Contractor to clean and maintain work environment, free from trash, cardboard, dust, dirt, etc. accumulated during and after the cabling infrastructure. Keep all liquids off finished floors and walls. Cabling Contractor is responsible to clean or repair scratched/damaged/soiled finishes caused by them, at their own expenses.

.16 Provide labor, all materials, tools, equipment and services for a complete installation herein described.

.17 Manufacturers' part numbers are for reference purpose only. It is the responsibility of the Contractor to verify with the manufacture/distributors and Owner exact component/devices, prior to purchase and installation.

1.6 SUBMITTALS

.1 Submit product data in accordance with Section 16010 including:

.1 Catalog and technical data

.2 Installation data including allowable pulling tension, pulling radius, and bending radius

.2 Submit fiber communication cabling drawings stamped / signed by a qualified professional accredited by BICSI as a Registered Communication Distribution Designer (RCDD).

.3 Submit markups of all supplied drawings showing any field changes.

.4 Complete wire and cable designation schedule in MS Excel indicating origin, terminus, origin terminal identification, terminus terminal identification, cable function, type and cable designation, pass/fail result and cable length at each demarcation point.

.5 Submit a complete equipment testing plan outlining the following:

.1 A qualified professional who will take responsibility as the designated data installation manager for the Project networks and who will coordinate the installation with all related equipment supplied.

.2 Detailed list of equipment to be tested and commissioned.

.3 Detailed list of special equipment provided necessary for testing and commissioning.

.4 Procedures to test and commission each piece of equipment.

.5 Identify personnel to test and commission equipment.

.6 Schedule for checking, testing and commissioning.

.6 Submit all cabling test results generated from the approved testing unit in both native format and .pdf.

.7 Operating Manuals

.1 See Section 16010 for additional requirements.

.2 Include all final results, indexed and dated, of all data obtained by testing and commissioning. This will include but not be limited to:

.1 Fiber optic performance verification test results

.2 Fiber optic inspection logs

.3 Copper plant performance verification results.

2. PRODUCTS

2.1 Ethernet Network Cable - Copper

.1 CAT 6 Cable shall be CSA approved and shall be constructed as follows:

.1 Category 6A Cable (non-armored) to be CSA approved and to be constructed as follows:

.1 Complies with ANSI/TIA-568.2 Category 6A standards

.2 CSA rated

.3 Twenty-three (23) AWG solid copper conductors minimum

.4 Pairs: Four (4) bonded

.5 Bandwidth: 500 MHz minimum

.6 Cable jacket to be marked F/UTP

.7 Includes copper drain wire, minimum 26 AWG

.8 Shield complies with ANSI/TIA-568.2 for screened cables

.9 Outer jacket color: Blue

.10 Jacket: PVC

.11 Flame test rating: FT4, CMR or FT6, CMP

.12 Minimum operating temperature range: -20 ºC to 75 ºC

.13 Sequentially printed with length markings on outer jacket, in one foot or meter (preferred) intervals.

.2 Armored Category 6 Cable to be constructed as follows:

.1 Jacket rated to 300V minimum, 600V AWM

.2 Complies with ANSI/TIA-568.2 Category 6 standards

.3 CSA certified

.4 Twenty-three (23) AWG solid copper conductors minimum

.5 Pairs: Four (4) bonded

.6 Bandwidth: 350 MHz minimum

.7 Outer jacket color: Blue

.8 Jacket: PVC

.9 Flame test rating: FT4, CMG

.10 Minimum operating temperature range: -20 ºC to 75 ºC

.11 Cable jacket to be marked F/UTP or SF/UTP

.12 Includes copper drain wire, minimum 26 AWG

.13 Shield complies with ANSI/TIA-568.2 for screened cables

.14 Sequentially printed with length markings on outer jacket, in one foot or meter (preferred) intervals.

.2 Acceptable Product: Belden 7953A DataTuff Cat 6, (4 pr) 23 AWG Solid BC, PP/PVC/PVC, EtherNet/IP, Foil Shld, CMR, CMX, 600 V AWM

.3 Armored cable to be constructed per the following:

.1 Single interlocking aluminum armor

.2 FT4 outer jacket

.3 Sunlight Resistant outer jacket

.4 Minimum operating temperature range: -20 ºC to 75 ºC

.5 Acceptable Product: Belden 121872A Multi-Conductor - Category 6

.6 DataTuff Twisted Pair Cable

.7 (3) Multi-Ethernet cables in a single interlocking aluminum armored jacket is permitted.

.4 CAT 6A Terminations

.1 Terminations shall suite the wiring type in use. Shielded cables will terminate into shielded connectors unless otherwise directed. Category 6A cable will terminated into Category 6A connectors. Category 6 cable may terminate into Category 6A or Category 6 connectors, as per ANSI/TIA-568.2 standards.

.2 Structured cabling terminations to meet the following:

.1 Belden RevConnect series (Unless otherwise approved)

.2 Complies with ANSI/TIA-568.2 Category 6A standards

.3 Keystone compatible

.4 Compatible with patch panels and wall face plates systems

.5 Available in multiple shielded, non-shielded, and a range of colors

.6 Colored inserts available for shielded connectors

.3 8P8C shielded field terminated connector

.4 Acceptable Equipment: Belden RevConnect RVAMJKSME,

.5 (4) M12-X Coded field terminated connector

.6 Acceptable Equipment: Phoenix Contact, SACC-MSX-8QO SH ETH SCO – 1411043

.5 Data Structured Cabling Patch Panels

.1 All data patch panels will comply with ANSI/TIA-568.2 Category 6A standards

.2 19" rack mount panels acceptable equipment:

.1 24-Port Shielded – Tripp Lite Blank Patch Panel RJ45 HDMI Cat5e/Cat6, PN. N062-024-KJ-SH

Note: for all rack mounted equipment see Section 16750 General requirements for Data infrastructure

.3 DIN rail mount single port panel acceptable equipment:

.1 Phoenix Contact CUC-PP-D1PGY/R4IDC8 – 1419024

.2 Harting 09 45 851 0000 RJI DIN-rail outlet for keystone jacks

.4 DIN Rail Mount (4 Port) acceptable equipment:

.1 Belden BMIP/AD/CNNN

.6 Structured Cabling Patch Cables

.1 All patch cables will comply with ANSI/TIA-568.2 Category 6A standards.

.2 Cables will be pre-terminated and factory tested.

.3 Type: U/UTP unless permanently installed device requires shield, then use F/UTP.

.4 Color: Blue (U/UTP), Grey (F/UTP)

.5 Length: 0.6m, 2m, 4m, 8m (Other lengths by approval only)

.7 Connectors Color Code

.1 Outlet colors for IT and Utility networks will comply with the following color code:

.1 Black: Phone Analog, VoIP, and IT

.2 White: Intercom, radio, security, and CCTV

.3 Yellow: Maintenance

.2 Outlet colors for SCADA networks will comply with the following color code:

.1 Blue: Field Device Network & Computer Interface Unit (HMI)

.2 Grey: Controller Network (Primary)

.3 Black: Controller Network (Secondary)

.4 Yellow: Server Local Area Network (Primary)

.5 Orange: Server Local Area Network (Secondary)

.6 White: Packaged Program Logic Controllers and Power Distribution

2.2 Fibre Optic Cabling

.1 Compliance with the following standards IEC 60793, ISO/IEC 11801 and EIA/TIA 492 specifications.

.2 Single mode fibre optic cable to be 12 / 24 strand, 45µm (or less), TIA-492CAAB/ITU-T G.652.D Single-mode (SM) OS2/FT4 rating that meet ANSI/EIA/TIA 568B.3 standards campus type. Cable to conform to the following:

.1 Cable Standard: TIA 472E000/ICEA S-104-696 indoor/outdoor cable

.2 CSA rated

.3 Minimum Pulling Tension: 2670 N (600 lbf)

.4 Minimum Operating Temperature Range: -20ºC to 40ºC

.5 Outer-jacket Material: PVC

.6 Outer-jacket Color: Yellow

.7 Cable Jacket: FT4, OFCR Riser Rated Cable, Sunlight Resistant

.8 Fiber Format: Loose Tube

.9 Attenuation Maximum: 0.4/0.4 dB/km @ 1,310 / 1,550 nm

.10 Fiber color coding as per TIA-598

.11 Armored cable to be constructed per the following:

.1 Single interlocking aluminum armor

.2 Minimum operating temperature range: -20 ºC to 75 ºC

.12 Un-armored cable to be constructed per the following:

.1 Dielectric strength members surrounding cable inside outer jacket

.2 Minimum operating temperature range: -20 ºC to 75 ºC

.13 Standard of acceptance: Armored - Corning NNNEUF-T310DAY, Un-armored - Corning NNNEUL-T3601DAY where NNN indicates the fiber count.

.3 Multi-mode fibre optic cable 6/12/24 strand, 50/125 µm, OFCR/FT4 rating that meet ANSI/EIA/TIA 568B.3 standards cable tray rated, characteristics as follows;

.1 Colour-coded PVC buffers, orange colour jacket.

.2 Fiber optic cabling to be marked with manufacturer's name, sequential length, cable type and rating, strand count and cUL/CSA listing.

.3 Optimized for operation in the 850/1300 nm wavelength.

.4 Max Attenuation (dB/km): 3.5/1.0

.5 Multimode (OM3)

.6 Maximum backbone nominal cable length: 300 m @ 1Gps

.7 Physical Characteristics:

.1 Crush Resistance (EIA-455-41): 2000 N/cm

.2 Impact Resistance (EIA-455-25): 2000 Impacts @ 1.6 N-m

.3 Operating Temperature: -40 to +70 °C

.4 Minimum Bend Radius Installation: 20 X OD

.5 Minimum Bend Radius Long Term: 10 x OD

.8 Manufacturer and model:

.1 BELDEN FDxT0NNRF OFNR/OFN FT4 PVC jacket for Non-Armored type (where x – Fibre Grade Code and NN – Fibre Count) or Engineer approved equal

.2 BELDEN FDxT0NN5F OFNR/OFN FT4 PVC jacket for Armored type (where x – Fibre Grade Code and NN – Fibre Count) or Engineer approved equal

.4 Acceptable Fibre Optic Cable Manufacturers:

.1 Corning

.2 Belden

.3 Prysmian/Draka

.5 Acceptable Termination Manufacturers:

.1 Corning

.2 Belden

2.3 Patch Cable Conduit

.1 Conduit used for the purpose to install fiber optic patch cable within a room may be of industry acceptable construction while ensuring the installation conforms to the CEC. The preferred type of conduit is Electrical non-metallic tubing.

.2 Conduits exiting server or electrical room shall be Rigid Metal Conduit.

2.4 Panels Modules (patch panel)

.1 Corning CCH 12F OS2 UPC compatible panels modules.

.2 Fiber Standard: ITU-T G.652.D Single-mode (SM) OS2

.3 Connector Format: LC (TIA-604-10) oven-cure aluminum/ceramic

.4 Connector Type: Duplex (LC only) SM UPC (Blue)

.5 Module Type: Pigtailed Cassettes or Pigtailed Panel

.6 Splice tray included where Pigtailed Panel is used.

.7 Acceptable Equipment:

.1 12F LC-UPC Cassette - Corning CCH-CS12-A9-P00RE

.2 12F LC-UPC Panel - Corning CCH-CP12-A9-P03RH

2.5 Patch Panels Enclosures

.1 All data patch panels will comply with ANSI/TIA-568.3 Optical Fiber Cabling Components standards

.2 19" rack mount panels acceptable equipment:

.1 Corning CCH-0N, where N indicates the height of panel in rack units

.2 Belden ECX-0XU, where X indicates the height of panel in rack units

.3 Wall mount, electrical rooms and non-process areas; NEMA 3S, Corning - ICH-06P and/or ICH-12P C/W Splice Tray, Corning – M67-110

.4 Wall mount, outdoor and process industrial areas; NEMA 4X, Corning - EDC-STEEL-2P-NH, C/W Splice Tray, Corning – M67-110

.5 Internal control panel mount:

.1 DIN Rail Mount

.2 Corning - SPH

.3 Splice Tray - Internal

.4 Break-out cables to be tight-buffer construction

2.6 Structured Cabling Patch Cables

.1 Connectors as per TIA-604. Specific connector to suite application.

.2 Cables will be pre-terminated and factory tested.

.3 Cable Standard: ANSI/TIA-568-C.3

.4 Cable: Minimum 0.9mm Zip-cord, Yellow

.5 Fiber Standard: Bend-insensitive Single-mode (SM) OS2, ITU-T G.657.A1

.6 Fiber color coding as per TIA-598

.7 Connector: UPC (Blue)

.8 Duplex cables will have the ability to interchange connectors on the duplex clip to allow the cable to be A-B or A-A.

.9 Cables will be marked with A-B indications to determine crossover status.

.10 Length: 1m, 2m, 4m, 8m (Longer lengths to suite application, shop made only)

2.7 Fibre Optic Connectors

.1 "SC" Connectors shall supports 900µm or 300µm overall diameter buffered fibre cordage.

.2 Meet EIA and IEC standards for repeatability, have a locking mechanism to assure no optical connector disconnect.

.3 Connector loss not to exceed 0.5dB per termination.

.4 Meet fibre optic connector intermateability and FOTP-171 standards.

.5 Insertion loss to be maintained to a minimum of 200 mating cycles as per EIA/TIA –455.21 and without violating the specifications.

.6 Multimode Transmission Characteristics:

.1 Insertion Loss (one mated pair) @1300nm: 0.2dB

.2 Return Loss maximum: -40dB

.3 Mating durability: 5 00 reconnect without signal degradation.

.4 Operating temperature: -40° to 85°C.

.5 Material: Zirconia Ceramic connector, housing and body engineered resin.

.6 Flame Retardancy: UL 94 V0

.7 Connector Mating Loss: 0.75dB loss, 26dB optical return loss

.7 Single Mode Transmission Characteristics

.1 Index of refraction: 0.37%.

.2 Max. attenuation: 1.0dB/km @ 1310nm; 1.0dB/km @ 1550nm.

.3 Zero dispersion wavelengths: 1310 ± 10nm.

.4 Zero dispersion slope: 0.092ps/nm-2km.

.5 Maximum dispersion: 2.8ps/nm-km 1285 to 1330nm.

.6 Polarization mode dispersion coefficient: 0.5ps/km @ 1310nm.

.7 Cut-off wavelength: 1150/1350nm.

.8 Cable cut-off wavelength: <1260nm.

2.8 Fibre Optic Labeling

.1 Label all Fibre optic patch panels, jacks and fibre optic cabling at each end. Labeling shall be as follows: Plant Area – Fibre and Jack Number (i.e., 06A-F001).

.2 Use Vendor provided software for all labeling.

3. EXECUTION

3.1 Installation General

.1 Install instrumentation cables in conduit systems or in cable trays. For conduits use a minimum of 300 mm length of liquid tight flexible conduit to connect the field sensors to the conduit and associated junction box.

.2 Where instrumentation cables are installed in cable trays, provide barriers in the tray to separate instrumentation cables from power cables.

.3 At each end of the run leave sufficient cable length for termination.

.4 No more than two 90° bend in conduit run between pull points.

.5 Provide pull box for every 30 m (100') of conduit run.

.6 All conduits for data outlets to be minimum of 27 mm from outlet to raceway or ceiling space, unless noted otherwise.

.7 Conduits 50 mm or less to have a bend radius of six (6) times the conduit diameter. Conduit greater than 50 mm to have a bend radius of ten times the conduit diameter.

3.2 Fibre Optic Cables

.1 Follow manufactures recommended procedure for cable installation.

.2 Maintain not less than minimum bend radius for fibre optic cable.

.3 Terminate fibre optic cables on fibre optic patch panels, and at both ends with appropriate end connectors and fibre optic patch panels, unless otherwise specified.

.4 Fibre optic cabling between communications rooms to be installed as individual links. No splices or intermediate connections points are allowed.

.5 Follow manufacture guidelines and recommendations when installing fibre optical cables.

.6 Provide a minimum of 5 m (15 ft) of slack (service loop) cable in each communications room, before termination for future additions, moves and changes.

.7 Label all fibre optical cables with a high quality material and adhesive type label and as the following example: 02A-F001, where 02A indicates area number, F indicates fibre cable and sequential number of Fibre strands.

.8 Label fibre optical patch panel with the word: "CAUTION".

.9 When installing fibre optic riser (backbone) cables in conduit, use Yellow 77 lubricant or equivalent. Confirm with Owner prior to use, if other alternative is proposed.

.10 Maximum conduit fill:

Fibre Optic Link	**Fill**
One Cable	53%
Two Cables	31%
Three cables or more	40%

.11 Label fibre optical riser cables at 3 m (10 ft) intervals and with the word: "CAUTION FIBE OPTIC".

3.3 Copper / CAT 6 Cable Installation

.1 Install Ethernet cable in accordance with ANSI/TIA-568.2.

.2 Cables installed in Category 2 Locations will be suitable for the installation and installed in accordance with the CEC.

.3 Data cable routes to be field run, with routes determined by the installer. The path should generally be the shortest route between the destination and the nearest source/equipment panel.

.4 Cable without interlocking armor will be installed using one of the following methods for mechanical protection and support:

.1 Rigid aluminum conduit

.2 Cable tray (Server and office rooms only)

.3 Cable management (Equipment cabinets only)

.5 A maximum installed field length of 90m measured by cable jacket markings is permitted.

.6 Cable length should be planned for a maximum of 80m.

.7 Do not make splices in any of the data cable runs.

.8 Cable bundles will be sized no larger than the quantity identified in TIA-TSB-184 for the type of cable installed.

.9 Cable will be suitable for the installation environment. The installer will notify the Engineer prior to installation, of any cables which may not be appropriate for the specific installation environment.

.10 Protect cables from mechanical damage including but not limited to crush, pinch, strain, kinks, and excessive vibration, temperature extremes, and chemical exposure. Cable installation will be suitable for the installation and prevent short and long-term damage.

.1 The installer will be responsible to remove and replace any cable which is damaged or fails testing.

.2 Abandoning of cable is unacceptable.

.11 Ensure cables do not exceed the manufacturers specified minimum bend radius. No sharp bends or pressure points will exist at any point along any cable.

.1 Cable transitions from horizontal to vertical will use waterfalls.

.2 Cables routed inside cabinets will avoided being routed over sharp angles.

.12 Cable will be installed with sweeping bends to allow for seismic movement in cable tray and transitions. The requirement is in addition to meeting manufacturer specified minimum bend radius.

.13 Cable will be supported a minimum of every 6m for vertical installations, regardless of the installation. Where cable tray is used the cable should be supported every 1m.

3.4 Armored and TC Rated Cable Installation

.1 Armored cable and tray cable will adhere to all requirements of general cable installation unless otherwise stated.

.2 Armored cable and tray cable will be installed using one of the following methods for mechanical protection and support:

.1 Cable tray

.2 Conduit, including underground

.3 Attach cabling to walls and ceilings with PVC clamps with clamp backs at intervals not exceeding 1.5m.

.4 Attached to strut channel with one-piece pipe clamps at intervals not exceeding 1.5m.

.3 Cable installed in vertical installations of greater than 20m will securely fasten a minimum of 2 full cable coils to a fixed object every 20m to couple the internal cable components to the interlocking armor. Ensure the minimum bend radius is maintained.

.4 Cable installed in vertical installations to be supported a minimum of every 1m.

.5 Cable ties will not be used as a method of support for cables. Use of cable ties to secure cable within a tray is acceptable.

.6 Fiber optic cables with conductive components, including armor, must not be placed in the same race way as electric light, power, or Class 1 circuit conductors, which includes discrete control circuits. Fiber optic cables may be installed into a cable tray in the following cases:

.1 The tray meets the CEC as an acceptable raceway for fiber optic cables with conductive components.

.2 A barrier is installed in the tray where the fiber optic cables are installed such that only fiber optic or other communications cables are installed.

.3 The fiber optic cables are installed in the outer-web of the tray. This application will is limited to a maximum of 3 cables per web. The cables will be secured in the web using cable ties at a minimum of 1.5m intervals.

.7 Armored cable will terminate into cabinets and boxes using a cable connector. Ensure bonding is continuous from the cable armor to the appropriate ground bar.

3.5 Cable Terminations

.1 Fibre cables are terminated as follows:

.1 Terminate all cables and fibers into the corresponding patch panel and port locations as indicated in the Drawings.

.2 Fiber will be fusion spliced for both splicing and terminations to connector pigtails. All termination equipment will be supplied as part of a manufacturer supplied assembly. Mechanical connectors and breakout cables outside of an assembly are not acceptable.

.3 Losses introduced by a fusion splice per splice shall not exceeded the following:

.1 Insertion loss: 0.3 dB Maximum

.2 Return loss: 55 dB Maximum

.4 The following connectors will be used for terminations: LC Duplex

.5 Ensure the panel reference terms key-up and key down following the procedure below:

.1 The standard manufacturer supplied panel will be considered key-up with the top connector key pointing towards the number “1” on the panel.

.2 The installer will rotate each of the connectors in the panel while maintaining the same fiber position to create a key-down panel such that the top position connector key is pointing towards the number “2”.

.3 In both cases with port 1 on top, odd numbered fibers will be on the left and even numbered fibers will be on the right. Fibers will be installed consecutively (1-12) from top to bottom.

.4 Ensure panels is labelled with A and B to indicate polarity

.6 Neatly route the cable in the cabinet or equipment panel to allow use of all remaining rack space for future equipment. Cable must not prevent the operation of doors, pull out equipment, or be strapped in such a way that prevents the installation of future rack mounted equipment.

.7 Terminate cables as follows:

.1 Cables to be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568 document, manufacturer's recommendations, and good Industry Practice.

.2 The inner-cable jacket to be maintained to the patch panel enclosure strain relief.

.3 Buffer tubes to maintain a minimum of 30mm bed radius or according to the manufacturer's recommendations, whichever is greater.

.4 All parts of the cable to be adequately secured to ensure prevent accidental snag when working in the panel/enclosure.

.8 Terminate copper cables in corresponding patch panel port locations as indicated in the

.9 Drawings.

.10 Follow T568A termination pinout to be used for eight-position modular jack pin/pair assignment.

.11 Ground cable shields at one end only. Unless otherwise stated, the cable source patch panel will be the point of shield grounding. Cable shielding will be connected through the termination receptacle, to the patch panel using the inherited manufacturer designed connection method. The patch panel will be directly grounded to the Rack Grounding Busbar (RGBs) located in the Equipment Panel.

.12 The distributor side (patch panel) of the data cable will be neatly routed in the cabinet to allow use of all remaining rack space for future equipment. Cable must not prevent the operation of doors, pull out equipment, or be strapped in such a way that prevents the installation of future rack mounted equipment. Approximately 3m of cable length will be left in the cabinet to allow reconfiguration if necessary.

.13 All data cabling will terminate into wall modular data jacks at the equipment outlet and patch panels in the distributor area (IT Rack Panel), unless otherwise noted. No intermediate splicing of data cabling is acceptable.

.14 Outlets/connectors will be used unless field data plugs are explicitly call for by the application. Examples where field plugs are acceptable include outdoor WAP and Outdoor CCTV cameras.

.15 Equipment outlets (EO) will be concealed behind drywall in locations that have drywall finished walls with a 32mm EMT conduit stubbed into the ceiling space. In other locations, EO will be surface mounted.

.16 Equipment or office outlets will be installed in a 4 inch (100mm) 491mL square box with a single or two device cover. The cover plate will match the electrical cover plate style in the room (Decora).

.17 Do not coil cables in the in-wall or surface-mount boxes. Loop above stub up to house the cable coil without exceeding the manufacturer's bend radius. In hollow wall installations where box-eliminators are used, excess wire to be stored in the wall. Approximately 300 mm of slack to be stored in an in-wall box, modular furniture raceway, or insulated walls.

.18 Excess slack to be neatly coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

.19 Equipment outlets terminations will match the type and color of the patch panel data receptacle.

.20 Authorized plug ends for data cabling shall be of industrial type. Plastic crimp on RJ-45 terminations are unacceptable.

.21 Equipment mounting heights as per Section 16010.

.22 Terminate cables as follows:

.1 Cables to be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568 document, manufacturer's recommendations and Good Industry Practice.

.2 Pair untwist at the termination not to exceed 6.5 mm at the connecting hardware.

.3 Bend radius of the cable in the termination area to be greater than 4 times the outside diameter of the cable.

.4 The cable jacket to be maintained to the termination point.

.5 Equipment outlet terminations to occupy the top position(s) on the faceplate.

.6 Outlets in horizontally oriented faceplates to occupy the left-most position(s).

3.6 Identification

.1 The installer will label all cables according to this guide at the appropriate places:

.1 On both ends of the armored jacket immediately before the cable enters a connector (if applicable)

.2 On both ends of the cable at the patch panel strain relief.

.3 Immediately upon entering and before exiting any pull box/junction box where the cable is not terminated.

.2 Label all components as per ANSI/TIA/EIA 606-A standards and as per manufacturer recommendations.

.3 Labels to be visible during and after the installation of the cabling infrastructure.

.4 Labels to be resistant to the environment, such as moisture, heat, grease and ultraviolet light.

.5 Labels to be printed or generated by a mechanical device. No hand written labels will be accepted.

.6 Conduits and armored cables to be labelled as per Section 16010 – Conduit and Cable Identification

.7 Non-armored cables and inner cables will be labelled as per Section 16010 – 2.5.2 Conductor Identification. The label will be applied immediately before the patch panel strain relief.

.8 Provide labels and administration system as per BELDEN standards.

.9 Label the panel module using the provided insert. The label will be visible when the front cover is both open and closed.

.10 Label all ports and patch cable connectors with the polarity (A or B). Labelling of panel modules may be limited to Port 1 as it is expected that all ports will be keyed alike.

.11 Any single fiber found to fail testing will be labelled as “Failed” beside the port.

.12 All patch panel surface labels will be Brady B-499, B-595 Patch Panel Adhesive Strips

.13 A unique identifier to be placed on each connecting passive hardware component installed like: riser cables, horizontal cables, faceplates, etc.

.14 Labels to support linkages to others individual/groups of records, like "as-built" drawings that will allow a person to easily located and/or relate outlets, pathways spaces within a given area or telecommunications room.

.15 Horizontal cabling

.1 All (individual) horizontal cables to be labeled, and within 150 mm to 230 mm from the cable ends.

.2 Labeling to include cables in the main server and electrical rooms.

.16 Riser cables:

.1 All riser cables to be labeled at each end, indicating source and destination, and number of pair/strands.

3.7 Testing

.1 Provide a Microsoft Excel file in electronic format (memory stick, or via email), tabulated results for every cable, length, polarity information, pair attenuation (db), induced noise (db), worse pair NEXT, wire map, impedance, ACR and indicate whether the cable has passed/failed.

.2 **Fibre Optical Cables:**

.1 Multiple tests will be completed at various stages of the cable life:

.1 Manufacturer: Testing to be completed by the manufacture to ensure cable meets specification. All fibers will be tested. Test will include a minimum of OTDR test.

.2 On Site before pull (on reel): Testing to be completed by the cable installer to confirm cable was not damaged in shipping. Minimum of one fiber from each buffer tube to be tested. Test will include a minimum of OTDR test.

.3 After Cable Pull (Optional): An optional test may be completed after the cable pull to ensure cable was not damaged during installation. This is only recommended if different contractors are responsible for the installation and termination Works.

.4 After Cable Termination: Testing to be completed in the link segment after the permanent install and termination. All fibers will be tested. Complete Tier 2 test to be completed.

.5 After Equipment Connection: Testing to be completed after the networking equipment is installed. In-use links will be tested as a complete channel using the diagnostics tools built into the equipment optical modules. Completed an OTDR test if the values differ by more than 3db from channel loss or the optical module is incapable of performing the measurements.

.2 All permanent link segments as per Section 17125 and Section 2.2., to be tested to ANSI/TIA-568.0 Tier 2 (OLTS and OTDR methods) standards by a qualified professional. Testing to be completed to TIA-526-7 using procedure OFSTP-7.

.1 OLTS to use Method A.1 (One Jumper Method) unless otherwise approved by the Engineer.

.2 Testing will be completed for both 1310 and 1550nm.

.3 Calibration verification is not required.

.4 Only one direction testing required.

.5 The test results to be automatically evaluated by the equipment and the result shown as pass/fail.

.6 Test results to be printed directly from the test unit or from a download file provided by the test equipment manufacturer.

.7 The printed test results will include all tests performed, the expected test result and the actual test result achieved.

.8 The testing unit will save the measured data for all tested parameters.

.3 All instruments will have a valid calibration sticker attached showing when the last calibration was performed. Calibration of the instruments should be performed at intervals specified by the manufacturer.

.4 Data cables will be tested using an ANSI/TIA-1152 compliant automated level IIIe qualified tester, as approved by the cabling manufacturer as follows;

.1 The data cable test results to be automatically evaluated by the equipment and the result shown as PASS/FAIL.

.2 Test results to be printed directly from the test unit or from a download file provided by the test equipment manufacturer.

.3 The printed test results will include all tests performed, the expected test result and the actual test result achieved.

.4 The testing unit will save the measured data for all tested parameters.

.5 All patch cables will be tested using Tier 1 (OLTS) only. Results will be made available to Engineer and Owner, and included in O&M Manuals.

.6 All connections will be visually inspected, both connectors and ports, using IEC 61300-3-35 grading criteria. Permanently damaged patch cables will be disposed of. The installer will keep a log of each inspection. The intention is to ensure patch cables are clean and free of defects upon first use. Documentation to be recorded visual inspection log will include:

.1 The installers initials

.2 The inspection date

.3 PASS/FAIL of final inspection results

.4 Note (if required), including corrective or reason for failure

.7 Documentation to be recorded for OLTS test results will include:

.1 Date of the test

.2 Test personnel

.3 Description of equipment used; manufacturer model number and serial number

.4 Date of latest equipment calibration

.5 Type and length of test jumpers

.6 Fiber identifier (ID)

.7 Test procedure and method used

.8 Link loss results (including direction) at tested wavelength(s)

.8 Documentation to be recorded for OTDR test results will include:

.1 Date of the test

.2 Test personnel

.3 Description of equipment used; manufacturer model number and serial number

.4 Date of latest equipment calibration

.5 Type and length of launch fiber

.6 Fiber identifier (ID)

.7 Measured length of link

.8 Trace of the fiber or cabling link

.9 Test wavelengths

.9 Provide documentation that indicated the complete channel test results between active links indicating the following:

.1 Equipment

.2 Ports tested (mapping)

.3 Loss Budget

.4 Measured Loss

.5 Length

.6 Pass/Fail

.7 The list may be measured or calculated based on the sum of all permanent installed links and patch cables. It is also acceptable to generate results from installed equipment if such functionality is available.

.10 The following specific test will be obtained. Failure to meet these results will be considered a FAIL for the specific test.

.1 The insertion loss for each mated fiber connector pair to be less than 0.75dB.

.2 For spans greater than 100m, each span to have a test result less than or equal to the value determined by calculating a link loss budget.

.3 For spans 90m and less, each tested span to have a loss less than 2.0dB.

.11 Preliminary results of testing to be submitted to the Engineer of Record within 7 days of testing.

.1 The Engineer reserves the right to reject cable which has more than 10% of fibers FAIL the tests above.

.2 The Engineer reserves the right to require the installer to replace the cable, free of charge, if the installer cannot provide reasonable evidence fiber failures were beyond the installers control.

.12 Termination test results will be supplied in both a native format from the tester and .pdf.

.13 For all other test results, only a .pdf copy is required.

.14 The final SAT test results for the above tests to be included in the Operations Manual

.15 If fibre optic strands, or cables are suspected of any problems, Contractor shall provide, upon request of the consultant or client representative, at not additional cost, OTDR testing to determine problems and repair. Submit test results to verify fibre test parameters.

.16 Refer to products section, fibre optic cabling single mode / multimode proposed performance transmission specifications.

.3 **CAT 6 (6A) Cable Testing**

.1 All cabling, including patch cables will be tested. Factory test results for patch cables are acceptable.

.2 Cable testing will be completed on the permanent link.

.3 Any cable which fails the tests above will be removed and replaced free of charge.

.4 Data cabling systems to be tested to the specifications set out in TIA-568.2 for the Category cable under test.

.5 Data cables will be tested using an ANSI/TIA-1152 compliant automated level IIIe qualified tester, as approved by the cabling manufacturer.

.1 The data cable test results to be automatically evaluated by the equipment and the result shown as pass/fail.

.2 Test results to be printed directly from the test unit or from a download file provided by the test equipment manufacturer.

.3 The printed test results will include all tests performed, the expected test result and the actual test result achieved.

.4 The testing unit will save the measured data for all tested parameters.

.6 Test the following performance parameters:

.1 Wire Map (Including screen continuity)

.2 Insertion Loss

.3 Length

.4 Near End Crosstalk (NEXT), local end and far end

.5 Power Sum Near End Crosstalk (PSNEXT) Loss, local end and far end

.6 Attenuation to Crosstalk Ratio, Far End (ACRF)

.7 Power Sum Attenuation for Crosstalk Ratio, Far End (PSACRF)

.8 Return Loss (RL)

.9 Propagation Delay

.10 Delay Skew

.11 D.C. Loop Resistance

.7 Alien crosstalk testing is not required if the cable manufacture will provide product the warranty without such testing. If these criteria is not met, the installer will submit and execute a plan which adequately asses testing of PSANEXT and PSAACRF alien cross talk parameters according to TIA-1152 using a limited sampling of cables according to IEC. 61935-1 to the extent which will meet the manufacturer's warranty requirements.

.8 For multi-pair cables, the longest pair length to be recorded as the length for the cable.

.9 Preliminary results of testing to be submitted to the Engineer within 7 days of testing.

.10 Test results will be supplied in both a native format from the tester and .pdf.

.11 The final SAT test results for the above tests to be included in the Operations Manual.

.12 All costs associated with correction and re-testing of defective cabling will be the responsibility of the Contractor.

.4 Test Results:

.1 Test result to include all parameters listed on these specifications, and as per latest manufacturer's recommendations.

.2 Provide legible printed forms and electronic copy (memory stick) using a recognized computer software application, like Microsoft Excel. This to include, but not limited to, cable reports, cross-connects and connecting hardware. Include any software tools to view, and print any or all cable test reports.

.3 Contractor to provide documents for all test result, and for all conductor pair strands of each cable.

.4 Reports to be generated from a computer-based recognized program.

.5 Test recorded in the memory of the field tester to be transferred into a windows ™ based database software, unaltered and "as saved in the tester".

3.8 Quality Assurance:

.1 Contractor and sub-contractors to be fully certified to install the manufacturer products and have a minimum of three (3) years on the installation of systems of this type and size.

.2 Material to be new and conform to commercial grade, good quality, and meet industry standards.

.3 Subcontractor, if any, to assume all rights and obligations as the contractor toward the Owner and herein described.

3.9 As-built Drawings:

.1 Contractor to provide two (2) copies of "As built" drawings showing, communications room, outlets locations and labeling.

.2 Submit soft and hard copies, along with other project deliverables, to the Owner/Engineer within 30 days of substantial completion.

3.10 Warranty and Certification

.1 A two-part certification program, provided by the manufacturers CSV, would cover all cable and connectivity components. The first part is an assurance that the certified system will support the applications for which it is designed (including 1000BaseT and Category 6 standards), during the lifetime of the certified system. The second part of the certification is a twenty (20) year warranty provided by the manufacturer and the CSV on all products within the system. Manufacturer to administer a follow-up program through the CSV to provide support, guarantee, warranty and service.

.2 The contractor, upon completion, is to provide a warranty for the entire installed communications system. Response time associated with this warranty is to be within twenty-four (24) hours of the initial request, during or outside regular working hours.

.3 The contractor is to provide the certification number within two (2) weeks of substantial completion, and will include:

.4 Verification of a complete cabling solution.

.5 Verification of correct performance levels for the Cat 6 solution.

.6 Manufacturer's Certification number.

.7 Identification of the installation by location and project number.

.8 A copy of the manufacturer's warranty request form.

.9 This guarantee to include all labor, material and time to travel to and from the site.

.10 Acceptance of the "structured cabling systems" work will be subject to completion of all related work, testing and receipt of full documentation as described herein.

END OF SECTION

1. GENERAL

1.1 Description

.1 Provide a complete system of wiring, making all connections necessary for the installation shown on Drawings.

.2 Supply and install wireways and auxiliary gutters and fittings as a means for flexible wiring system. All wireways and gutters to be two piece with removable cover to provide access to wiring.

1.2 Related Work

.1 Section 16010 – General Electrical Requirements

1.3 Reference Standards

.1 This section conforms to the following reference standards:

.1 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.

.2 CSA C22.2 No. 131 - Teck 90 Cables.

.3 CSA C22.2 No. 38 - Thermoset-Insulated Wires and Cables.

.4 CSA C22.2 No. 239 – Control and Instrumentation Cables.

.5 CSA C22.2 No. 65-18 Wire Connectors

.6 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 A Maximum Rating).

.7 ANSI/NEMA CC1-2018 – Electric Power Connections for Substations.

.2 Install and rate power cables in accordance with the Canadian Electrical Code requirements, or in accordance with ICEA requirements where permissible.

1.4 Shop Drawings and Product Data

.1 Submit shop drawings in accordance with Section 16010 - Electrical General Requirements.

2. PRODUCTS

2.1 Materials

.1 Pressure type wire connectors: with current carrying parts same material as conductors sized to fit the conductors as required.

.2 Fixture type splicing connectors: with current carrying parts same material as conductors sized to fit the conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for copper conductors.

.3 Stud clamp bolts.

.4 Bolts for copper conductors.

.5 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, aluminum sheathed cable, flexible conduit, as required.

2.2 Building Wires

.1 Compliance with:

.1 CSA C22.2 No. 38 - Thermoset-Insulated Wires and Cables.

.2 Conductors, unless otherwise shown or specified:

.1 Stranded copper.

.2 Minimum size #12 AWG, except #14 AWG for control circuits. Stranded for #10 AWG and larger.

.3 Insulation chemically cross-linked, thermosetting polyethylene, and, unless otherwise specified, rated RW90, 1000 V. Use RWU 90 insulation where specified and in all wet locations.

.4 Color coding to Section 16010 - Electrical General Requirements; wires sized No. 2 AWG and smaller to be factory-coded, taping will not be accepted.

.5 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene (XLPE) material rated RW90.

.6 Copper conductors: size as indicated, with thermoplastic insulation type TWU rated at 1000V for 600V wiring and 300V for 120V/208V wiring.

2.3 Teck90 Power and Control Cables

.1 To CSA C22.2 No. 131 – Teck Cable.

.2 To CSA C22.2 No. 174 – Hazardous Locations.

.3 Minimum conductor size is #12 AWG for power cables and #14 AWG for control cables.

.4 Conductors:

.1 All conductors shall be copper.

.2 Circuit conductors: size as indicated.

.5 Insulation:

.1 Type: Chemically cross-linked thermosetting polyethylene (XLPE): 1000 VAC for power, 600 VAC for control wiring.

.6 Jackets: Shall be sun resistant.

.7 Armour: Interlocking aluminum.

.8 Temperature Rating: 90°C to -40°C.

.9 "HL" and "FT4" rated per CSA.

.10 Low Acid Gas and Lead Free.

.11 All TECK cables installed in the hazardous locations to be HL marked and shall comply with CSA C22.2 NO 174-M1984 Cables and Cable Glands for Use in Hazardous Locations.

.12 Fastenings:

.1 One hole steelstraps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 1000 mm centers.

.3 Six mm dia. threaded rods to support suspended channels.

2.4 Variable Speed Drive Cable

.1 For VFD drive applications, provide variable speed drive rated cables between the VFD drive and motor.

.2 Cable shall comply to:

.1 CSA C22.2 No. 123 – Metal sheath cables

.3 Variable Speed Drive Cables shall include:

.1 Triple grounded, increased dielectric type Teck cable suitable to reduce the high-frequency noise emissions of the drive and reduce the bearing current effects.

.2 Contain a geometric arrangement of the conductors to ensure identical coupling capacitance is obtained.

.3 Provide type W connectors for dry or wet locations. Refer to Teck Cable connectors for additional requirements.

.4 Acceptable Products

.1 Nexans DriveRx 1kV rated cable or equivalent

2.5 AC 90 Cables

.1 Compliance with:

.1 CSA C22.2 No. 0.3 - Test Methods for Electrical Wires and Cables.

.2 CSA C22.2 - No. 51 Armoured Cables.

.2 AC 90 may be used only for lighting installation in office space areas for drops up to 3 meters, or wiring in metal stud walls for receptacles for length no longer than 6 meters.

.3 Fastenings and supports as for conduits specified in Section 16111 - Conduits, Conduit Fastenings and Fittings; the following applies:

.1 Dry locations, as for Rigid Aluminum (RA) conduit.

.2 Wet and outdoor locations, as for RPVC conduit.

.3 Corrosive locations, as for ERA conduit.

2.6 Flexible Cables

.1 Designations and Compliance:

.1 Flexible Cords; Type S0W, to CSA C22.2 No. 49, Type ST, to CSA C22.2 No. 49 Flexible Cords and Cables.

.2 Portable Cables up to No. 2 AWG, Type SGOW, to CSA C22.2 No. 96 Portable Power Cables.

.3 Portable Power Cables up to 500 KCM, Type G, to ICEA S-68-516 Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

.2 Conductors and Insulation:

.1 Stranded.

.2 Size as per specification or contract drawings.

.3 Insulation and conductor arrangement as determined by governing standard.

2.7 Connectors and Terminations

.1 Copper or Aluminum long barrel compression connectors as required and sized for conductors.

2.8 Wire Connectors

.1 The following listings specify products for copper conductors only. Aluminum conductors are not foreseen for this project. In the event that aluminum conductors are specifically approved by the Engineer, it is the Contractor's responsibility to select the appropriate connector, using the following specifications as the guideline.

.2 Compliance with:

.1 CSA C22.2 No. 65 – Wire Connectors.

.2 CSA C22.2 No. 188:18 – Splicing Wire Connectors.

.3 Twist-On Connectors:

.1 Insulated serrated or wing-type cap.

.2 Internal spiral spring; set-screw or crimp-type not acceptable.

.3 Minimum rating 600 V.

.4 Limited for use up to No. 10 AWG wire.

.4 Terminal Connectors:

.1 Ring-type or locking fork-type, crimp-on terminal with nylon insulating sleeve over brazed seam shank.

.2 Minimum rating 600 V, 105°C.

.3 Conductive member made from electro tin-plated copper.

.4 Limited for use up to #10 AWG.

.5 Compression Lugs:

.1 Made from one-piece pure electrolytic copper tubing, tin plated.

.2 Color coded or marked with manufacturer's die index.

.3 Long barrel for minimum two crimps.

.4 For use with wires, #8 AWG and larger.

.5 Install ferrules with nylon insulating sleeves on all #14 and smaller stranded wires being terminated on terminal strips.

.6 Compression splices: similar to compression lugs, suitable for in-line, C-tap and similar configurations.

.7 Use 3M “Scotchlock”, self-insulated connectors for hand twist wire joints for lighting, small power, and control wiring.

.8 Use Thomas & Betts non-insulated ring type compression lugs for terminating #10 AWG and smaller motor connections. Tape with rubber and scotchtape. Lugs to accept ten - 32 x 3/8” machine bolts.

.9 Terminate conductors #8 AWG and larger with Thomas & Betts Colour-Keyed compression connectors Series 54000, or on lugs provided with equipment.

.10 Thomas & Betts “KOPR-SHIELD” compound Series CP8 on all terminations for compression connectors.

2.9 Teck Cable Connectors

.1 Size connectors to suit cable diameters and in accordance with the recommendations of the cable manufacturer.

.2 Compliance with:

.1 CSA C22.2 No. 18.3 – Conduit, tubing, and cable fittings.

.3 Connectors are to be liquid and dust tight, with aluminum ground ring, with multi-fingered flange, gland bushing, Thomas & Betts "Sabre Tooth" Series 10464 or Crouse Hinds TMC.

.4 In hazardous locations use Thomas & Betts type c/w sealing compound.

.5 Connectors:

.1 Connects to be watertight approved for the use of TECK cables (dry-type not acceptable) equal to Thomas & Betts Star-Teck aluminum fittings in non-classified areas and Thomas & Betts Star-Teck explosion proof for classified environments.

.2 Material compatible with the connecting body such as junction, outlet or splice boxes to which the connection is made. Grounding ring or “fingers” and neoprene bushing is required.

.6 Approved Products:

.1 Corrosive locations

.1 Thomas & Betts STAR TECK, all with PVC coating.

.2 All other areas

.1 Thomas & Betts STAR TECK

2.10 Strain Relief Connectors

.1 Watertight type for use with flexible cables.

.2 Material compatible with connecting body such as junction, outlet or splice box to which connection is made.

.3 Stainless steel wire mesh cord grip where connector is used with free-hanging cable.

.4 Acceptable Products: Thomas & Betts Type RANGER.

2.11 Joint Compound

.1 Conductive compound, suitable for application to threaded and compression connections.

.2 Compatible with cable and conductor insulation and material.

.3 Capable of being brushed on at temperatures from minus 25°C to 110°C.

.4 Acceptable products, within the limitations outlined:

.1 Aluma-Shield

.2 Burndy Penetrox

.3 Thomas & Betts Kopr-Shield.

2.12 Wireways

.1 Sheet steel with hinged cover to give uninterrupted access.

.2 Finish: based gray enamel.

.3 Elbows, tees, couplings and hanger fittings manufactured as accessories to wireway supplied.

3. EXECUTION

3.1 General

.1 Establish exact location of equipment and their connection points before wiring installation is commenced.

.2 Protect wiring against damage from welding spatter and other construction activity by suitable means.

.3 If available blockouts through slabs or walls are insufficient in size or location, enlarge, chip or drill additional openings in accordance with Divisions 3 and 4.

.4 Protect metallic cable connectors in process areas with heat-shrinkage sleeves. Sleeve length to extend 75 mm past the connector and to provide a tight fit around connector and cable.

.5 Do not use TC cable in areas classified as hazardous locations.

.6 Arrange wiring in process area such that motor connection boxes and other field mounted devices are entered at the side or bottom of the connection box or enclosure.

.7 Provide sufficient length of "free" cable for motors mounted on slide rails to permit the motor to travel the full length of the rails.

.8 Install reducing bushings where threaded entry in a motor connection box is larger than the hub size of the cable connector.

.9 In-line splices are not acceptable unless done in a junction or splice box.

.10 At the discretion of the Engineer damage to a cable jacket may be repaired in accordance with the manufacturer's recommendation. If requested by Engineer, replace the entire length of a damaged cable.

.11 Arrange cable supports such that maintenance work or removal of the equipment served by the cable, will not cause any damage to the cable.

.12 Feeder cables exiting duct banks exposed into buildings and tunnels are to be run to their final termination point in conduit or covered cable tray if not of armored construction.

.13 Minimum conductor size #12 AWG except for luminaire drops which can be #14 AWG if fed from 15A PLC circuits.

3.2 Installation of Building Wires

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 16110.

.2 In wireways and auxiliary gutters in accordance with Section 16116.

.3 In underground ducts in accordance with Section 16106.

3.3 Installation of Teck Cable 0 - 1000 V

.1 Comply with Canadian Electric Code, CAN/CSA C22.1.

.2 Install cables in cable troughs or trays as indicated on drawings. Space so that no de-rating factor is applied or de-rate cable ampacity as required.

.3 Where cables pass through poured concrete or masonry wall, install sleeves for the cables.

.4 In-line splices are not permitted.

.5 Provide mechanical protection for cables where cables rise through a floor using sleeves or slots. Provide channels, angle sills or rigid conduit sleeves which protrude at least 150 mm above the finished floor.

.6 Where cables are grouped and not run in tray, support on channels. Run cables parallel to the lines of the building. Bends are to be concentric. Channel spacing not to exceed 1500 mm.

.7 Fasteners for single cables larger than 51 mm, two hole strap type. For single cables less than 51 mm, one hole malleable iron type. Group cables whenever possible. Use non-ferrous fasteners in wet locations. Use aluminum "P" clamps when fastening to support channel.

.8 All power cables shall be clamped to vertical or inclined trays with clamps as manufactured by the tray manufacturer. All power and control cables shall be secured to horizontal trays with adequately sized tie wraps.

.9 Cinch anchors shall be used to fasten the strut brackets to walls. Concrete beams shall not be drilled without prior authorization by the Consultant. Care shall be taken in drilling concrete blocks or masonry work to ensure the surface will not be cracked.

.10 Powder actuated fastening tools shall not be used without written approval from the Consultant.

.11 Unistrut channels complete with beam clamps and floor anchor plates shall be provided. Unistrut sections for this purpose shall be sized as required.

.12 Teck connectors shall be installed in accordance with the recommendation of the cable manufacturer.

.13 All cable entries to motors, field devices, instruments, control stations and panels in process areas shall be from the bottom, unless approved by the Engineer.

3.4 Installation of Armoured Cables

.1 Group cables wherever possible.

.2 Terminate cables in accordance with Section 16153 - Connectors and Terminations.

.3 Terminate armour with approved connectors.

3.5 Wire Connectors

.1 Select hand twist connectors for wire size and install tightly on conductors.

.2 Brush “KOPR-SHIELD” compound on terminations for compression connectors as recommended by the manufacturer.

.3 Install compression connectors using methods and tools recommended by manufacturer.

.4 Do not install stranded conductors under screw terminals unless compression lugs are installed.

3.6 Surface Installation for Teck Cables

.1 Install individual runs of teck cable or multiple runs, where specified or as specified herein.

.2 Fasten unistrut to the ceiling or wall as required.

.3 Secure cables to unistrut with cable clamps.

.4 Provide only corrosion resistant clamps, hot dip galvanized, stainless steel or PVC coated.

.5 Install unistrut supports with a maximum spacing of one (1) metre.

.6 One (1) or two (2) surface mounted cables may be strapped using one (1) hole straps and stand-off spacers. Fastening, strapping and support materials shall be compatible with the area conditions.

.7 Three (3) or more cables shall be installed in 150 mm or larger cable tray.

3.7 Installation of Wireways

.1 Install wireways and auxiliary gutters.

.2 Keep number of elbows, offsets, connections to minimum.

.3 Install supports, elbows, tees, connectors, fittings.

.4 Install barriers to separate different voltages or to separate different systems.

.5 Install gutter to full length of equipment.

3.8 Connector Sizing

.1 Strictly adhere to manufacturer's listing for matching connector and terminal sizes to cable and conductor sizes.

.2 Similarly, select the proper compression tools and dies for each compression fitting to obtain the correct compression strength and as not to damage insulation sleeves and finishes.

.3 Select cable connectors with correctly sized grommets, bushings, glanding devices and threads. The application of tape or using reducers is not an acceptable alternative to selecting the correct size connector.

3.9 Wire Connectors

.1 Select hand twist connectors for wire size and install tightly on conductors.

.2 Brush "KOPR-SHIELD" compound on terminations for compression connectors as recommended by the manufacturer.

.3 Install compression connectors using methods and tools recommended by manufacturer.

.4 Do not install stranded conductors under screw terminals unless compression lugs are installed.

3.10 Terminations and Splices

.1 Splicing of wires or cables is not permitted except where specifically indicated on drawings or as approved by the Engineer.

.2 Twist-on connectors limited for use on lighting circuits, utility and control wiring in outlet boxes, luminaries, and with factory-supplied leads or pig-tails in field devices. Pre-twist conductors tightly prior to installation of twist-on connectors.

.3 Do not use twist-on connectors inside panels and apparatus which are equipped with terminal blocks.

.4 Use locking fork-type connectors on flat screw-type terminals.

.5 Use ring-type connectors up to #10 AWG on stud and post-type terminals and any termination subject to vibration.

.6 Use compression-type lugs for #8 AWG and larger unless equipment is provided with proper lugs designed for conductor terminations.

.7 Unless motor connection boxes are equipped with terminals, use compression-type motor connection lugs and machine bolts at motors for conductors up to #1 AWG. For larger conductors use two-hole compression lugs; apply self-vulcanizing tape or heat-shrink end cap over termination.

.8 In moist or corrosive areas, apply joint compound to conductor prior to installation of compression fitting.

.9 Exercise care in stripping insulation from wire. Do not nick conductors.

.10 Strictly follow manufacturer's instructions with regards to tool size and application methods of terminations and compounds.

3.11 Workmanship

.1 Before pulling wire, ensure conduit is dry and clean. If moisture is present, thoroughly dry out conduits; vacuum if necessary. To facilitate pulling, recognized specially manufactured wire pulling lubricants may be used. Do not use grease. Employ suitable techniques to prevent damage to wire when ambient temperature is below the minimum permitted for each insulation type. Do not pull wires into incomplete conduit runs.

.2 Installation to be free of opens and grounds. Before energization, measure insulation resistance and comply with the Canadian Electrical Code. Submit data sheet with values measured.

.3 Do not install any conductor smaller than #12 AWG, except where specifically indicated otherwise, i.e. for fire alarm system station circuits, P.A. wiring, etc.

.4 Provide sizes of conductors as shown on drawings. Voltage drop from lighting panels to farthest outlet must not exceed 2% at full load in any case. Advise Consultant if problem is foreseen.

.5 Exercise care in stripping insulation from wire. Do not nick conductors.

3.12 Cable Identification

.1 All Teck90 cables shall be identified with stainless steel tag labels. The labels shall be securely attached to the cables.

.2 Conductor and cable designations shall correspond to those shown on the drawings or as agreed upon with the Consultant.

.3 Where Teck90 cables exit from cable trays, the cables shall be identified as described for terminations.

.4 Each phase conductor cable of power feeders shall be color coded at all terminations and taps to identify phasing. Color coding shall be provided by the attachment of color phase tape as indicated in Section 16010 – Electrical General Requirements.

.5 For control wiring, identify each conductor with the wire numbers shown on the drawings or agreed upon with the Consultant using a printed heat shrink wire marker as Brady Perma Sleeve or Raychem TMS.

3.13 Wiring Identification, Coding and Balancing

.1 For branch circuit wiring, follow identification system shown on the drawings and as specified in Section 16010 - Electrical General Requirements.

.2 Connect single phase equipment to minimize imbalance on feeders. Adjust branch circuiting shown as required for optimum balancing. Record all changes on "record" drawings.

.3 Colour code all feeders at all terminations, at all points where taps are made, and at all panelboards, switchboards, motor control centres, etc. Use two wraps of 3M #471 plastic film tape 48 mm wide.

.4 Conductors sized No. 10 and smaller are required to be factory coloured, not taped on site.

.5 For direct current wiring use red for positive and black for negative.

3.14 Testing

.1 All power and control wiring shall be tested for insulation resistance value with a 1000 volt megger. Resistance values shall be as recommended by the cable manufacturer.

.2 All wire test results shall be properly tabulated, signed, dated, and submitted to the Consultant.

END OF SECTION

REGIONAL DISTRICT OF NANAIMO

Appendix D
Environmental Impact Study

French Creek Pollution Control Centre Stage 4 Expansion

Construction Environmental Impact Study

Prepared for the Regional District of Nanaimo

Project number: 60590631

February 2021

Statement of Qualifications and Limitations

The attached Report (the “Report”) has been prepared by AECOM Canada Ltd. (“AECOM”) for the benefit of the Client (“Client”) in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the “Agreement”).

The information, data, recommendations and conclusions contained in the Report (collectively, the “Information”):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the “Limitations”);
- represents AECOM’s professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to AECOM which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time..

AECOM shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. AECOM accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

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Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
01	February 8, 2021	Draft		Bruce Ford	Permitting Biologist
02	February 22, 2021	Final		Bruce Ford	Permitting Biologist

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Table of Contents

Figures

Tables

Appendices

1. Introduction

AECOM has been retained by the Regional District of Nanaimo (RDN) for the pre-design, detailed design, construction, and post-construction phases of the French Creek Pollution Control Centre Stage 4 Expansion Project ("the Project"). This report provides an assessment of environmental effects associated with the Project, including identification of environmental challenges and constraints associated with the site. The report also provides measures to mitigate potential project effects

2. Project Overview

The French Creek Pollution Control Centre (FCPCC) is a secondary wastewater treatment plant operated by the RDN near Parksville, BC (Figure 1). The plant provides primary treatment followed by secondary treatment to remove the remaining solids and organic pollutants from the wastewater. The effluent currently meets provincial and federal regulatory requirements.

The FCPCC is near its operating capacity of 10 mega litres per day, average flow, and the expansion will increase the capacity to approximately 13.3 mega litres per day to meet growth in the service area to the year 2035. This upgrade is referred to as the Stage 4 Expansion.

The new infrastructure for the Stage 4 Expansion will be located on the lower portion of the site to the northwest of the existing plant, on the opposite side of Morningstar Creek. The existing influent dewatering building is located in this area. The existing plant is located on the upper portion of the site on the southwest side of the property, near the intersection of Highway 19A and Lee Road.

The Stage 4 Expansion includes the following items:

- New secondary treatment infrastructure based on a conventional activated sludge process
- Upgrade of the odour control system
- Maintenance building and storage area adjacent to secondary treatment infrastructure
- Effluent pump station replacement with a new facility for all flows
- New dewatered sludge bin loading conveyors and relocated truck scale
- Renovated administration building with second story addition
- Upgrades to the Morningstar Creek crossing, involving replacement of the existing bridge with a new arch culvert
- New site access from the Island Highway complete with vehicle gate
- New electrical service and power distribution
- Relocate the existing Motor Control Center above the hydraulic grade line where needed to mitigate flood risk
- New generator and fuel tank adjacent to new Stage 4 secondary treatment infrastructure
- Equalization tank to attenuate peak diurnal flows and improve wet weather management

The main components of the upgrade are shown on Figure 2 which shows the location of the new footprint for the upgrades on the northwest corner of the RDN site. The total FCPCC site is 4.1 ha, the total ground disturbance associated with the Stage 4 Expansion is 0.97 ha. The footprint for new Combined Treatment Unit (CTU) building, clarifiers and bioreactors is approximately 4700 m^2 and will be located on a section of the lot that is currently treed. The new access road/driveway will be added along the western edge of the property which and will cover approximately 1800 m^2 in an area that is also currently a treed. The crossing of Morningstar Creek will be upgraded by removing the existing bridge and replacing it with a 17.8 m long by 3.3 m wide open bottom arch culvert.

836000
837000
Highway 19A
French Creek
Strait of Georgia
Morningstar Creek
Highway 19A
5476000
836000
837000
5476000

Basemapping from ESRI, City of Burnaby, DataBC, Government of Canada and AECOM 2018.

N
W E
S

0 40 80 120
Metres

1:4,000
NAD 1983 UTM Zone 9N

Legend

- FCPCC Site Boundary
- Morningstar Creek Bridge
- Highway 19A Roadside Ditch
- Road
- Watercourse
- Waterbody
- Pond Boundary (Approximate)

Overview Map

French Creek Pollution Control Centre (FCPCC)

October 2019

AECOM

Figure 1

File Location: P:\60590631\900-CAD_GIS\920-929 (GIS-Graphics)\02_MXDs\FCPCC\Fig1_60590631_FCPCC_.mxd
Date Revised: October 24, 2019 Reviewed By: AI Paper Size: 11"x17" Scale is referenced to the specified paper size.

PLANT AREAS	
AREA 100	PRELIMINARY TREATMENT
AREA 200	SEDIMENTATION TANKS
AREA 300	ATADs
AREA 400	TRICKLING FILTERS
AREA 500	SLUDGE DEWATERING
AREA 600	SECONDARY TREATMENT
AREA 800	OPERATIONS BUILDING

6.0m WIDE ASPHALT ACCESS ROAD
PROPOSED FENCE (TYP)
BIOREACTOR 2
SECONDARY CLARIFIER 5
SRS DISTRIBUTION BOX
TRANSFORMER
SECONDARY CLARIFIER 4
BIOREACTOR 1
TRUCK AXLE SCALE
AREA 600
PROPERTY LINE (TYP)
CTU BUILDING
MOTORIZED SLIDING GATE WITH ACCESS CONTROL
EXISTING DRYING BED
EXISTING DRYING BED
EXISTING DRYING BED
CENTRATE PUMP STATION
DEWATERING BUILDING
ASPHALT DRIVEWAY
GENSET
AREA 500
TREELINE
MORNINGSTAR CREEK
ISLAND HIGHWAY
REMOVE EXISTING BRIDGE AND REPLACE WITH ARCH CULVERT
AREA 100
EQUALIZATION TANK
TRICKLING FILTERS
AREA 400
CONTACT
FILTER PUMP
SRS SPLITTER BOX
PARKING STALLS
RIPARIAN AREA
15m BUFFER ZONE FROM MORNINGSTAR CREEK AND 4.5m FROM PROPERTY LINE. (TYP)
Pcl. A
DD 5360–N
2
PLAN 2570
4
N 2570
AREA 300
AREA 200
AREA 800
CONC. CURB
RETAINING WALL
WASTE BIOLOGICAL THICKENER BUILDING
SURVEYED HIGH WATER MARK OF MORNINGSTAR CREEK (TYP)
SEPTAGE HOLDING TANK
OPERATIONS BUILDING
R3
P. 9203
EXISTING GATE TO BE REMOVED. INSTALL MOTORIZED GATE WITH CONTROL ACCESS
LEE ROAD
GRAVEL
DL. 28

0 12.5 25 m
1:500

SITE PLAN
1:500

DRN BY:	SI
DES BY:	MC
CHK BY:	KM
APP BY:	MC

VERIFY SCALE IF PLAN SHEET IS REDUCED
30 mm

REV	DESCRIPTION	DRN	CHK	DATE (Y/M/D)
B	ISSUED FOR 90% DETAILED DESIGN	SI	BY	2020/07/24
A	ISSUED FOR 60% DETAILED DESIGN	SI	KM	2019/09/24

PREPARED FOR:
REGIONAL DISTRICT OF NANAIMO

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REGIONAL DISTRICT OF NANAIMO
FRENCH CREEK POLLUTION CONTROL CENTRE
STAGE IV EXPANSION

CIVIL
SITE LAYOUT AND AREA PLAN

PROJECT START DATE (M / Y)	SEP/2019
PROJECT NO.	60590631
FILENAME	60590631-C-1001.dwg
RDN DRAWING No.	
DRAWING No.	C-1001

Plotted By: sneja.ignatova
Plot File Date Created: Jul/20/2020 3:28 PM
Layout-Sheet Name: C-1001
Filename: C:\USERS\SNEJA.IGNATOVA\DESKTOP\60590631-DESKTOP\910-CAD\20-SHEETS\C\60590631-C-1001.DWG

The culvert crossing will provide a 5 m wide road surface and will support and protect several utilities including electrical cables and the main pipes that carry sewage from the intake building and primary treatment facility to the new clarifiers and bioreactors. The layout for the new culvert is provided in Appendix A.

3. Regulatory Context

The information below summarizes federal, provincial and municipal legislation applicable to the Project.

3.1 Federal Legislation and Requirements

3.1.1 Fisheries Act

The federal *Fisheries Act* applies to all Canadian fisheries waters and provides protection and conservation for fish and fish habitat on provincial, federal, and private lands. Morningstar Creek supports fish population and provides spawning and rearing habitat for a variety of fish species. Therefore, the *Fisheries Act* protects the fish and the fish habitat including water quality of the creek.

Construction of a new culvert in the creek has the potential to impact fish and fish habitat. To avoid infringing on the protections provided under the *Fisheries Act*, a request for review has been submitted to Fisheries and Oceans Canada (DFO) and the project is currently under review. It is anticipated that the culvert installation can proceed based on advice provided by DFO in response to the request for review.

3.1.2 Migratory Birds Convention Act

The *Migratory Birds Convention Act* (MBCA) protects migratory bird populations in Canada by regulating potential harmful human activities. The Regulations under the MBCA provide for the conservation of migratory birds and for the protection of their nests and eggs. Specifically, they prohibit depositing or permitting the deposit of a substance that is harmful to migratory birds in waters or an area frequented by migratory birds or in a place from which the substance may enter such waters or such an area. A prohibition against the disturbance, destruction, or taking of a nest, egg, or nest shelter of a migratory bird is also set out in the Regulations. Possession of a migratory bird, nest, or egg without a permit is also prohibited. The Act and its regulation could apply to this project if cutting of trees and removal of vegetation takes place during the active nesting season from March 15 and August 15.

3.1.3 Species at Risk Act

The *Species at Risk Act* (SARA) is designed to prevent Canadian indigenous species, subspecies, and distinct populations from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species and encourage the management of other species to prevent them from becoming at risk. Under SARA, critical habitat is defined as the habitat that is necessary for the survival or recovery of listed extirpated, endangered, or threatened species, and that is identified in a recovery strategy or action plan.

3.2 Provincial Legislation

3.2.1 Riparian Areas Regulation

The Riparian Areas Protection Regulation (RAR), enabled by the *Riparian Areas Protection Act*, guides development in riparian areas. The RAR applies to residential, commercial, or industrial activities in the RDN. However, the RAR does not restrict the construction of municipal infrastructure, referred to as “Institutional Development” in Section 1.4.1 of the Riparian Areas Regulation Assessment Regulations (BC Ministry of Forests Lands and Natural Resource Operations 2006). Since the Project is exempt from RAR requirements, the RAR assessment and results are presented for information purposes only.

The RAR assessment methodology presents the approach to determine a Streamside Protection and Enhancement Area (SPEA). The SPEA is defined as the area that is “adjacent to a stream that links aquatic to terrestrial ecosystems and includes both existing and potential riparian vegetation and existing and potential adjacent upland vegetation that exerts and influence on the stream”. The Detailed Assessment methodology requires an evaluation of

stream width, reach breaks, potential vegetation type and channel type and then applies a formula to determine the SPEA width. The Detailed Assessment determines the “Zone of Sensitivity” for the features, functions and conditions of the riparian assessment area through a series of assessments. The SPEA width is then the largest “Zone of Sensitivity” resulting from an individual assessment.

The RAR defines a stream as any watercourse – natural or human-made – that provides fish habitat that contains water on a perennial or seasonal basis, is scoured by water or contains observable deposits of mineral alluvium or has a continuous channel bed including a watercourse that is obscured by overhanging or bridging vegetation or soil mats. A stream may not itself be inhabited by fish, but may provide water, food and nutrients to streams that do support fish. Wetlands directly connected to other watercourses are also included in the definition of a stream in accordance with RAR.

3.2.2 Water Sustainability Act

The work in and around Morningstar Creek is an approved works under the Water Sustainability Regulation as it is a culvert installed for a road crossing of the creek. Installation of the culvert will require the stream flow to be diverted around the work area and this is also an approved works under the regulation and will require the submission of a notification.

A notification of proposed work must be submitted to FrontCounter BC a minimum of 45 days before beginning work. Submitting more than 45 days ahead of time is recommended. If a habitat officer with Ministry of Forests, Lands and Natural Resource Operations & Rural Development (MFLNRORD) has not responded within 45 days (or by the proposed start date, if you submitted more than 45 days in advance), work may proceed. However, the proponent is responsible must make sure that the work meets the terms and conditions described in Part 3 of the Water Sustainability Regulation and any terms and conditions specific to the region in which the work is proposed.

3.2.3 Wildlife Act

The *Wildlife Act* defines wildlife as all native and some non-native amphibians, reptiles, birds, mammals that live within BC. Within Canada, the management of wildlife is a shared responsibility between federal and provincial governments. Provincial agencies are responsible for all matters involving the conservation and management of wildlife populations and habitat within the province that are not under federal government jurisdiction.

Section 34 of the *Wildlife Act* provides legal protection of: birds and their eggs; the nest of an eagle, peregrine falcon, gyrfalcon, osprey, heron, or burrowing owl, regardless of the nest status (i.e., active or inactive); as well as the active nest of other species. Due-diligence must be exercised by attempting to identify existing nests. The destruction of any nest (or nest tree) requires a permit from the province.

To conduct works in fish bearing water, a permit to salvage or collect fish is required under the *Wildlife Act*. This would apply to the establishment and dewatering of a work area for the culvert installation.

3.3 Municipal Legislation

The Project Site is in Electoral Area G of the RDN. No RDN bylaws that would apply to the environmental aspects of the project were identified. Municipal bylaws of the adjacent City of Parksville and Town of Qualicum Beach do not apply to this area.

RDN Bylaw 1469.02 - A Bylaw To Establish Floodplains, Construction Levels In Floodplains, And Setbacks For Landfill And Structures In Floodplains, specifies construction setbacks in floodplains adjacent to watercourses, applicable to Electoral Area G. Based on Section 13 of this bylaw, a horizontal setback of 15 m is required from the Natural Boundary of a Watercourse for a landfill or portion of a landfill slope, or a structural support required to support a floor system or Pad above the Designated Flood Level.

4. Biophysical Conditions

4.1 Methods

4.1.1 Desktop Review

A desktop review of available information on existing environmental conditions in the Project area was conducted in January 2019. Sources of information included:

- BC Ministry of Environment and Climate Change Strategy (BC MOECCS) Habitat Wizard webmap (BC MOECCS 2019a)
- Conservation Data Centre (CDC, BC MOECCS 2019b)
- Fisheries Information Summary System (FISS, BC MOECCS 2019c)
- DFO Aquatic Species at Risk Maps (DFO 2017)

Wildlife components were assessed based on existing reports and databases describing key habitat features. A desktop assessment of wildlife and wildlife habitat was completed to characterize general terrestrial habitats, identify sensitive ecosystems or wildlife features, and assess the potential for species at risk within the study area. Understanding existing wildlife habitat is important to identify features that could be affected by the proposed Project, assess the type and extent of Project effects on wildlife and wildlife habitat, as well as to provide recommendations on measures to mitigate potential adverse effects.

4.1.2 Field Survey

A site investigation was completed on 25 January 2019. A Qualified Environmental Professional (QEP) visited the site and completed a visual reconnaissance of the Project area. The QEP completed an assessment following the RAR Detailed Assessment Methods (BC MFLNRO 2006). A Reconnaissance (1:20,000) Fish and Fish Habitat Inventory site card was also completed, in accordance with the Reconnaissance (1:20,000) Fish and Fish Habitat Inventory: Standards and Procedures (RIC 2001). Photographs documenting the existing environmental conditions were taken. Locations of Project components and environmental features were recorded using a handheld GPS unit.

Dominant vegetation species in the vicinity of the FCPCC were identified and recorded. Because of the time of year of the survey no rare plant or ecosystem survey was conducted as part of this reconnaissance. Incidental observations of wildlife and potential wildlife habitat features were recorded. Existing biophysical conditions were used to determine general habitat suitability for potential species at risk. No species-specific surveys were conducted.

An assessment to determine the potential width of a Streamside Protection and Enhancement Area (SPEA) was completed following the RAR Detailed Assessment Methods as laid out in the RAR Assessment Methods Schedule (Government of BC 2016). The assessment to determine the width of the SPEA was conducted within the Riparian Assessment Area (RAA), defined as a 30 m wide strip on either side of a watercourse. The RAR Detailed Assessment requires a QEP to evaluate stream width, reach breaks, potential vegetation type and channel type in the RAA. This information is entered into formulas to determine the SPEA width. Once the SPEA has been determined, measures to protect the integrity of the SPEA may also be determined. However, because this is a preliminary assessment and the Project is not bound by RAR, specific measures to protect the SPEA were not developed.

4.2 Results

4.2.1 Desktop Overview

4.2.1.1 Fish and Fish Habitat

Historic fish capture records and conservation statuses of these species are available for Morningstar Creek and French Creek are provided in Table 1.

Table 1: Historic Fish Capture Records for Morningstar Creek and French Creek

Common Name	Scientific Name	Morningstar Creek	French Creek	BC Status	SARA Status
Coho salmon	*Oncorhynchus kisutch*	✓	✓	Yellow – S4	No Status
Chinook salmon	*Oncorhynchus tshawytscha*		✓	Yellow – S4	Endangered (East Vancouver Island Stream Spring population)
Chum salmon	*Oncorhynchus keta*		✓	Yellow – S5	No status
Pink salmon	*Oncorhynchus gorbuscha*		✓	Yellow – S5	No status
Atlantic salmon	*Salmo salar*		✓	Exotic	No status
Rainbow trout/ steelhead	*Oncorhynchus mykiss*		✓	Yellow – S5	No status
Coastal cutthroat trout	*Oncorhynchus clarkii clarkii*	✓	✓	Blue – S3S4	No status
Sculpin (general)	*Cottus* sp.	✓		-	-
Stickleback (general)	*Gasterosteus* sp.	✓		-	-

Notes:
✓= Present
Yellow = Species at least risk of being lost; Blue = Species that is of special concern; Red = Species that is at risk of being lost (extirpated, endangered, or threatened);
S3S4 = Either Vulnerable or Apparently Secure; S4 = Apparently secure; S5 = Secure;
Reference: BCMOECCS 2019a

4.2.1.2 Vegetation and Terrestrial Resources

The Project is within the Coastal Douglas Fir zone Moist Maritime subzone (CDFmm). This zone occurs at low elevations along southeast Vancouver Island, from sea level up to 150 m in elevation (Green and Klinka 1994). Climate in this zone is typically mild, with warm, dry summers, and milt, wet winters. The CDFmm subzone forest is typically dominated by Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), and western redcedar (*Thuja plicata*). Common understorey species include salal (*Gaultheria shallon*), dull Oregon-grape (*Mahonia nervosa*), and ocean-spray (*Holodiscus discolor*).

The BC MOECCS Vancouver Island Region Environmental Stewardship Division reports that a wide variety of wildlife species are known to inhabit the CDF subzone on Vancouver Island (BC MOECCS 2019d). A total of 323 bird species, 11 amphibian species, 9 reptile species, and 44 terrestrial mammals are found in this zone for at least part of the year.

A search of the Habitat Wizard database was conducted to identify recorded wildlife species observations within a 5 km buffer of the Project area. Results of this search are presented in Table 2.

Table 2: Historic Wildlife Observations within 5 km of the FCPCC Site

Common Name	Scientific Name	Wildlife Group	BC Status	SARA Status
Common garter snake	*Thamnophis sirtalis*	Reptile	Yellow – S5	None
Northwestern garter snake	*Thamnophis ordinoides*	Reptile	Yellow – S4	None
American bullfrog	*Lithobates catesbeianus*	Amphibian	Exotic	None
Great blue heron	*Ardea herodias fannini*	Bird	Blue – S2S3B, S4N	Special Concern
Roosevelt elk	*Cervus elaphus roosevelti*	Ungulate	Blue – S3S4	None
Harbour seal	*Phoca vitulina*	Marine mammal	Yellow – S5	None

Notes: Yellow = Species at least risk of being lost; Blue = Species that is of special concern; Red = Species that is at risk of being lost (extirpated, endangered, or threatened);
S2S3B = Either Imperilled or Vulnerable Breeding Population; S4N = Apparently Secure Nonbreeding Population; S4 = Apparently secure; S5 = Secure;
Special Concern = A species that may become threatened or endangered.
Reference: BCMOECCS 2018c

No great blue heron colonies were identified in the vicinity of the Project area in the COSEWIC Assessment and Update Status Report for Great Blue Heron during the desktop review (COSEWIC 2008). A breeding colony is shown on the Habitat Wizard webmap approximately 6.8 km to the southwest of the Project area, near the community of Coombs, BC, however the colony was reported as inactive in 2002 (BC MOECCS 2019a; MWLAP and MSRM 2002).

Harbour seal observations were recorded in the marine environment of the Strait of Georgia. No marine habitat suitable to support harbour seals is located at the Project site.

4.2.1.3 Sensitive Species

A search of the CDC database was conducted to determine sensitive species within a 2 km and a 5 km buffer of the Project area. No sensitive species occurrences were identified within the 2 km buffer. Within the 5 km buffer, four occurrences of sensitive species were identified: one blue-listed rush species, one red-listed forest ecosystem, and two Secured CDC features. A Secured CDC Occurrence indicates the presence of a species or ecosystem that is susceptible to harm and has been masked from public access to protect it. The edges of the masked occurrences are located more than 2 km from the Project area and are therefore unlikely to be impacted by Project activities. A request for more information on the masked polygons was submitted to CDC and CDC staff confirmed that the mapped species are not anticipated to be impacted by Project activities (pers. comm. J. Clare, MOECCS). Identified species occurrences are presented in Table 3.

The FCPCC site is located in an area that may provide habitat for bats at risk, including Townsend's big-eared bat (*Corynorhinus townsendii*, Provincial Blue list – S3S4), as reported by CDC biologists during a review of the project area (pers. comm. J. Clare, MOECCS).

Table 3: Sensitive Species/Ecosystems Identified within a 5 km Buffer of the Project Area

Species Group	Common Name	Scientific Name	Provincial Status	SARA Status	Habitat Requirement
Plant	Pointed rush	*Juncus oxymeris*	Blue – S3	None	Wet meadows and riverbanks in lowland CDFmm, CWHdm, and CWHxm biogeoclimatic zones
Plant community	Douglas-fir/dull Oregon grape	*Pseudotsuga menziesii/Berberis nervosa*	Red – S1	None	Middle slopes, on all elevations and at low elevations in coastal BC. Moderately dry moisture regime. Douglas-fir-dominated forest with dull Oregon grape-dominated shrub layer.
Unknown	Two Secured Conservation Data Centre Species Occurrences	N/A	Unknown	Unknown	Unknown

Notes: CWHdm is Coastal Western Hemlock Dry Maritime subzone; CWHxm is Coastal Western Hemlock Very Dry Maritime subzone.

4.2.2 Field Survey

4.2.2.1 Fish and Fish Habitat

Three aquatic features were identified on the FCPCC site: Morningstar Creek, a roadside ditch adjacent to Highway 19A, and a small, isolated pond near the existing FCPCC building.

Morningstar Creek is a well-defined stream with a riffle-run morphology (Photos 1 and 2). It runs generally towards the northeast, through the FCPCC site. The creek crosses under Highway 19A at the FCPCC site boundary, then drains into the Strait of Georgia, approximately 500 m downstream of the Project area. French Creek also discharges to the Strait of Georgia near the Morningstar Creek outlet. French Creek was designated as a sensitive watershed by the BC Ministry of Water, Land, and Air Protection (MWLAP and MSRM 2002).

Photo 1: Facing upstream showing a typical section of Morningstar Creek downstream of the bridge crossing.

Photo 2: Facing downstream, showing a typical section of Morningstar Creek upstream of the bridge crossing.

Photo 3: Facing upstream, showing detail of the instream bridge abutment on the left downstream bank.

Photo 4: Facing downstream, showing the inlet of the dual-culvert crossing of Morningstar Creek at Highway 19A.

Two crossing structures over Morningstar Creek were identified on or near the FCPCC site – a bridge on the FCPCC site and a dual-culvert crossing under Highway 19A (Photos 3 and 4). The Morningstar Creek bridge consists of a concrete deck supported on concrete abutments that are located within the high-water mark of the creek. At the time of survey, the western abutment was within the wetted area of the creek and the eastern abutment was outside of the wetted area, but below the high-water mark. The dual-culvert crossing at Highway 19A consisted of two parallel 1500 mm diameter concrete pipes with a length of approximately 20 m. Both pipes were conveying water with no evident obstacles. Neither the bridge nor the culvert structure appeared to present a barrier to fish passage under the observed flow conditions.

Morningstar Creek was characterized by a series of alternating riffle and run habitat types with an irregular meandering pattern through the FCPCC site. Channel dimensions were measured at eleven transect sites, extending over approximately 150 m of stream channel. Measurements are presented in Table 4. Mean bank-full channel width was 6.74 m, mean wetted width was 5.66 m, mean residual pool depth was 0.70 m, and mean bank-full depth was 0.72 m. Measured channel gradients ranged from 1.5 to 2.0 %. Channel substrates were dominated by gravels, with fines subdominant. D95[1] was 0.56 m and D[2] was 0.10 m. Water temperature at the time of survey was 5.5°C and the water was moderately turbid. Side- and mid-channel gravel bars were present throughout Morningstar Creek, particularly in the upper portion of the study reach. Small off-channel wetted areas were present throughout the study

[1] D95 is defined as the diameter of the bed material particle that is larger than 95% of the materials in the stream channel.
[2] D is defined as the size of the largest particle on the channel bed that will be moved at channel forming flow levels.

reach, the largest of which was a shallow pool measuring approximately 5 m by 5 m on the left downstream bank[3] of the creek, approximately 20 m downstream of the bridge crossing (Photo 5). Large and small woody debris was present in the channel, with the largest accumulation present approximately 45 m downstream of the bridge in a large channel-spanning jam (Photo 6).

Channel banks were generally sloping, with some nearly-vertical eroding sections. Bank substrates were dominated by fines, gravels, and small cobbles. Riparian vegetation consisted of mixed mature forest, described in greater detail in Section 4.2.2.2. Crown closure provided by riparian vegetation was estimated to be between 21 and 40%.

Table 4: Morningstar Creek Channel Dimensions

Location	Transect	Bank-full Width (m)	Wetted Width (m)	Residual Pool Depth (m)	Bank-full depth (m)
Downstream of Morningstar Creek Bridge	1	5.10	4.90	-	-
	2	4.85	4.35	0.67	-
	3	4.95	4.30	-	0.65
	4	5.95	5.70	0.64	-
	5	7.40	7.20	-	-
	6	7.70	7.20	0.63	-
Upstream of Morningstar Creek Bridge	7	6.15	5.80	-	-
	8	5.15	4.95	1.10	-
	9	11.10	8.80	-	-
	10	7.25	3.00	-	0.78
	11	8.55	7.10	0.45	-
Mean	-	6.74	5.66	0.70	0.72

Photo 5: Facing the left downstream bank, showing an off-channel pool downstream of the bridge crossing.

Photo 6: Facing downstream, showing a channel-spanning accumulation of woody debris. This jam is not anticipated to impede fish passage.

[3] Left downstream bank is defined as the bank on the observer's left-hand side when facing downstream.

Photo 7: Facing upstream, showing the furthest downstream riffle habitat unit. The instream rock appears to be artificially-placed angular material intended to provide habitat complexity.

Photo 8: Facing the right downstream bank, showing two piles of angular stone placed against an eroding bank, likely intended to minimize further erosion.

Cover available for fish was estimated to be moderate in abundance, covering approximately 20% of the channel area. Deep pool with low water clarity was the dominant cover type, with boulders, large woody debris, and overhanging vegetation the subdominant cover types. Small woody debris, undercut banks, and instream vegetation provided trace amounts of cover for fish.

Habitat quality for salmonid species was generally rated as good throughout Morningstar Creek. Juvenile rearing habitat quality was good, based on the diversity of habitat and cover types and the presence of pool and off-channel areas for feeding. Spawning habitat quality was rated as good for the portion of the creek upstream of the bridge where clean gravel substrates are abundant. Spawning habitat is poor downstream of the bridge, where substrates are dominated by coarse placed rock and deeper pools with fine substrates. Migratory habitat quality was rated as good, based on the absence of barriers to fish movement under observed flow conditions. Overwintering habitat was rated as good, based on the presence of deep pools and observed high water levels during winter conditions.

Instream habitat enhancement features were observed in Morningstar Creek during the site visit. Downstream of the bridge crossing, a series of three riffles, constructed from apparently artificially-placed angular cobbles and boulders, spanned the channel (Photo 7). Additionally, placed angular cobble and boulder material was present along the right downstream bank at two sites - one upstream and one downstream of the bridge crossing, at eroding banks, likely to provide erosion protection (Photo 8). Several pieces of large woody debris cabled together were identified approximately 60 m upstream of the bridge crossing. This coarse rock material and woody debris increases habitat complexity and is expected to increase the quality of the habitat available for fish.

The small pond on the FCPCC site, shown on Figure 1, is approximately 25 m long and 8 m wide, with a maximum water depth of 40 cm (Photo 9). The pond was fed by a 300 mm diameter concrete pipe culvert, which is expected to provide stormwater drainage from the adjacent road surface (Photo 10). Minimal inflows were observed at the time of survey and no discernible flow in the pond was observed. Organic material, including decomposing leaves and woody debris was abundant and a strong organic odour was noted. Common duckweed (*Lemna minor*), sedges, and grasses were observed in the pond. No overland flow from the pond was identified and fish access to the pond is not expected to exist. Subsurface seepage from the pond to Morningstar Creek is expected to provide water and food and nutrient inputs only.

The Highway 19A roadside ditch runs parallel to the Highway at the northeast side of the FCPCC site and drains directly into Morningstar Creek immediately upstream of the Highway 19A culvert crossing (Photos 11 and 12). The ditch had a defined channel with a mean width of approximately 1 m and a bankfull depth of 15 cm. At the time of survey, the mean wetted width of the ditch was approximately 0.9 m. Ditch substrates were dominated by clean scoured gravel. No obstacles to fish access were identified. This ditch is expected to provide seasonal fish habitat for small-bodied fish, including juvenile salmonids when water depths are sufficient to allow access.

Photo 9: Facing northwest, showing the isolated pond.

Photo 10: Facing down, showing the thick layer of accumulated organic debris in the isolated pond.

Photo 11: Facing down, showing the clean gravel substrate and shallow flowing water in the Highway 19A roadside ditch.

Photo 12: Facing the right downstream bank of Morningstar Creek, where the Highway 19A roadside ditch joins the creek.

4.2.2.2 Vegetation

The vegetation community in the vicinity of Morningstar Creek consists of two general types: a narrow strip of deciduous-dominated forest immediately adjacent to the watercourse and a coniferous-dominated forest adjacent to the deciduous zone (Photos 13 and 14). The coniferous-dominated forest continued to the west and east of Morningstar Creek and Highway 19A where the majority of trees will be cleared for the CTU Building and bioreactors (Figure 2). Also, on the west side of Morningstar Creek, a disused and vegetated roadbed runs between the bridge crossing and Highway 19A (Photos 15 and 16). This roadbed had a mean width of 6 m and runs between the two observed forest types. Vegetation on the road surface included grasses, and mosses with patches of sedge.

Photo 13: Facing north, showing the trunks of deciduous trees immediately adjacent to Morningstar Creek. Coniferous trees can be seen to the right and at the background of the frame, further from Morningstar Creek.

Photo 14: Facing downstream, showing a narrow buffer of deciduous trees adjacent to Morningstar Creek with coniferous trees located further from the creek.

Photo 15: Facing southwest near Highway 19A, showing the old road bed that runs along the west side of Morningstar Creek.

Photo 16: Facing southwest, showing the old road bed near the Morningstar Creek bridge crossing

The deciduous strip was dominated by red alder (*Alnus rubra*) and bigleaf maple (*Acer macrophyllum*) trees. This width of this strip was approximately 5 to 10 m on both sides of Morningstar Creek. The coniferous zone was dominated by Douglas-fir, western redcedar, and sitka spruce (*Picea sitchensis*), with big-leaf maple also present. Dominant understorey species were sword fern (*Polystichum munitum*) and salmonberry (*Rubus spectabilis*), with common snowberry (*Symphoricarpos albus*), Himalayan blackberry (*Rubus armeniacus*), salal, dull Oregon-grape, English ivy (*Hedera helix*), and trailing blackberry (*Rubus ursinus*) also present. Sedges (*Carex* spp.), grasses (Graminoids), and mosses (Bryophytes) were also present throughout the site. Species identified on the FCPCC site are presented in Table 5.

Table 5: Plant Species Identified at the FCPCC Site

Scientific Name [1]	English Name	Form	Native	Exotic
Pseudotsuga menziesii	Douglas-fir	Tree	X	-
Thuja plicata	Western redcedar	Tree	X	-
Picea stichensis	Sitka spruce	Tree	X	-
Alnus rubra	Red alder	Tree	X	-
Acer macrophyllum	Big-leaf maple	Tree	X	-

Scientific Name [1]	English Name	Form	Native	Exotic
Gaultheria shallon	Salal	Shrub	X	-
Mahonia nervosa	Dull Oregon-grape	Shrub	X	-
Rubus spectabilis	Salmonberry	Shrub	X	-
Symphoricarpos albus	Common snowberry	Shrub	X	-
Rubus ursinus	Trailing blackberry	Shrub	X	-
Rubus armeniacus	Himalayan blackberry	Shrub	-	X
Hedera helix	English ivy	Shrub	-	X
Polystichum munitum	Sword fern	Herb	X	-
Graminoid species	Grass	Herb	X	-
Carex species	Sedge	Herb	X	-
Bryophyte species	Moss	Herb	X	-

1. Names according to Klinkenberg (2018)

4.2.2.3 Wildlife

Based on information obtained from desktop review, the Project Site does not overlay areas of species or ecosystems at risk, nor have there been any recorded observation of wildlife in the Project Site (BC MOECCS 2019). Notwithstanding the desktop review and field observation, the CDFmm biogeoclimatic zone on Vancouver Island is home to a wide variety of animals, many of which are highly mobile and have the potential to occur at the site (BC MOECCS 2019d). During the site reconnaissance visit the prints of black-tailed deer (*Odocoileus hemionus columbianus)* and raccoon (*Procyon lotor*) were observed. Both are Yellow listed species with no status under SARA.

There is a wide diversity of birds found on Vancouver Island with the potential to nest or feed, permanently or seasonally, within the Project Site. Raptors and owls have the potential to nest and/or feed in the vicinity the Project site owing to the surrounding mature forest and likely presence of prey such as small rodents. Passerine species are also expected to occur within the Project Site. During the field survey no raptor nests were observed within the Project Site. One inactive passerine nest was observed near Morningstar Creek (Photo 17). Several standing dead trees (snags) were present on site (Photo 18). These trees provide foraging and cavity nesting opportunities for a variety of birds and small mammals.

Herptiles with the potential to occur at the site include frogs, salamanders, snakes, and lizards; though a desktop review and field observations did not identify species within the Project Site. The area offering the highest suitability for amphibians is anticipated to be the pond area located to the northeast of the Morningstar Creek bridge site. In addition, low velocity side channel areas of Morningstar Creek or the Highway 19A roadside drainage ditches also offer suitable habitat for amphibian species. No herptiles were observed or heard calling during the site reconnaissance visit.

Photo 17: An inactive stick nest in a tree near Morningstar Creek.

Photo 18: A standing dead tree with abundant cavities created by foraging animals.

4.2.3 Riparian Setbacks

4.2.3.1 SPEA Width Determination

Data gathered during the field assessment was entered into the RAR Detailed Assessment Form (Form 3) to calculate the resulting SPEA widths for the watercourse and the wetland. Results are summarized below and the completed detailed assessment form is attached to this report (Appendix B).

The following characteristics are used to determine watercourse Zones of Sensitivity (ZoS):

- Reach breaks: the subject watercourse consists of a single reach within the site.
- Average channel width: 6.474 m
- Average channel slope: 1.8%
- Channel type: Riffle-pool
- Site Potential Vegetation Type (SPVT): Deciduous or coniferous tree (TR).

These characteristics determine the width of the ZoS for the features, functions, and conditions of riparian areas described in Table 6.

Table 6: RAR Zones of Sensitivity

Zone of Sensitivity Category	Description of Calculation	Resulting Zone of Sensitivity Width (m)
Large Woody Debris, Bank, and Channel Stability	For riffle-pool streams with TR SPVT, ZoS is three times the channel width of 6.47 m. Maximum value is 30 m and minimum value is 10 m.	19.4 m
Litter Fall and Insect Drop	For streams with TR SPVT, ZoS is three times the channel width of 6.47 m. Maximum value is 15 m and minimum value is 10 m.	15 m
Shade	For streams with TR SPVT, ZoS is three times the channel width of 6.47 m along the south side of the stream. Maximum value is 30 m.	19.4 m

[4] Note that the RAR Detailed Assessment methodology for calculating the average channel width involves removal of the highest and lowest stream width measurements, leading to a slightly different mean width than was presented in Section 4.2.2.1.

The largest ZoS width is used to establish the SPEA. The 19.4 m ZoS for Large Woody Debris, Bank, and Channel Stability and Litter Fall and Insect Drop results in a SPEA width of 19.4 m on both sides of the watercourse. The 19.4 m SPEA would apply to the riparian area extending from the high-water mark of Morningstar Creek.

4.2.3.2 Proposed Riparian Setback

The existing design for the FCPCC calls for a 15 m setback from the high-water mark of Morningstar Creek, in accordance with RDN Bylaw 1469.02. Site infrastructure will be generally placed outside of a 15 m wide area on both sides of Morningstar Creek. The exception to this setback will be the construction area required for Morningstar Creek crossing works.

Within the 15 m buffer, existing vegetation will be retained where possible and riparian vegetation planting will be conducted following the completion of construction activities to enhance the quality of the aquatic environment of Morningstar Creek. Any disturbed areas within this buffer area will be reclaimed and revegetated following completion of construction. The planting area will include a portion of the existing old roadbed on the west side of Morningstar Creek. The old roadbed is vegetated only with graminoids and other low growing herbs and currently offers little value to the creek in terms of shading, provision of woody debris, or organic debris inputs. Although the proposed 15 m buffer is narrower than the 19.4 m buffer suggested by the RAR assessment, the maintenance of a 15 m vegetated buffer and the establishment of riparian vegetation on the road bed adjacent to the creek is anticipated to offer reasonable protection and potential improvement of the aquatic environment.

5. Potential Project Effects

Potential project effects associated with the construction phase are described and discussed in this section. Project activities discussed here with the potential to cause environmental effects include:

- Replacement of the existing bridge with an open bottom culvert crossing system, and
- Vegetation clearing within the new FCPCC footprint.

The two activities listed above have the potential to directly impact the aquatic environment of Morningstar Creek. The fish habitat in Morningstar Creek is known to support blue-listed coastal cutthroat trout and Pacific salmon species, most likely coho salmon. In order to minimize effects to fish and fish habitat, instream works would take place during the period of least risk to fish which is August 15 to September 15 based on the species of fish that could be present in these creeks (see Section 6.6.4). Under ideal conditions, the installation of the culvert crossing would be completed during a period of no flow in Morningstar Creek. If this is not possible due to flow conditions or construction timing restrictions, the crossing work area would be isolated, fish salvaged from the work area and water pumped around so that work can be conducted in the dry. Once the work is complete, the stream bed and banks would be restored to pre-construction conditions including replanting of riparian vegetation. The appropriate Instream Work Standards and Best Practices (WLAP 2004) will be followed to minimize potential effects and appropriate approvals or authorizations would be required from Fisheries and Oceans Canada under the *Fisheries Act* and the provincial Ministry of Forests Lands and Natural Resource Operations and Regional Development under the *Water Sustainability Act*.

Vegetation clearing will be required to prepare for the installation of the Morningstar Creek culvert (approximately 560 m^2), the area for the CTU building and the bioreactors is approximately 4700 m^2 and the new access road along the western boundary is approximately 1800 m^2. Clearing for the culvert installation will have the potential to impact fish habitat by removing vegetation in the riparian area. Removal of riparian vegetation can cause a number of changes to the existing fish habitat, including increased water temperatures due to loss of shading, decreased nutrient inputs from falling insects and organic debris, decrease of hydraulically-functional woody debris inputs, and decrease in bank stability. Removal of vegetation during bird nesting season (typically occurring from mid-March to mid-August on Vancouver Island) has the potential to result in the destruction of nests or the death of birds protected under the *Migratory Birds Convention Act* or the *Wildlife Act*. Vegetation clearing has been kept to a minimum and it is unlikely that any new trees will have to be cleared for the culvert installation and the building setback on the west side of the creek will allow the preservation of at least a 15 m wide riparian area next to Morningstar Creek.

Where clearing results in the exposure of soils there is the potential for erosion and sedimentation. Standard best practices for construction works, in particular when working around watercourses, can eliminate or reduce erosion and sedimentation issues.

Non-native plant species were identified in the vicinity of the FCPCC site, namely Himalayan blackberry. Additional non-native and invasive plants are expected to be present in the vicinity. Between seeds from nearby plants the use of construction equipment moving soils around that could contain seeds, there is a significant risk for invasive species to proliferate the area.

No mapped habitat of at-risk mammals or amphibians was identified during the desktop review and field reconnaissance. However, Morningstar Creek, roadside ditches, and the pond area on the FCPCC site may provide habitat for small aquatic mammals or amphibians. Prior to the start of construction, a QEP should conduct a Project-specific assessment of amphibian and mammal habitat. This assessment would be used to determine whether aquatic mammal or amphibian salvage/relocation work is required and to identify the specific areas requiring salvage.

Construction activities can be an issue for nearby residents and users of nearby public spaces from increased traffic and on site activity causing additional noise.

6. Environmental Protection and Mitigation Measures

The adoption of appropriate mitigation measures and best management practices during construction will reduce the potential impacts associated with Project activities. This section provides general guidelines and recommendations for environmental protection and mitigation during the construction phase. The following information is general in nature and should be refined prior to construction and incorporated into an environmental management plan (EMP) to address the specific construction equipment and methods and timing of works.

6.1 General Measures

6.1.1 Demarcation of Construction Boundaries and Sensitive Areas

Prior to any site preparation or construction activities, footprint boundaries, sensitive areas, riparian areas, and known sensitive habitat features (e.g., nests) should be outlined on site plans and in the field with ‘No Work Area’ or similar flags, to reduce the possibility of causing unnecessary disturbance to surrounding ecosystems. Visual boundaries should be reviewed throughout the construction phase to ensure all boundaries are marked remain clear and as accurate as possible.

6.1.2 Monitoring

Throughout construction and particularly during works near Morningstar Creek, environmental monitoring and reporting should be conducted to confirm that environmental protection measures are being applied and effective. If they are not effective, the monitor will work with the contractor to modify protection measures until they are. The environmental monitor will be an appropriately qualified professional and will have the authority to stop construction if there is any contravention of environmental protection guidelines or regulations (i.e., impact to fish habitat) or if there is imminent threat of environmental damage. This is particularly important around the riparian areas of Morningstar Creek.

6.2 Erosion and Sediment Control

Figure 3 provides erosion and sediment control (ESC) details to be applied to this project and will be included with the drawings that will be issued for tender. The successful contractor will be required to develop an ESC plan detailing the specific time periods, locations and activities that will be followed to manage erosion and sedimentation, i.e. where silt fencing and sediment barriers will be installed. Due to the dynamic nature of site conditions, it is expected that measures will require additional adjustments and actions once construction begins. Additional erosion and sediment control measures will be incorporated as required based on observations during monitoring. Below are general minimum erosion and sediment control measures:

EROSION AND SEDIMENT CONTROL NOTES:

1. IT IS INTENDED THAT EROSION AND SEDIMENT CONTROL STRATEGIES BE IMPLEMENTED DURING ALL CONSTRUCTION PHASES.

2. THE EROSION CONTROL MEASURES OUTLINED HERE ARE INTENDED TO:
   - PREVENT THE GENERATION OF SUSPENDED SEDIMENT
   - SUPPORT EROSION CONTROL MEASURES BY CAPTURING AND RETAINING SUSPENDED SEDIMENT
   - TO LIMIT THE TRANSPORT OF SEDIMENT ONTO ROADWAYS. ALL SITE ACCESS FROM DISTURBED AREAS TO PAVED SURFACES WILL BE RESTRICTED WHERE POSSIBLE.
   - ALL PERSONS INCLUDING, BUT NOT LIMITED TO , ENGINEER, THE EROSION AND SEDIMENT CONTROL SUPERVISOR, THE GENERAL CONTRACTOR AND ALL SUB-CONTRACTORS INVOLVED WITH THE PROJECT (ALL PERSONS INVOLVED) SHALL COMPLY WITH ALL FEDERAL, PROVINCIAL AND REGIONAL DISTRICT OF NANAIMO (RDN) REGULATORY REQUIREMENTS FOR EROSION AND SEDIMENT CONTROL (ESC).

3. ALL PERSONS INVOLVED WITH THE PROJECT ARE RESPONSIBLE FOR ALL SITE ACTIVITIES THAT RESULT IN NON-COMPLIANCE WITH REGULATORY REQUIREMENTS.

4. PRIOR TO CONSTRUCTION START-UP, THE PROJECT PROPONENT OR PRIME CONTRACTOR MUST SCHEDULE AN ENVIRONMENTAL PRE-CONSTRUCTION MEETING TO DISCUSS SCHEDULING, ROLES AND RESPONSIBILITIES, AND ESC AND OTHER POLLUTION PREVENTION PRACTICES. MEETING INVITEES SHOULD INCLUDE THE DEVELOPER/PROJECT MANAGER, CONSULTANT, CONTRACTORS AND REGULATORS.

5. THE FOLLOWING INFORMATION MUST BE ON SITE (AND AVAILABLE UPON REQUEST), AND FILED FOR A MINIMUM OF TWO YEARS FOLLOWING FINAL SITE STABILIZATION:
   - THE EROSION AND SEDIMENT CONTROL REPORT AND/OR DRAWING(S), INCLUDING ALL AMENDMENTS;
   - DOCUMENTATION (INCLUDING PHOTOS AND UP-TO-DATE WRITTEN RECORDS) DETAILING IMPLEMENTATION, INSPECTION AND MAINTENANCE OF ESC PRACTICES.

7. REGULAR MONITORING INSPECTIONS ARE TO BE CARRIED OUT BY A QUALIFIED ESC MONITOR UNDER THE SUPERVISION OF THE ESC SUPERVISOR UNTIL PROJECT COMPLETION.

8. INSPECTIONS OF ALL ESC PRACTICES MUST BE COMPLETED AND DOCUMENTED AT LEAST EVERY 7 DAYS AND AT CRITICAL TIMES WHEN EROSION OR SEDIMENT RELEASES COULD OCCUR. NOTE: INSPECTIONS MUST BE COMPLETED AND DOCUMENTED DURING, OR WITHIN 24 HOURS OF, HEAVY SNOWMELT AND HEAVY AND/OR PROLONGED RAINFALL (DEFINED AS >12 MM PRECIPITATION WITHIN ANY 24 HOUR PERIOD, OR PRECIPITATION OR SNOWMELT ON WET OR THAWING SOILS).

9. AS DIRECTED BY THE ENGINEER OR ESC SUPERVISOR, PERSONS INVOLVED IN ESC MAINTENANCE ARE REQUIRED TO INSPECT AND UNDERTAKE ACTIVITIES TO MODIFY OR MAINTAIN ESC FACILITIES. THESE INCLUDE, BUT ARE NOT LIMITED TO ONSITE OR ADJACENT PAVED ROAD SURFACES, ONSITE OR ADJACENT CATCH BASIN AND FILTRATION FACILITY AND EQUIPMENT, AND ONSITE SEDIMENT FENCING.

10. THE ESC SUPERVISOR WILL BE RESPONSIBLE FOR ENSURING THAT MONITORING INSPECTIONS ARE CONDUCTED ON A REGULAR BASIS. THE ESC SUPERVISOR WILL REPORT TO THE RDN AND THE CONTRACTOR ON ESC ESC MEASURES AND SITE DISCHARGE. ESC MONITORING AND STORM DISCHARGE FROM THE SITE TESTED WEEKLY AND AFTER HIGH RAINFALL EVENTS (>25mm IN 24 HOURS).

11. THE ESC DRAWINGS ILLUSTRATES THE MINIMUM MEASURES REQUIRED TO MEET RDN REQUIREMENTS.ALL PERSONS INVOLVED WITH THE PROJECT WILL COMPLY WITH THE ESC PLAN AND WITH ALL INSTRUCTIONS ISSUED BY THE PROJECT'S ESC SUPERVISOR, RDN, AND FISHERIES AND OCEANS CANADA TO CORRECT DEFICIENCIES THAT WOULD RESULT IN NON-COMPLIANCE WITH THE CONDITIONS OF THE PERMIT.

12. THE APPROVED EROSION AND SEDIMENT CONTROL REPORT AND/OR DRAWING(S) MUST BE UPDATED WHEN THERE ARE CHANGES TO THE EROSION AND SEDIMENT CONTROL PRACTICES OR IMPLEMENTATION.

13. THE CONTRACTORS ARE REQUIRED TO HAVE A COPY OF THE ESC PLAN ONSITE AT ALL TIMES AND PROVIDE CONTACT DETAILS FOR THE ESC SUPERVISOR.

14. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ALL ESC MEASURES SPECIFIED ARE INSTALLED BEFORE CONSTRUCTION BEGINS. THE ESC SUPERVISOR SHALL CONDUCT MONITORING INSPECTIONS AS REQUIRED BY THE CONTRACT.

15. THESE PLANS AND NOTES ILLUSTRATES THE MINIMUM WORKS AND FACILITIES REQUIRED FOR CONTROLLING EROSION AND SEDIMENT . THE CONTRACTOR SHALL INSTALL ADDITIONAL EROSION AND SEDIMENT CONTROL WORKS AND FACILITIES INCLUDING BUT NOT LIMITED TO WHEEL WASH, SEDIMENT COLLECTION AND TEMPORARY DISCHARGE FACILITY AT SITE ACCESS POINT AS WORK PROGRESSES AND AS REQUIRED TO SUIT CONTRACTORS WORK FLOW AND METHODOLOGY TO ACHIEVE THE INTENT OF THE CONTRACTORS EROSION AND SEDIMENT CONTROL PLAN.

16. THE INTENT OF THE PLAN IS TO DIRECT CLEAN STORMWATER RUNOFF AWAY FROM THE WORK AREAS WHILE DIRECTING RUNOFF FROM ERODIBLE AREAS AND GRAVEL SURFACES SUBJECT FOR VEHICLE TRAFFIC TO CATCH BASINS WITH SEDIMENT BARRIERS OR SILT FILTERS.

17. SEDIMENT BARRIERS AND OTHER FACILITIES INTENDED TO PREVENT SEDIMENT FROM BEING DISCHARGED TO THE STORM DRAINAGE SYSTEM OR OTHER RECEIVING WATERS ARE CONSIDERED TO BE THE LAST LINE OF DEFENSE AND SHALL BE IMPLEMENTED IN CONJUNCTION WITH OTHER MEASURES THAT CONTROL SEDIMENT, SUCH AS SWEEPING, OR EROSION PREVENTION.

18. ALL EROSION AND SEDIMENT CONTROL WORKS AND FACILITIES SHALL BE MONITORED AND MAINTAINED IN PROPER OPERATING CONDITION ON AN ON-GOING BASIS. ALL COLLECTED SEDIMENT SHALL BE REMOVED AFTER SIGNIFICANT RAIN EVENTS.

19. ALL CATCH BASINS LOCATED ONSITE OR ADJACENT TO THE PROJECT, THAT COULD POTENTIALLY RECEIVE SEDIMENT LADEN RUNOFF DUE TO THE PROJECT WILL HAVE SEDIMENT PROTECTION INSTALLED TO MINIMIZE THE AMOUNT OF SEDIMENT ENTERING THE STORM SYSTEM. SEDIMENT BARRIERS ARE TO BE INSTALLED WITH A MINIMUM DEPTH OF 150mm TO FILTER, BUT NOT LIMIT, WATER FLOW.

20. GEOTEXTILE SEDIMENT FENCES ARE TO BE INSTALLED ALONG DITCHES AND OPEN WATER AT THE TOP OF BANK TO REDUCE MOVEMENT OF ERODED SEDIMENT. SEDIMENT FENCE WILL BE PLACED DUG IN A MINIMUM 150mm INTO THE GROUND, TO REDUCE SEDIMENT TRANSPORTATION AND ENSURE SEDIMENT IS KEPT AWAY FROM RIPARIAN AREAS (SEE DETAIL).

21. SILT FENCE IS TO BE 'CONTROL SILT FENCE PLUS' OR EQUIVALENT AS APPROVED BY THE ENGINEER. FENCE TO HAVE MIN. CLEAR WATER FLOW RATE OF 0.10cfs/sf. FENCE TO BE STAPLED @150mm O/C TO TREATED POSTS SPACED AT 1.0m O/C. BOTTOM OF SILT Ø100mm FENCE TO BE ANCHORED AS PER DETAIL.

22. GEOTEXTILE SEDIMENT FENCES ARE TO BE INSPECTED AND REPAIRED PRIOR TO EXPECTED RAIN EVENTS AND AFTER ALL SIGNIFICANT STORM EVENTS. SEDIMENT FENCES ARE TO BE CLEARED OF SEDIMENT OR REPLACED WHEN DEFICIENCIES ARE PRESENT.

23. PAVED ROAD SURFACES WITH ACCUMULATED SEDIMENT WILL BE CLEANED / SWEPT REGULARLY AS REQUIRED. FLUSHING OF ROADWAYS IS PROHIBITED.

24. ANY TEMPORARY STOCKPILES CONTAINING ERODIBLE MATERIAL WILL BE COVERED WITH A TARPAULIN OR PLASTIC TO PREVENT EROSION (SEE STOCKPILE DETAIL). A GEOTEXTILE SEDIMENT FENCE WILL BE PLACED 1 TO 2m FROM THE DOWNSLOPE TOE OF THE STOCKPILE AND DUG IN A MINIMUM 150mm INTO THE GROUND. TO REDUCE SEDIMENT TRANSPORTATION AND ENSURE SEDIMENT IS KEPT AWAY FROM DITCHES. STOCKPILES LEFT FOR PERIODS LONGER THAN ONE MONTH, WILL BE COVERED WITH VEGETATION (I.E., HYDROSEED). NO SEDIMENT LADEN MATERIALS SHALL BE DEPOSITED OR PILED OUTSIDE OF THE PROJECT BOUNDARIES, PARTICULARLY ON ACCESS ROAD SURFACES.

25. ALL INSTALLED EROSION AND SEDIMENT CONTROL FACILITIES ARE TO BE REPAIRED AND MAINTAINED WITHIN 24-HR OF DAMAGE BEING OBSERVED.

26. INSTALL GRAVEL SITE ACCESS AS SHOWN ON THE PLAN AT START OF CONSTRUCTION.

27. ALL CATCH BASIN PROTECTION DEVICES ARE TO BE INSPECTED WEEKLY MINIMUM, OR FOLLOWING SIGNIFICANT RAINFALL EVENTS, AND CLEANED-OUT OR REPAIRED AS NECESSARY WITHIN 24 HOURS. (MINIMUM CLEAN-OUT AT 40% CAPACITY)

28. AS CONSTRUCTION PROGRESSES, AND IF SITE GRADING REQUIRES TEMPORARY ELIMINATION OF DITCHES AND/OR OTHER MITIGATION MEASURES, THEY ARE TO BE IMMEDIATELY RESTORED BY THE END OF THE WORK DAY.

29. ALL GRAVEL PADS ARE TO BE IMMEDIATELY REPAIRED IF AFFECTED BY TRAFFIC OR CONSTRUCTION ACTIVITIES. ALL ROCK DRIVEWAY AND ACCESS PADS ARE TO BE MAINTAINED OR, IF SEDIMENT-LADEN, REPLACED.

30. ANY IRREGULARITIES SHALL BE REPORTED TO THE ENGINEER IMMEDIATELY.

31. SOLID WASTE (INCLUDING COLLECTED SEDIMENT, ASPHALT AND CONCRETE MILLINGS, FLOATING DEBRIS, PAPER, PLASTIC, FABRIC, CONSTRUCTION AND DEMOLITION DEBRIS AND OTHER WASTES) WILL BE DISPOSED OF PROPERTY AND WILL COMPLY WITH THE DISPOSAL REQUIREMENTS.

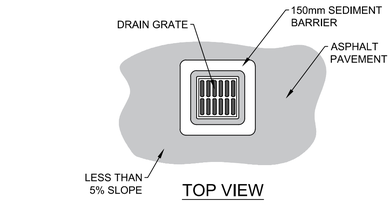
32. HAZARDOUS MATERIAL (INCLUDING OIL, GASOLINE, PAINT AND ANY HAZARDOUS SUBSTANCES) WILL BE PROPERLY STORED, INCLUDING SECONDARY CONTAINMENT, TO PREVENT SPILLS. LEAKS OR OTHER DISCHARGE. STORAGE AND DISPOSAL OF HAZARDOUS WASTE WILL BE IN COMPLIANCE WITH RDN REGULATIONS.

33. THE INTERNAL HAUL ROUTE(S) WILL BE DETERMINED BY THE EARTHWORKS CONTRACTOR AND CIRCULATED FOR REVIEW. THE HAUL ROAD WILL BE SPRAYED WITH WATER AS REQUIRED TO MINIMIZE DUST AND WIND EROSION.

DECOMMISSIONING

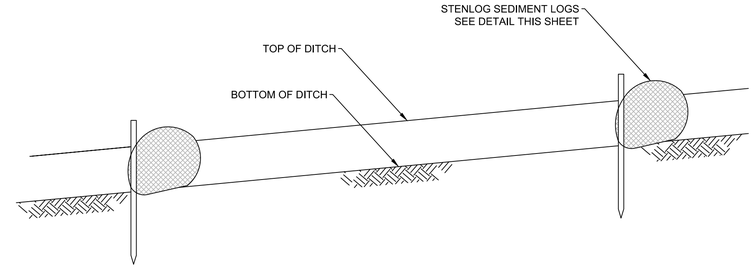
1. ALL SILT FENCES SHALL BE REMOVED.

2. ANY POINTS OF ENTRY OTHER THAN THE PROPOSED DRIVEWAYS SHALL BE REMOVED AND AREA REINSTATED AS PER THE DESIGN DRAWINGS.



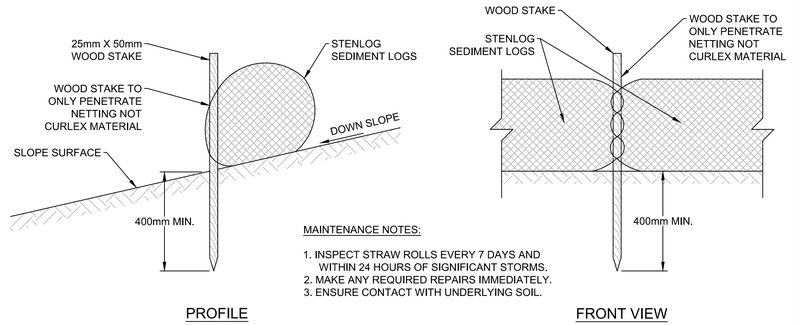
SEDIMENT BARRIERS TYPICAL

N.T.S.



TEMPORARY STENLOG SEDIMENT LOGS

N.T.S.



MAINTENANCE NOTES:

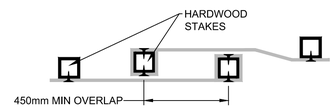
1. INSPECT STRAW ROLLS EVERY 7 DAYS AND WITHIN 24 HOURS OF SIGNIFICANT STORMS.
2. MAKE ANY REQUIRED REPAIRS IMMEDIATELY.
3. ENSURE CONTACT WITH UNDERLYING SOIL.

STRAW WATTLE DETAIL

N.T.S.

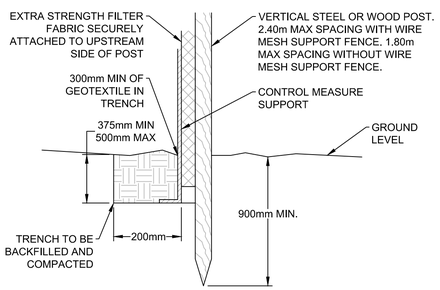
NOTES:

1. TO ENSURE OPTIMAL PERFORMANCE, SILT FENCE TO BE INSTALLED IN AN EXCAVATED TRENCH, MIN 150mm X 150mm OR AS REQUIRED BY THE LOCAL REGULATORY AUTHORITY.
2. STAKES TO BE POUNDED IN UNTIL FABRIC REACHES BOTTOM OF THE TRENCH.
3. POSTS TO BE INSTALLED FACING DOWNHILL. RUNOFF SHOULD PUSH FABRIC AGAINST POST NOT AWAY FROM THEM.
4. THE TRENCH TO BE BACKFILLED BY A BACKHOE OR OTHER EARTH MOVING EQUIPMENT.



WHEN INSTALLING SEVERAL LENGTHS OF SILT FENCE END TO END, OVERLAP THE EDGES OF THE FABRIC AT LEAST 450mm.

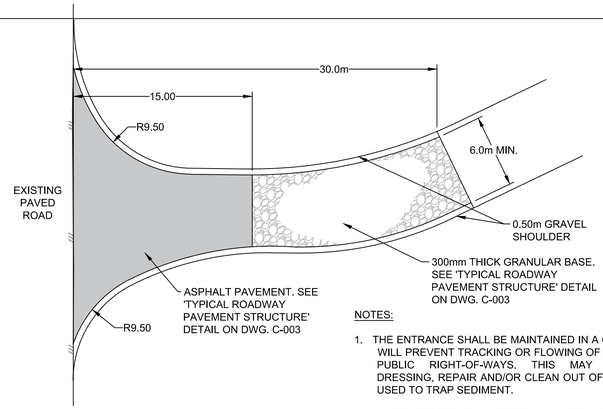
TOP VIEW



SITE VIEW

SILT FENCE INSTALLATION

N.T.S.

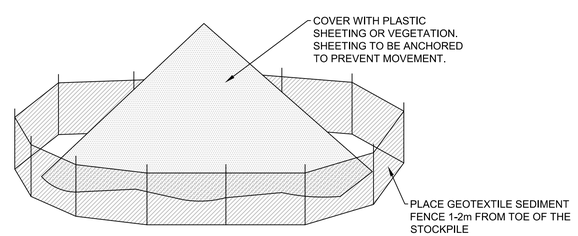


NOTES:

1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURED USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT OF WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AND APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE / EXIT

N.T.S.



STOCKPILE

N.T.S.

DRN BY:	DES BY:	CHK BY:	APP BY:
SI	BY	KM	MC

VERIFY SCALE IF PLAN SHEET IS REDUCED — 30 mm

REV	DESCRIPTION	DRN	CHK	DATE (Y/M/D)
B	ISSUED FOR 90% DETAILED DESIGN	SI	BY	2020/07/24
A	ISSUED FOR 60% DETAILED DESIGN	SI	KM	2019/09/24

PREPARED FOR:

REGIONAL DISTRICT OF NANAIMO

PREPARED BY:

AECOM
4th FLOOR,
3292 PRODUCTION WAY,
BURNABY, B.C., V5A 4R4
604-444-6400

REGIONAL DISTRICT OF NANAIMO
FRENCH CREEK POLLUTION CONTROL CENTRE
STAGE IV EXPANSION

CIVIL
EROSION AND SEDIMENT CONTROL NOTES AND DETAILS

PROJECT START DATE (M / Y)	SEP/2019
PROJECT NO.	60590631
FILENAME	60590631-C-002.dwg
RDN DRAWING No.	
DRAWING No.	C-002

- Implement the sediment and erosion control measures identified in the EMP prior to starting any works that may result in sediment mobilization.
- Ensure sediment and erosion control measures are maintained by the Contractor throughout the life of the Project.
- Retain existing vegetation and minimize disturbance to ground cover to the extent possible.
- Protect all disturbed areas from erosion and restore them to stable condition as soon as practical.
- Store excavated or fill material and debris in a stable location beyond the high-water mark of any watercourse, and cover or otherwise stabilize so material does not erode during rain events.
- Direct clean rainwater away from areas susceptible to erosion to minimize the amount of contaminated water that must be managed.
- Contain sediment laden water and prevent its re-entry to the watercourse downstream by diverting water to dry land or developing a system for filtration or settlement.
- Ground disturbances and earth moving activities should be stopped or restricted during periods of heavy rain.
- Extra ESC materials (i.e. silt fence, straw bales, etc.) to be maintained.

6.3 Management of Deleterious Substances

6.3.1 Concrete

If concrete is to be poured on site care must be made to avoid uncured concrete reaching Morningstar Creek or ditches that may convey water to fish bearing waters. Concrete, cement, mortars, grouts and other Portland cement or lime-containing materials are basic or alkaline and can significantly increase the pH of stream water. During any concrete work:

- Do not directly or indirectly expose concrete, cement, mortars and other Portland cement or lime-containing materials into or about any watercourse.
- There shall be no discharge of concrete wash water to ground, watercourses (including ditches), or storm drains from concrete trucks and/or equipment related to the supply, pumping, or placement of concrete. This includes, but is not limited to, concrete truck chutes and hoppers, and pump line hoses.
- All concrete wash water and/or excess concrete should be collected in an impermeable container and disposed off-site in accordance with applicable regional bylaws, and provincial and federal legislation.
- If concrete pouring takes place in or adjacent to a watercourse or any other location where run-off from wet concrete can enter a watercourse, the pH of the water shall be monitored before, during, and 48 hours after the work. Water quality guidelines for pH are presented in Section 6.6.3.
- Detailed procedures for managing concrete spills should be included in a Spill Prevention and Emergency Response Plan (see Section 6.3.2.2), which is to be on site at all times.

6.3.2 Hydrocarbons and Spill Response

6.3.2.1 General Measures for Hydrocarbon Use

General measures for equipment and hydrocarbon products are as follows:

- Equipment, vehicles, and machinery shall be in good operating condition, free of leaks, and excess oil and grease.
- Equipment, vehicles, and machinery will be inspected regularly to ensure that they are in good operating condition and free of leaks. Drip trays should be used for equipment that is parked on site overnight or extended periods of time.
- All hydraulic machinery working in and around a watercourse, including ditches or ponds, will use environmentally sensitive hydraulic fluids that are non-toxic to aquatic life and are readily or inherently biodegradable, wherever feasible.

- Servicing and refueling of equipment (including refilling of small field containers) shall be undertaken a minimum of 15 m away from any watercourse, ditch, or pond.
- Storage of fuels and petroleum products will comply with safe operating procedures [e.g. *A Field Guide to Fuel Handling, Transportation and Storage* (MWLAP and MOF, 2002)] and include containment facilities.
- Storage, handling, fueling and equipment maintenance and repair sites will be located on flat, stable ground, at least 15 m away from environmentally sensitive areas such as watercourses, ditches, and ponds.
- The Contractor shall have a written Spill Prevention and Emergency Response Plan on site at all times (see Section 6.3.2.2).

6.3.2.2 Spill Response Planning

To prevent the occurrence and minimize the impacts of potential spills, accidents or malfunctions, an Emergency Spill Response, Containment and Management Plan shall be developed and implemented; copies of which shall always be on site and readily available. The plan would address issues such as procedures required to prevent spills and accidents, as well as appropriate responses for specific events to minimize potential effects. Regular site inspections should be conducted to ensure adherence to the plan, particularly during construction activities. If standards are followed and prudence is observed amongst work crews, risks and effects will be minimized.

Any spill of reportable quantities of a substance that is toxic, polluting, or deleterious to aquatic life shall be reported to the Emergency Management BC 24-hour phone line. It will be the responsibility of the Contractor to implement all activities in accordance with applicable legislative requirements.

6.3.3 General Waste

A regular disposal program will be implemented to prevent the unnecessary accumulation of construction-related wastes. The Contractor will ensure that upon completion of each day's work, and upon completion of substantial portions of construction works, that all waste or other materials that may potentially impact nearby watercourses are removed to a stable location and secured.

Sanitary facilities provided for the use of workers shall be secured to ensure they do not fall over and shall be located at least 15 m from top of bank of any watercourse.

6.3.4 Hazardous Materials

The Contractor will be responsible for ensuring that all relevant personnel are adequately trained for the handling and transport of Dangerous Goods and Controlled Products. hazardous waste generated during project works must be disposed in compliance with the *British Columbia Hazardous Waste Regulation*. Hazardous materials – including Dangerous Goods as defined under the *Transportation of Dangerous Goods Act* and Controlled Products as defined under the *Occupational Health & Safety Regulation* (BC Regulation 296/97) pursuant to the *Workers Compensation Act* – used during project works shall be stored and handled to protect worker health, avoid loss, and to allow containment and recovery in the event of a spill in accordance with all applicable legislation.

If construction activities encounter possible contaminated materials, including contaminated soils, the Contractor shall stop all work in the vicinity of the possible hazardous materials until further direction is provided.

6.4 Vegetation

Construction procedures to minimize the introduction and spread of invasive plants and noxious weeds are important and should include the following:

- Earth-moving equipment should be cleaned before arriving on site to remove any foreign soil and vegetation.
- Surficial material taken from areas infested by invasive plants should be handled appropriately to minimize the spread of invasive plants including covering stockpiles or removing them for proper disposal off site as soon as practical.
- Fully remove and properly dispose of noxious weeds and other invasive plants, as appropriate.
- Remove trees in accordance with any applicable jurisdictional legislation and ensure appropriate wildlife timing windows are adhered to (see Section 6.5.1).

- Complete restoration activities, i.e. seeding or planting, as required, that will lead to natural pre-disturbance conditions.
- Use native vegetation for site restoration and erosion control or use alternative methods until re-planting with native vegetation can occur.
- Any disturbed areas must be restored to function as it did in the pre-disturbance condition.

6.5 Wildlife and Wildlife Habitat

Several mitigation measures are available to minimize potential interactions between the Project construction site and local wildlife, and thus reduce the associated effects. Mitigation measures may include:

- Minimize sensory disturbance by:
  - Ensuring machines are well-maintained and use noise dampeners
  - Limit unnecessary lighting (i.e., reducing lighting at night and in areas where construction activities are not immediately occurring)
  - Adhering to municipal bylaws regarding light and noise restrictions (if applicable)
- Ensure staging areas (e.g., for machines, fuels) are minimized and as far as possible from nearby sensitive habitats, including Morningstar Creek, roadside ditches, or wetland areas.
- Reduce and ensure proper storage of potential attractants such as food, garbage, petroleum products or other materials with strong odours.

If project works have potential to affect any SARA-listed or provincially Red- or Blue-listed species, it is necessary to ensure compliance with species at risk legislation and to take steps to limit or avoid potential adverse effects. Some listed species may have no period of least risk. BCMOECCS's Regional Species at Risk Biologists or the Canadian Wildlife Service (CWS) should be contacted for project-specific guidance.

6.5.1 Migratory Bird Timing Restrictions

In the Vancouver Island region, the breeding bird window occurs from March 15 to August 15. Scheduling of construction activities (e.g., vegetation clearing) with potential to disturb or harm resident and migratory birds or their active nests should take place outside of the breeding bird season. This is to prevent contravention of the federal *Migratory Birds Convention Act* and the *Migratory Birds Regulation*, as well as Section 34 of the provincial *Wildlife Act*. If such activities must be conducted during the breeding bird season, a survey for active bird nest should be conducted by a QEP familiar with local avifauna and behaviours associated with nesting and territorial establishment of bird species that may be encountered.

In addition to the general breeding bird window, raptors require further consideration due to their extended breeding seasons and distinct life histories. Raptors and herons and their nests are also given special attention under provincial legislation and BMPs.

If an active nest is found (i.e., a nest occupied by a bird or its eggs, or if a bird is near the nest and displays signs of breeding or rearing activity), radial buffers based on provincial BMPs (Table 7) will be implemented. No vegetation clearing will be permitted within the target buffer area until the nest is determined to be inactive.

Table 7: Summary of Target Buffer Distances for Sensitive Wildlife Habitat Features

Feature	Target Buffer Distances (m)		Buffer Measured From
	Urban	Breeding Season "Disturbance Free" Zone	
Bald Eagle Nests	1.5 tree lengths	100	Base of nesting structure
Other Raptors	1.5 tree lengths	200	Base of nesting structure
Active Bird Nest (general)	30	30	Base of nesting structure

References: BC MOE (2013), Demarchi and Bentley (2005)

6.5.2 Shrew and Amphibian Salvage

A shrew and amphibian survey should be undertaken by a QEP well in advance of construction. If these animals are observed or the QEP recommends, a salvage should be conducted prior to construction. Salvage locations should be specified by a QEP at sensitive locations on the Project site. Captured animals would be relocated to a location downstream of the Project site before the start of Project activities. The process for salvage would include:

a. Obtain a wildlife salvage permit which will specify the measures to capture, handle and collect amphibians;

b. Identify the trapping techniques applicable to the observed species;

c. Conduct pre-construction trapping and relocation in accordance with best management practices detailed below;

d. If advised by the QEP, install fencing or other means to keep animals from returning to the construction area, and

e. Conduct post-salvage survivorship monitoring (if required).

Further information on the best management practices to be adopted is found in:

- British Columbia Ministry of Environment. 2014. Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia; and
- Best Management Practices for Amphibian and Reptile in Urban and Rural Environments in British Columbia (Ovaska et al. 2004).

6.6 Fish and Aquatic Habitat

6.6.1 Instream Works, Diversion and/or Dewatering

Any diversion of water and/or dewatering related to Project activities shall adhere to the following:

- Water intakes are to meet the *Freshwater Intake End-of-Pipe Fish Screen Guideline* issued by DFO (1995).
- Any sediment-laden water, including seepage that may collect within the isolated work area, will be collected and removed or discharged to an appropriate area as outlined in an EMP or as directed by a QEP.
- Construction machinery is not to encroach into the wetted area of a watercourse at any time outside of isolation areas.
- Instream activities must be conducted in the dry and the worksite must be isolated from water flowing in the stream channel.
- All equipment must be located and operated in the dry.
- Equipment used within or in close proximity to the wetted perimeter must be free of deleterious material (e.g. hydrocarbons) and in good mechanical condition (e.g. no fuel or hydraulic leaks).
- Measures must be taken to ensure that no harmful material (e.g. fuel and other hydrocarbons, soil, road fill, or sediment), which could adversely impact water quality, fish and other aquatic life, and /or fish habitat, can enter the wetted perimeter as a result of the project activities.
- Erosion and sediment control structures are to be available onsite and utilized as necessary.
- No work is to be conducted in weather conditions likely to cause sediment laden water to enter the stream.
- Minimize disturbance to natural materials (e.g. embedded logs) and vegetation that contribute to habitat or stream channel stability.
- If dewatering of a stream or bypass pumping systems are required for worksite isolation, the natural rate of water flow will be maintained downstream of the work area.

6.6.2 Fish Salvage

A fish salvage would be required if instream work requires areas to be isolated from stream flow. Federal and provincial permits are required to conduct a fish salvage. Salvaging activities should be conducted by QEPs trained in fish capture techniques. The salvage area should be isolated to prevent fish access and allow for effective removal of fish. Fish captured should be released downstream within the same watercourse.

6.6.3 Surface Water Quality

Water quality in watercourses and discharged water should be monitored as appropriate to ensure they meet the provincial guidelines presented in Table 8.

Table 8: British Columbia Approved Water Quality Guidelines for the Protection of Freshwater Aquatic Life

Parameter	Guidelines
Turbidity	Change from background of 8 NTU at any one time for a duration of 24 hours in all waters during clear flows or in clear waters Change from background of 2 NTU at any one time for a duration of 30 days in all waters during clear flows or in clear waters Change from background of 5 NTU at any time when background is 8 - 50 NTU during high flows or in turbid waters Change from background of 10% when background is >50 NTU at any time during high flows or in turbid waters
Total Suspended Solids	Change from background of 25 mg/L at any one time for a duration of 24 hours in all waters during clear flows or in clear waters Change from background of 5 mg/L at any one time for a duration of 30 days in all waters during clear flows or in clear waters Change from background of 10 mg/L at any time when background is 25 - 100 mg/L during high flows or in turbid waters Change from background of 10% when background is >100 mg/L at any time during high flows or in turbid waters
pH	6.5 to 9.0: unrestricted change permitted within this range. This component of the freshwater guidelines should be used cautiously if the pH change causes the carbon dioxide concentration to decrease below a 10 µmol/L minimum or exceed a 1,360 µmol/L maximum, as these concentrations may be toxic to fish.

Notes: BC MOECCS 2018

6.6.4 Aquatic Work Timing Restrictions

Any works in or about a stream should be undertaken only during the period of least risk (and with the appropriate regulatory approvals and permitting in place), as defined by MFLNRORD and DFO. The blue shaded areas in Table 9 represent applicable least risk periods for fisheries resources in the Project area. Considering the presence of cutthroat trout and coho salmon within Morningstar Creek; the refined least risk period would be August 15 to September 15. Project approvals and permits may reflect altered timing windows as determined appropriate by regulatory agencies.

Table 9: Periods of Least Risk (Blue) for Works in or about a Stream for Vancouver Island Region

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Coastal cutthroat trout												
Coho salmon												

Blue highlighted cells represent the reduced risk work windows.

Reference: Guidelines for Reduced Risk Instream Work Windows, BC MOE, Vancouver Island Region (2011)

6.7 Land Use

There are several residents within 200 m of the FCPCC with beach and creek side areas with in 400 m. The removal of trees will reduce the on-site barriers to noise. Construction activities can also affect local air quality. The measures presented above to minimize disturbance to wildlife will also limit disturbance to nearby residents and others. Properly maintained equipment fitted with proper noise suppression are effective mitigation measures for both air quality and noise concerns. Construction traffic can impact normal traffic flow. A traffic management plan may be required to address potential hazards associated with heavy trucks arriving and leaving the work site.

6.8 Site Restoration

At the end of the project, all equipment, supplies, and non-biodegradable materials will be removed from the site. Disturbed areas will be re-graded to a stable angle and returned as closely as possible to their natural state. A detailed site restoration plan will be required, specifically for riparian areas. Riparian planting criteria should be based on DFO's guidance document *Riparian Revegetation* and the BC MOE's *Planting Criteria for Restoration and Enhancement of Fish and Wildlife Habitat* (DFO No Date; BC MOE 2008).

Other disturbed areas will also be protected from surface erosion by re-seeding with an approved local seed mixture and/or installing biodegradable erosion blankets. All seeding and planting shall be planned to allow establishment before the end of growing season; the recommended timing is in the fall during September and October, or spring during March and April.

7. Summary

The Stage 4 Expansion of the FCPCC will increase treatment capacity by approximately 33% to meet projected population growth through 2035. The increased effluent flow will continue to meet provincial and federal effluent quality requirements. The expansion will be developed within the existing property boundaries of the FCPCC facility. The main elements of the expansion include clearing approximately 6500 m^2 of treed land and the replacement of an existing bridge over Morningstar Creek.

Morningstar Creek is the main environmental feature that could be affected by the project. The site layout was designed to maintain a 15 m setback from the creek and no additional trees within the riparian area will be cleared to upgrade the creek crossing. An open bottomed arch culvert was selected as a replacement for the existing bridge to maintain natural gravels in the channel and to provide a road bed over the creek that will also accommodate the pipes required to transfer the sewage from the east side to the west side of the lot.

The proposed Environmental Protection and Management Plan will be used to mitigate construction related issues such as erosion and sedimentation, emergency response, additional wildlife survey and if necessary, salvage and measures to mitigate effects related to the installation of the culvert.

With the measures adopted in the design of the project (i.e. riparian setbacks) and the proposed mitigation measures for the construction, the environmental effects of the Stage 4 Expansion will be confined to RDN's property and the on site effects will be minimal and remediated once the construction is complete.

8. References

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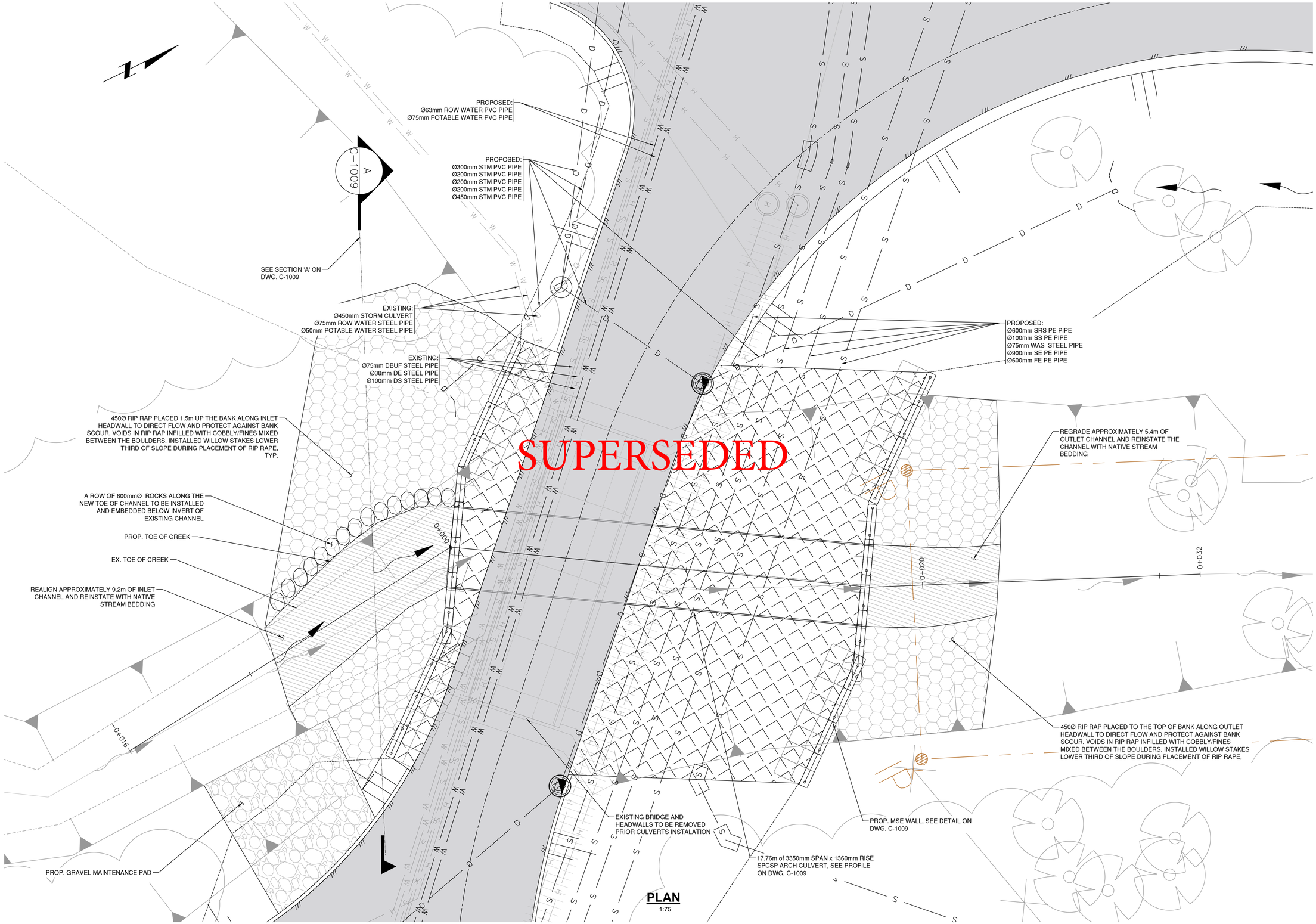
Appendix A.

Morningstar Creek Culvert Design Drawings

SUPERSEDED



PLAN
1:75

VERIFY SCALE IF PLAN SHEET IS REDUCED — 30 mm

REV	DESCRIPTION	DRN	CHK	DATE (Y/M/D)
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A	ISSUED FOR 60% DETAILED DESIGN	SI	MC	2019/09/24

DRN BY: SI
DES BY: SI
CHK BY: BY
APP BY: MC

PREPARED FOR:
REGIONAL DISTRICT OF NANAIMO

PREPARED BY:
AECOM
4th FLOOR,
3292 PRODUCTION WAY,
BURNABY, B.C., V5A 4R4
604-444-6400

REGIONAL DISTRICT OF NANAIMO
FRENCH CREEK POLLUTION CONTROL CENTRE
STAGE IV EXPANSION

CIVIL
MORNINGSTAR CREEK CULVERT
PLAN

PROJECT START DATE (M / Y)
AUG./2019
PROJECT NO.
60590631
FILENAME
60590631-C-1008-C-1009.dwg
RDN DRAWING No.
DRAWING No.
C-1008

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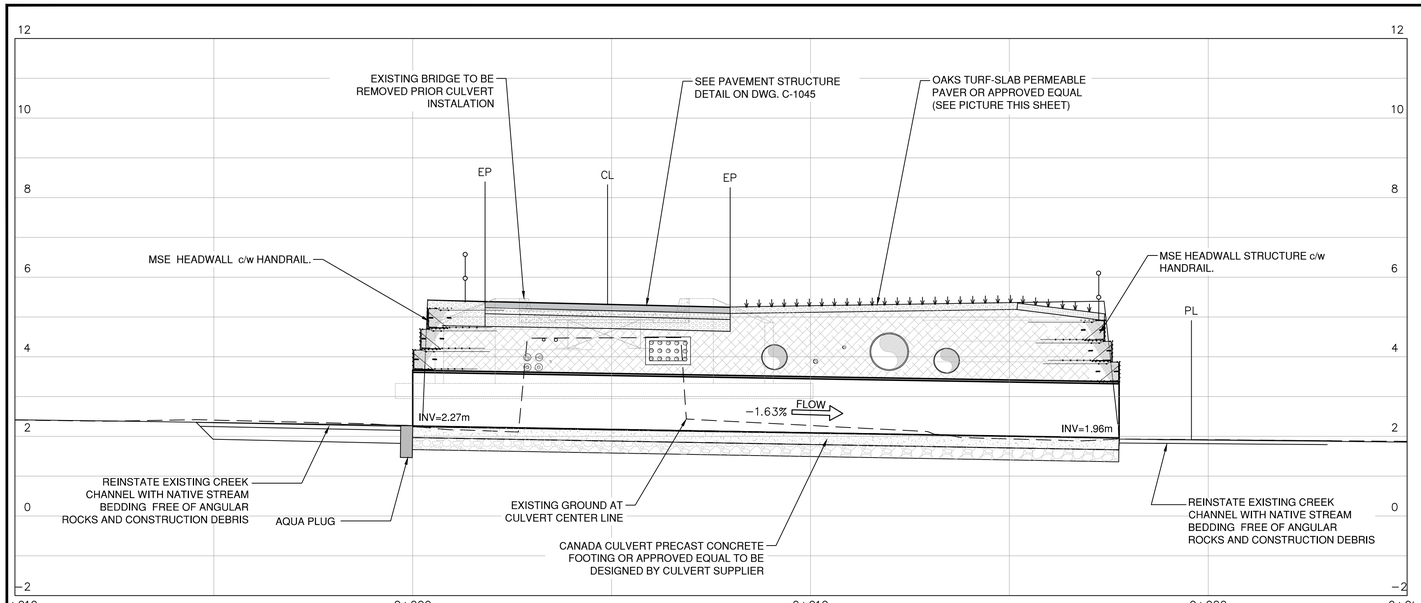

PROFILE
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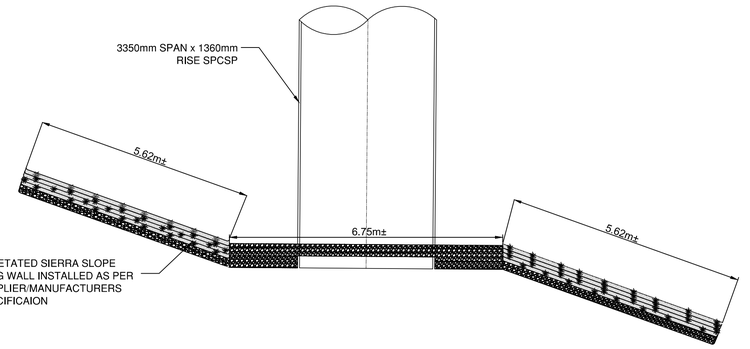

HEADWALL DETAIL-PLAN VIEW
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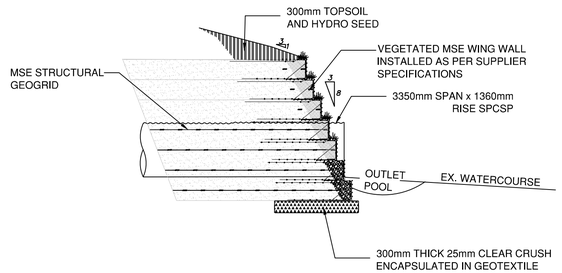
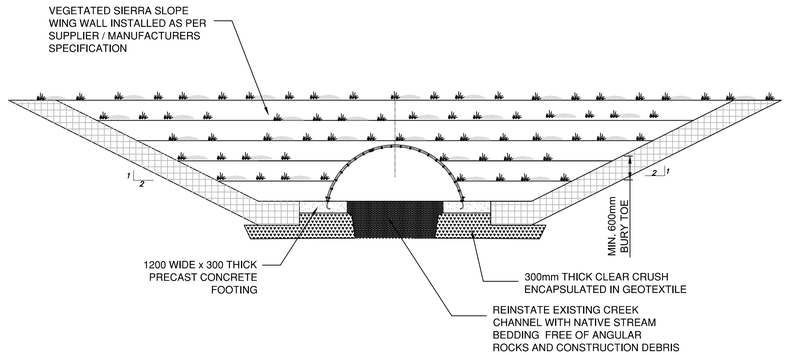
SUPERSEDED

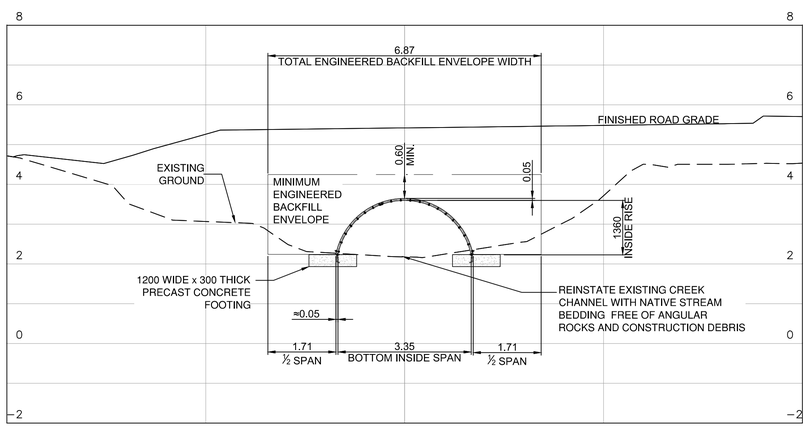
PERMEABLE PAVER
N.T.S.



HEADWALL DETAIL-SIDE VIEW
1:75

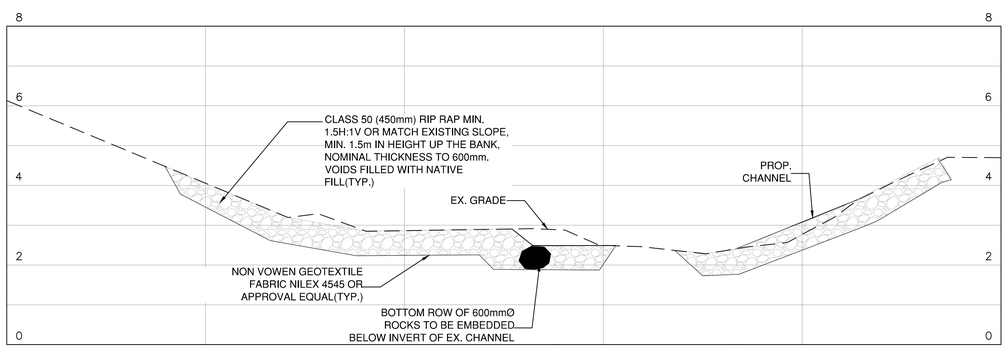


HEADWALL DETAIL-FRONT VIEW
1:75



TYPICAL SECTION AT CULVERT
1:75

NOTE: MSE WALL DETAIL FOR INFORMATION PURPOSE ONLY
MSE WALL TO BE DESIGNED BY THE CULVERT SUPPLIER



SECTION A
1:75

VERIFY SCALE IF PLAN SHEET IS REDUCED
30 mm

REV	DESCRIPTION	DRN	CHK	DATE (Y/M/D)
B	ISSUED FOR 90% DETAILED DESIGN	SI	MC	2020/07/24
A	ISSUED FOR 60% DETAILED DESIGN	SI	MC	2019/09/24

DRN BY: SI
DES BY: SI
CHK BY:
APP BY: MC

PREPARED FOR:
REGIONAL DISTRICT OF NANAIMO

PREPARED BY:
AECOM
4th FLOOR,
3292 PRODUCTION WAY,
BURNABY, B.C., V5A 4R4
604-444-6400

REGIONAL DISTRICT OF NANAIMO
FRENCH CREEK POLLUTION CONTROL CENTRE
STAGE IV EXPANSION
CIVIL
MORNINGSTAR CREEK CULVERT
PROFILE, SECTIONS AND DETAILS

PROJECT START DATE (M / Y): AUG./2019
PROJECT NO.: 60590631
FILENAME: 60590631-C-1008-C-1009.dwg
RDN DRAWING No.:
DRAWING No.: **C-1009**

REGIONAL DISTRICT OF NANAIMO

Appendix E
Geotechnical Information

Geotechnical Report

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 –

RETURNED TO CROWN BY PLAN 37634

OBLITERATED TITLED NATURAL BOUNDARY AS PER PLAN 37634 (RIGHT BANK OF CREEK, 1981).

FUTURE

ANAEROBIC DIGESTER 1

314.16 m²

DIGESTER CONTROL BUILDING

PLAN 1

400 m²

2500 m²

OFFICE AND ADMINISTRATION

314.16 m²

ANAEROBIC DIGESTER 2

GAS HOLDER

19.63 m³

AREA = 8.21 ha.

8.21 ha 82,119.7 m²

BIOREACTOR 4

BH23-05

598.68 m²

BIOREACTOR 3

BH23-04

598.68 m²

BH23-03

CLOSED ROAD PLAN EPP91066

BIOREACTOR 2

598.6779 m²

SRS DISTRIBUTION BOX

24.01 m²

BIOREACTOR 1

98.93 m²

11.71 m²

GENSET

AH17-03

SCPT17-01

45.00 m²

FUTURE TERTIARY FILTRATION

BH23-02

AH17-02

TP19-03

TP19-04

TP19-01

BH23-01

AH19-03

TP19-02

44.12 m²

1140.53 m²

CTU BUILDING

TRUCK AXLE SCALE

448.82 m²

UV DISINFECTION

239.12 m²

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

ISLAND HWY W 19A

ISLAND HIGHWAY

SEE PLAN EPP80238

NR SEE PLAN 11327

PLAN VIP60350

175.806

50.292

27.405

24.835

43.657

r=450.461 a=58.990

r=324.036 a=3.577

r=334.036 a=80.052

r=450.461 a=46.124

46.578

42.7

15.309

27.24

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

N

E:\VAN\VAN-23002846-A0\60 Execution\65 Drawings\23002846 TESTHOLE PLAN 2023-09-07.dwg

Sep 12, 2023 - 6:35pm

EXP Services Inc.
275–3001 Wayburne Drive
Burnaby, British Columbia V5G 4W3
Telephone: 604–874–1245
Fax: 604–874–2358
exp.com

DFTR.	DSGN.	CHK.
PDL	AN	BW

ISSUE/REVISION

No.	DESCRIPTION	DATE

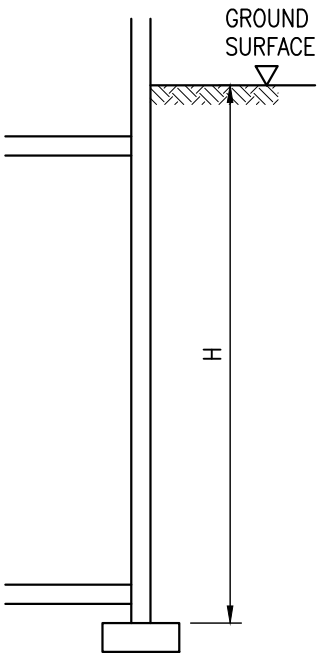
CLIENT: AECOM

PROJECT: French Creek Pollution Control Centre
957 Lee Road, Parksville, BC

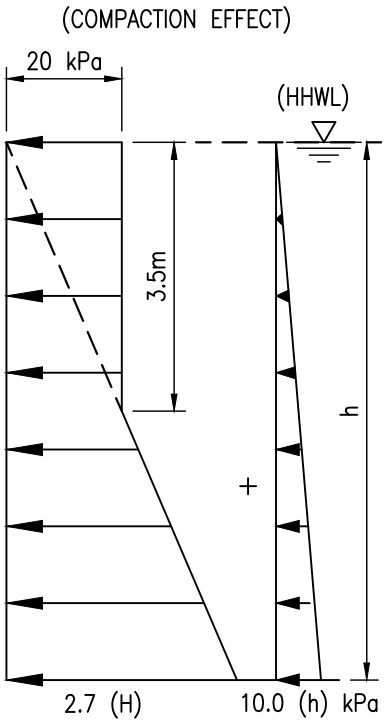
PROJECT NO.: VAN-23002846-A0

TITLE: Testhole Location Plan

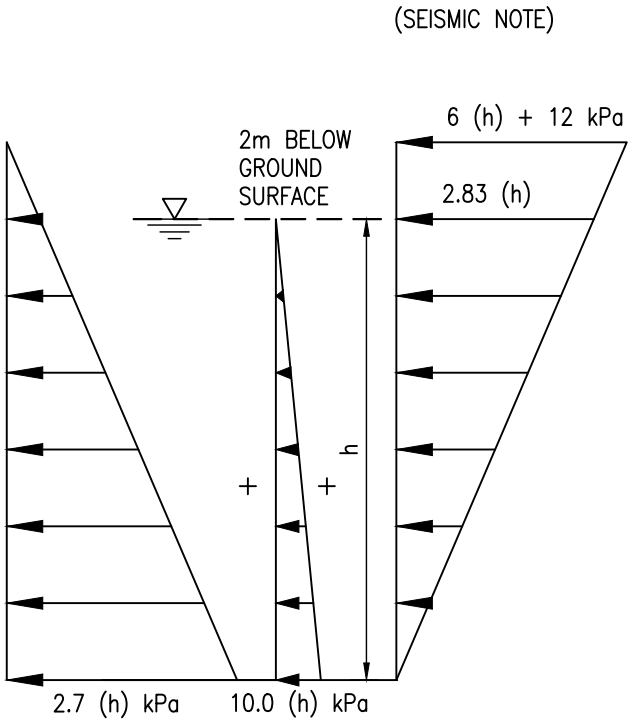
DATE	SCALE:	DWG NO.
2023-09-07	1:1000	Figure 1



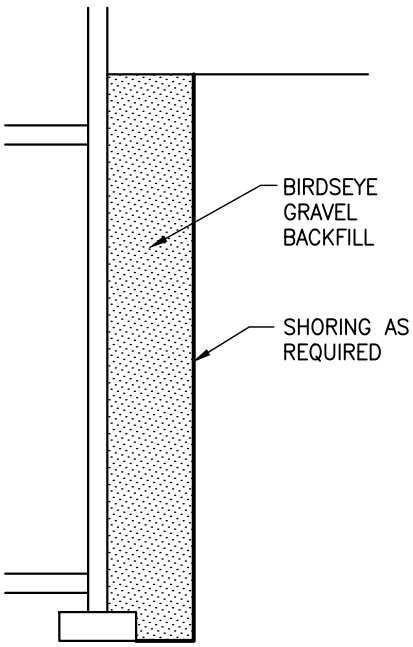
TYPICAL FOUNDATION WALL



STATIC + WATER PRESSURE



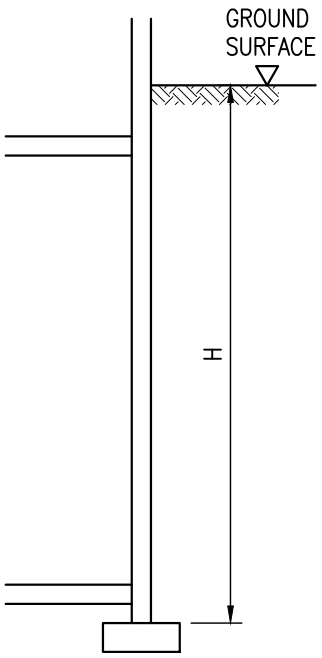
STATIC + WATER PRESSURE + SEISMIC



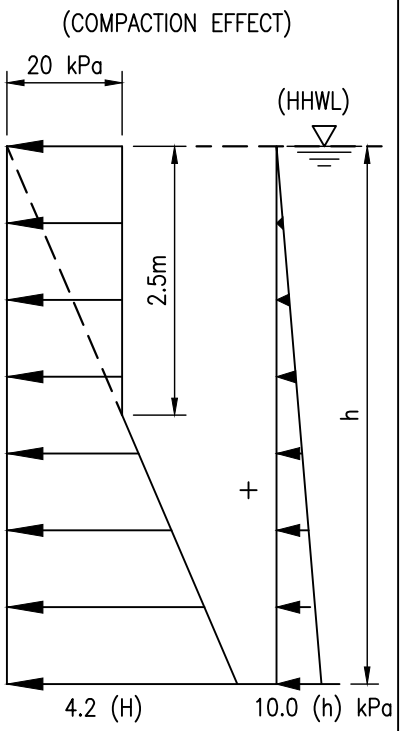
NOTES:

- 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

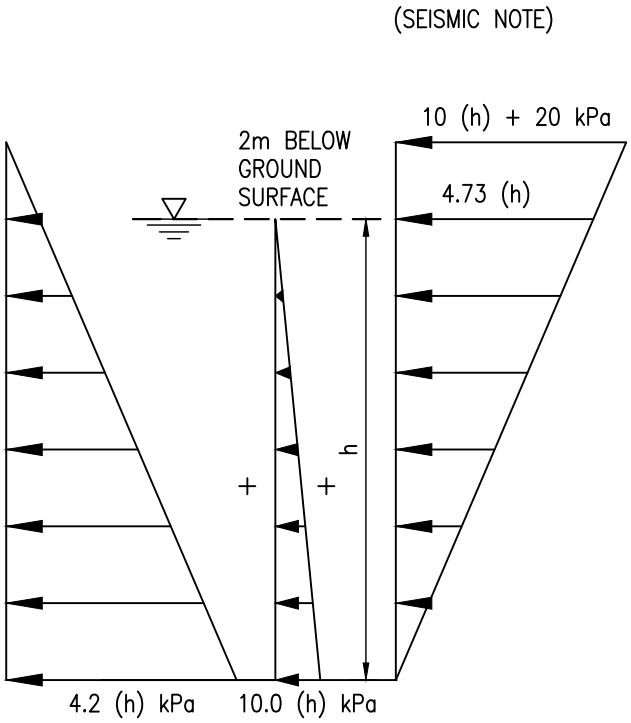
CLIENT: AECOM				TITLE: Lateral Earth Pressure on Yielding Walls, 2475 EQ		
PROJECT: French Creek Pollution Control Centre, 957 Lee Road, Parksville, BC						
PROJECT NO. VAN-23002846-A0	DFTR. MG	DSGN. UC	CHK. BW	DATE 2023-09-12	SCALE: NTS	DWG NO. FIGURE 2



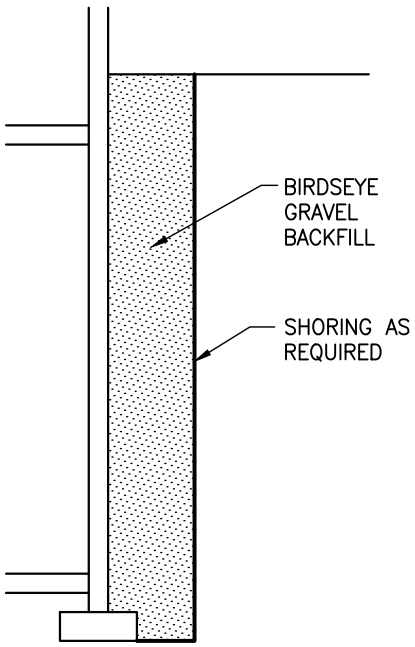
TYPICAL FOUNDATION WALL



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		

(Continued Next Page)

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

(Continued Next Page)

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.

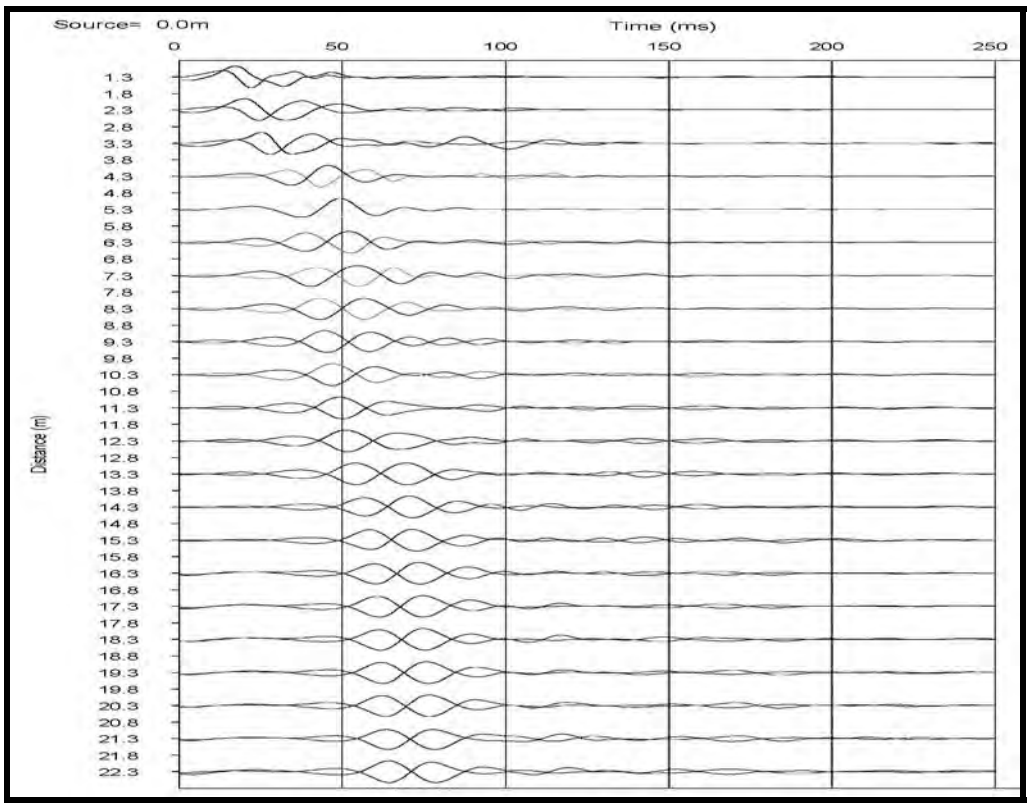


Figure 3.
Shear waves traces viewed in the frequency time domain

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

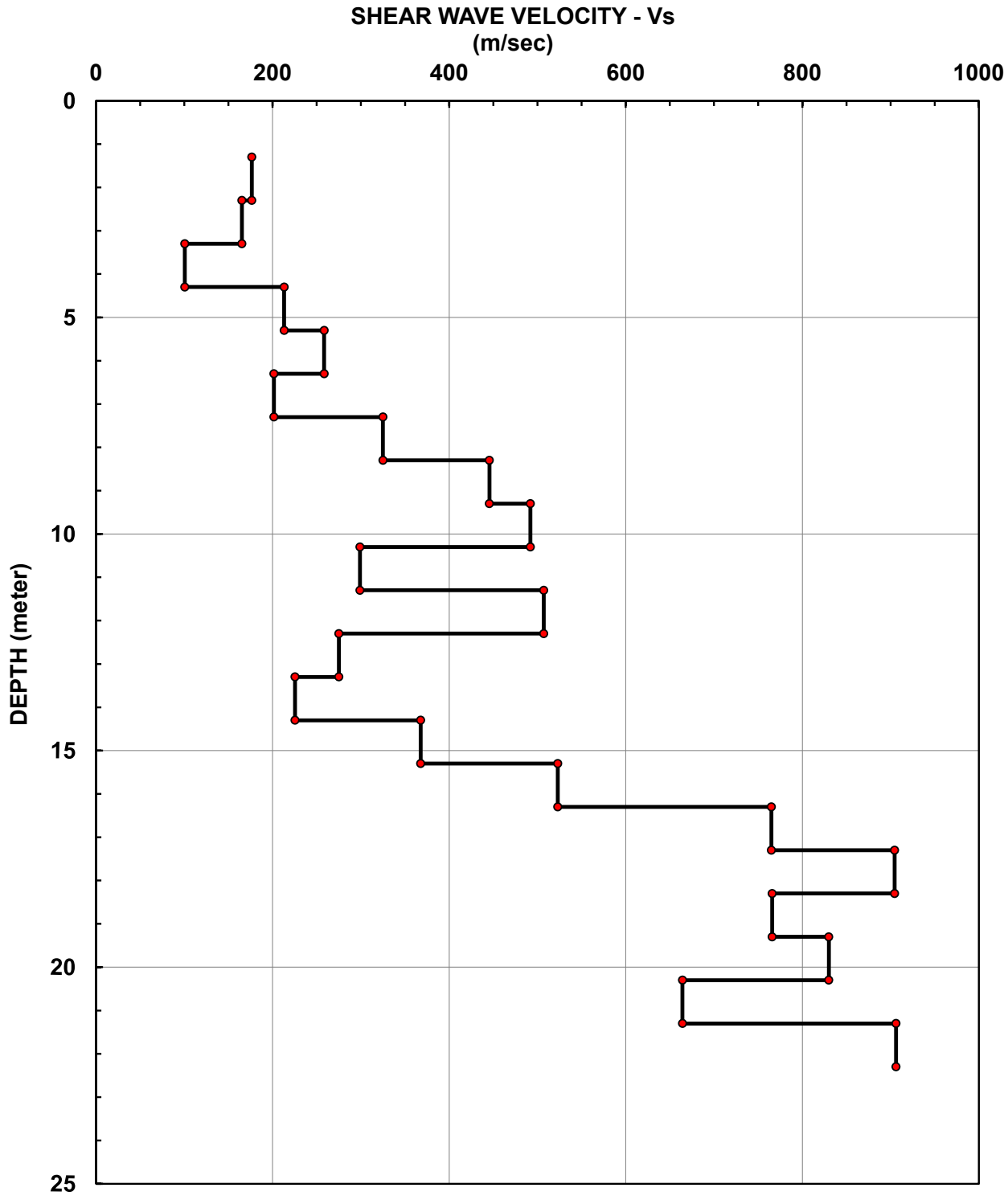
Geophone Depth (m)	Wave Path Length (m)	Change in Wave Path (m)	Wave Travel Time interval (ms)	Interval Vs Velocity (m/sec)
1.30	2.20			
		0.71	4.00	177
2.30	2.90			
		0.84	5.10	165
3.30	3.74			
		0.91	9.00	101
4.30	4.65			
		0.94	4.40	213
5.30	5.59			
		0.96	3.70	258
6.30	6.54			
		0.97	4.80	202
7.30	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

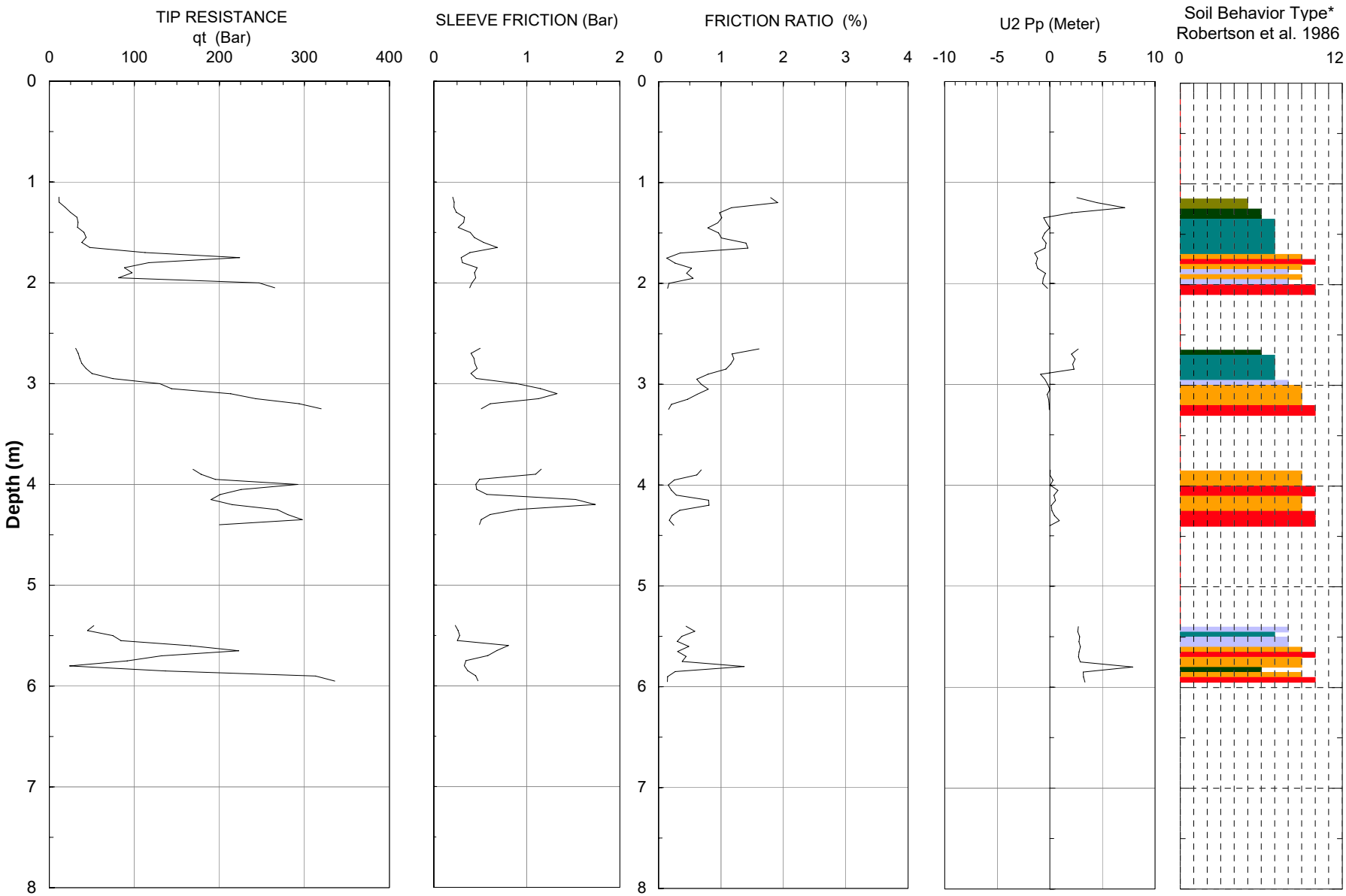
Client:	EXP	Date:	July 13, 2023
Test:	DHS23 - 04 at BH23 - 04	Tool:	Downhole
Site:	French Creek Parksville, BC	Source offset: Source:	1.77 m Impact Plates



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

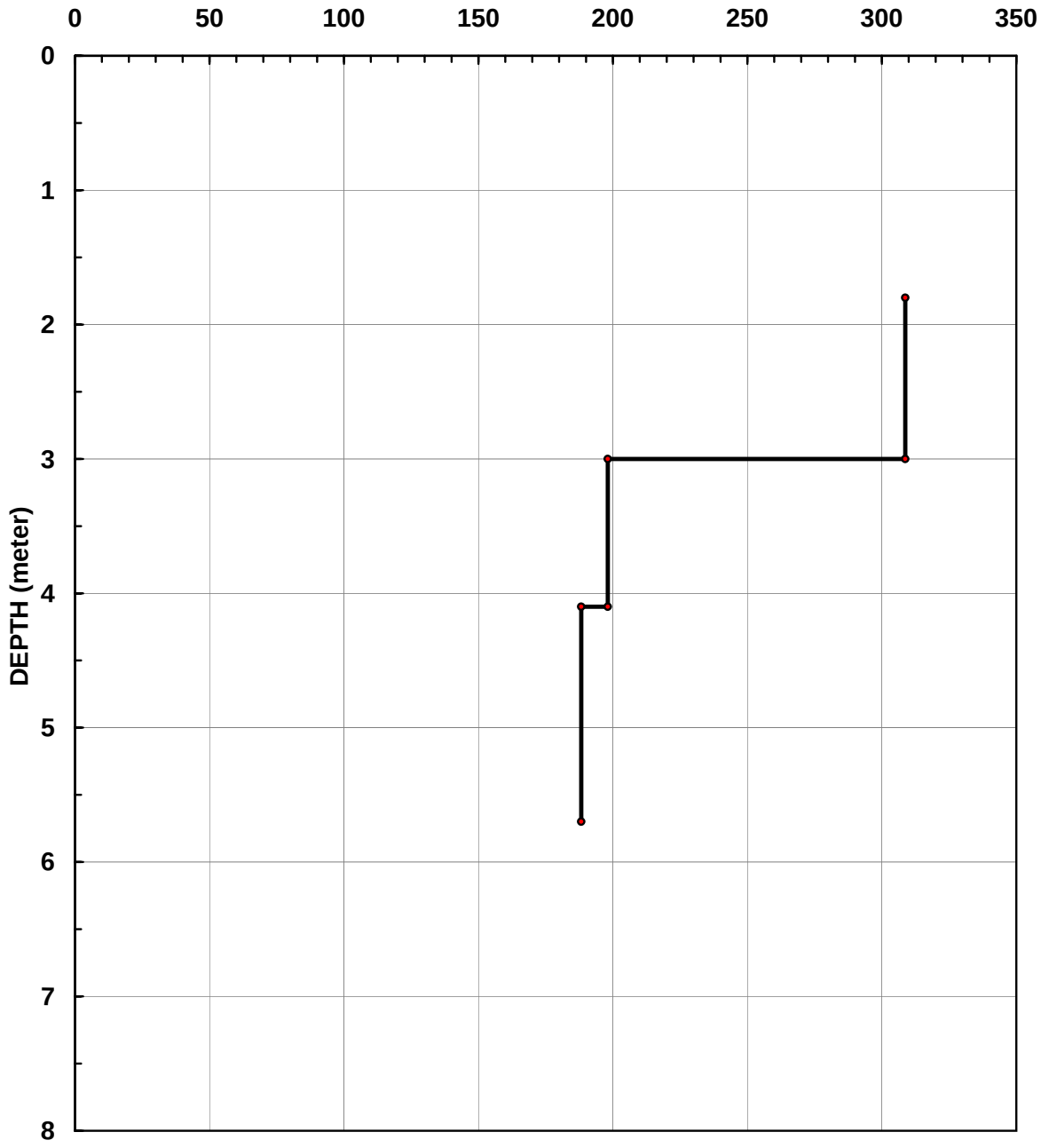
1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

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

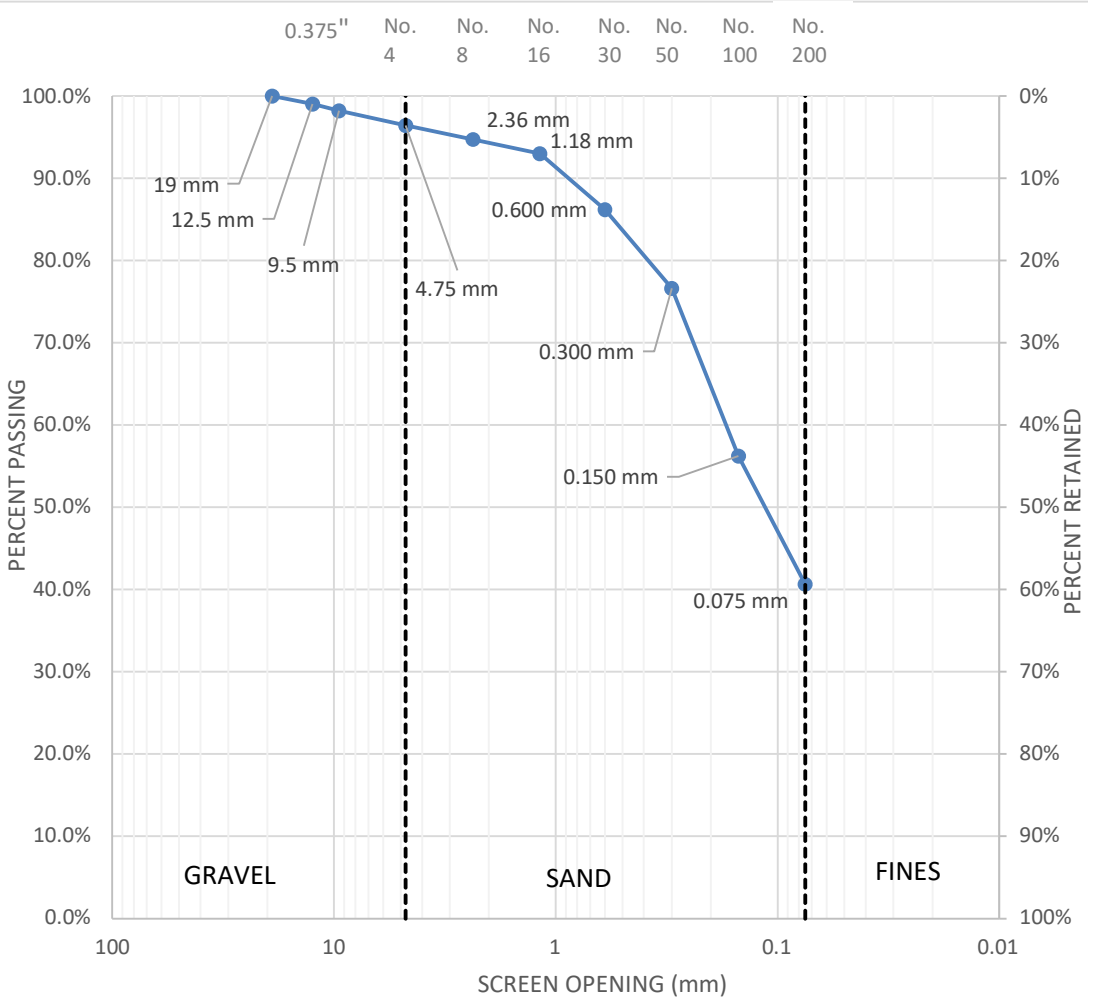
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

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

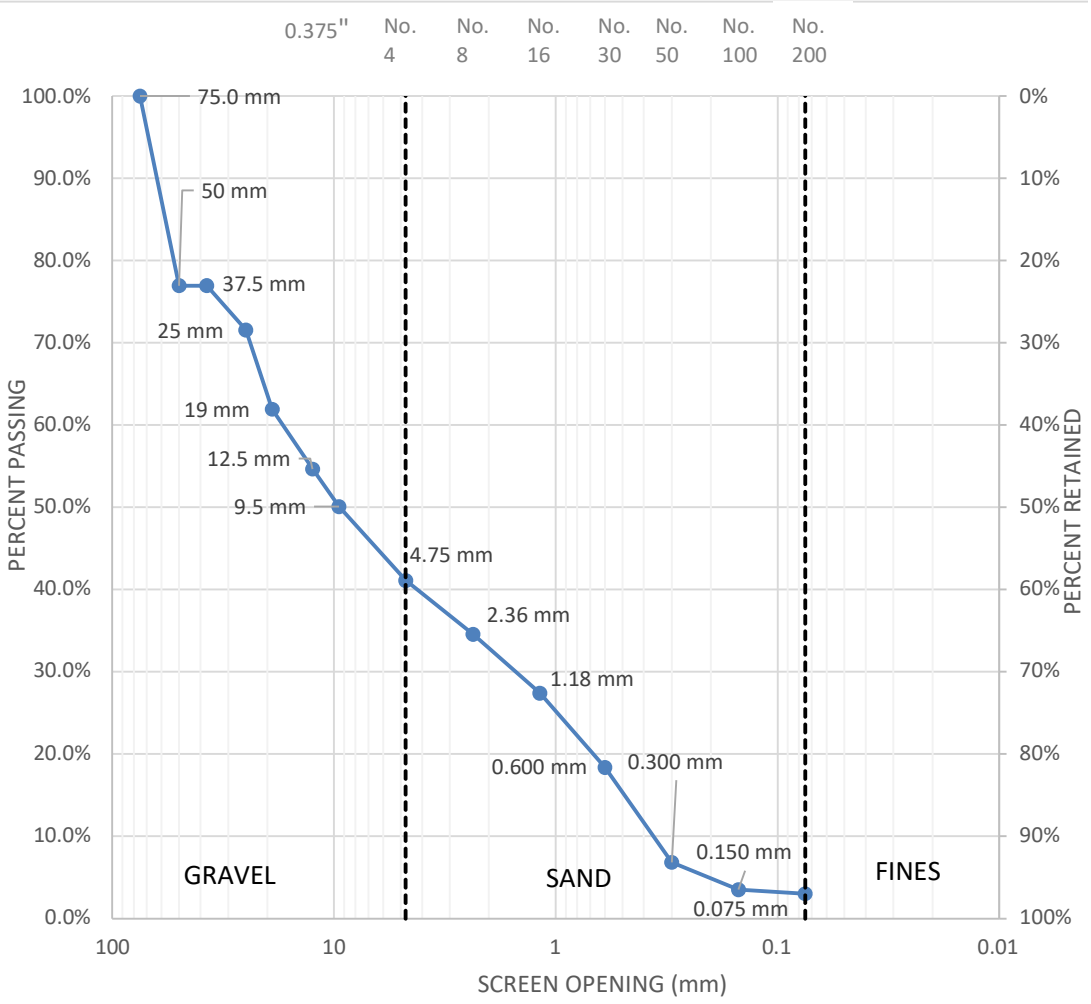
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

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

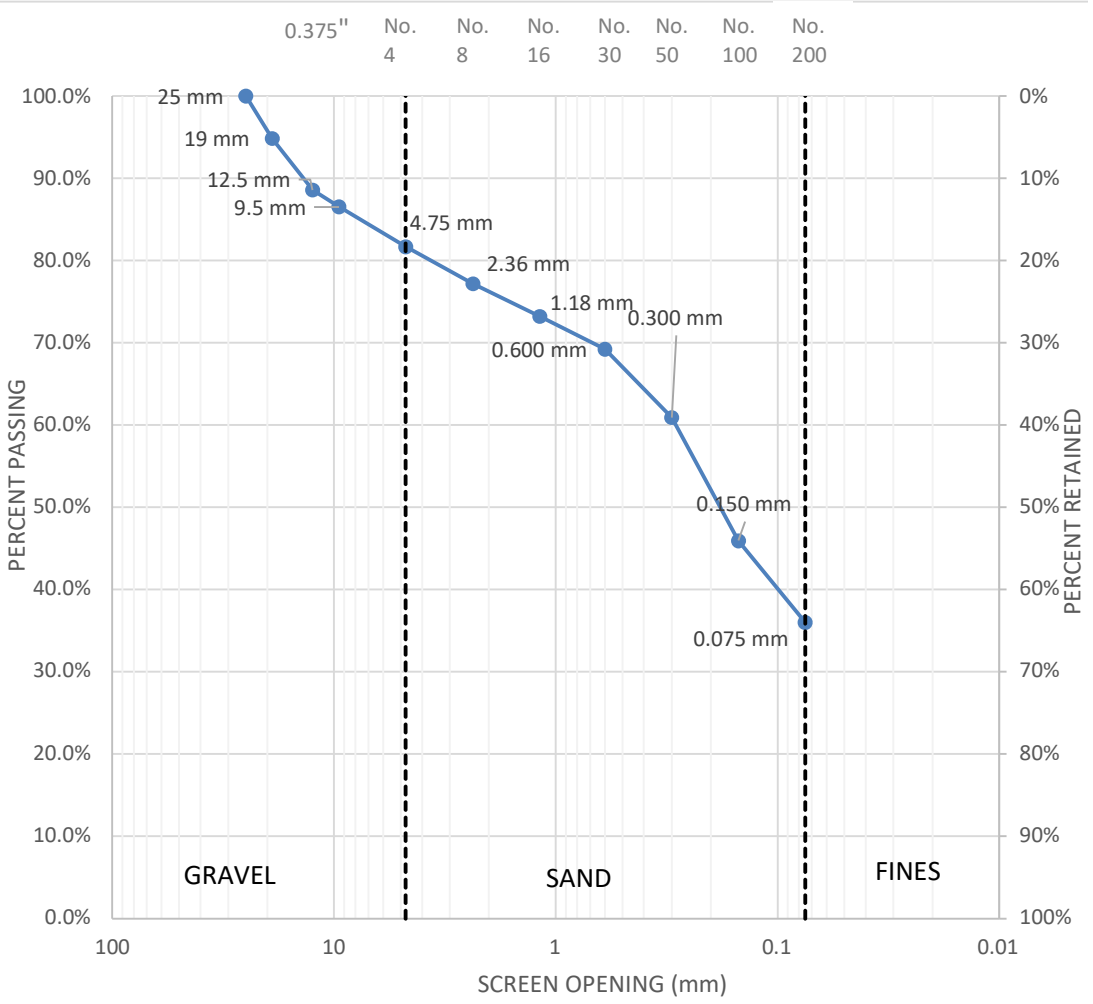
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

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

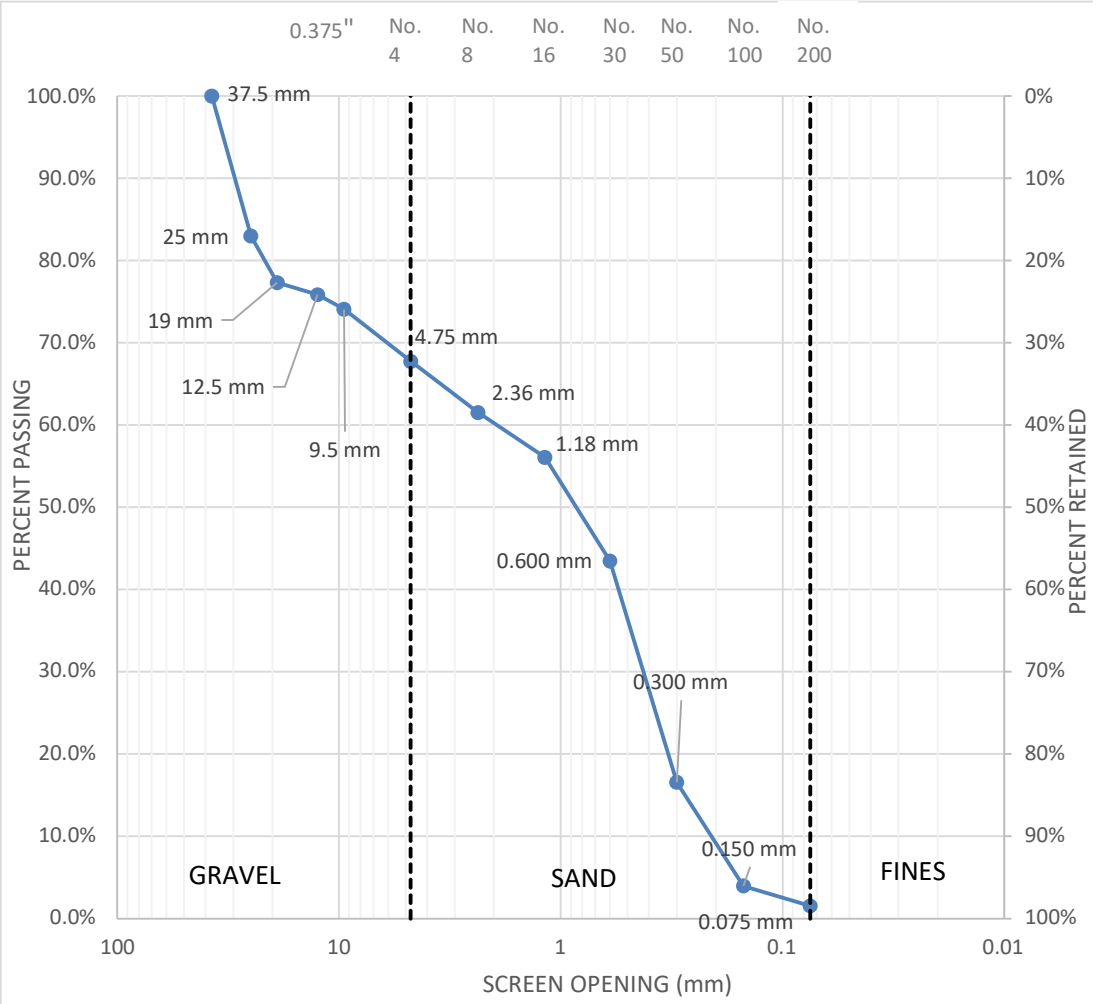
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

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

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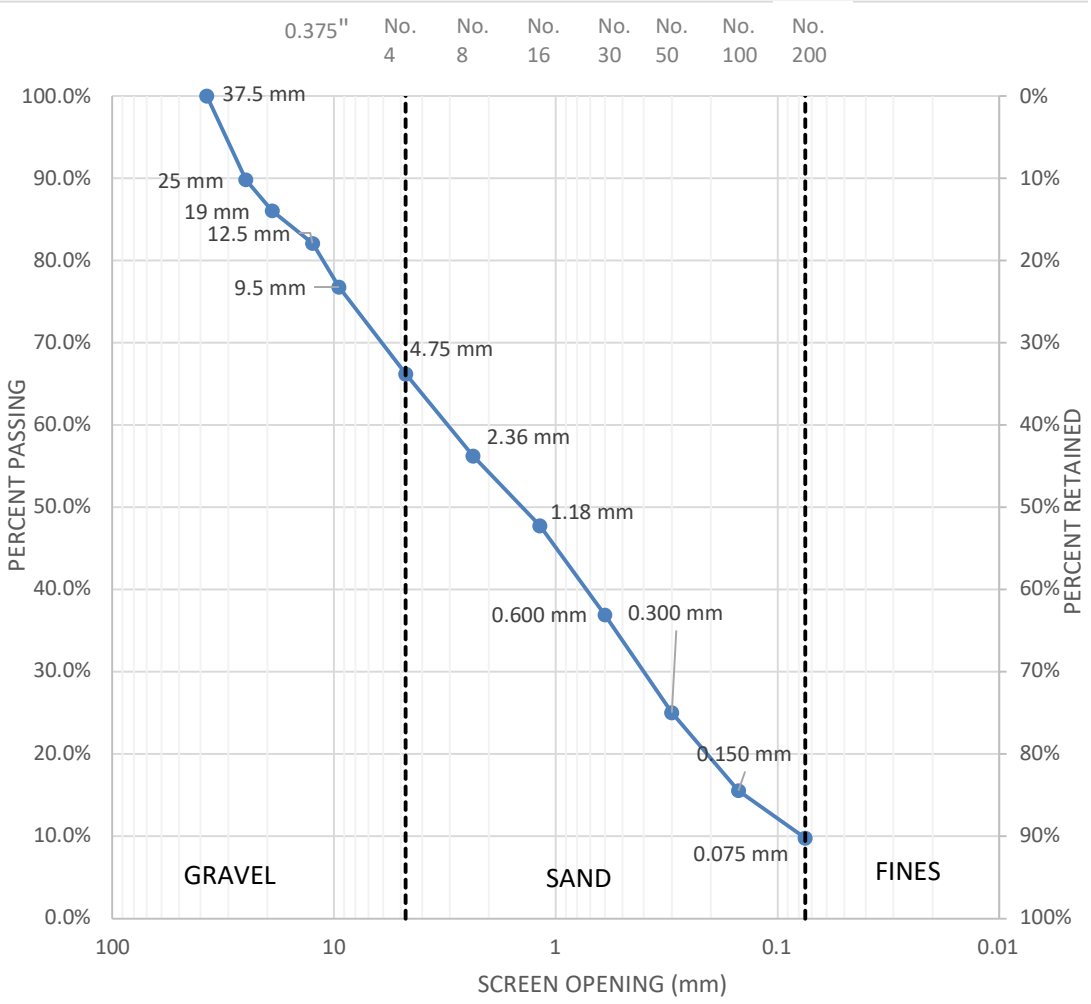
CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	SAND, GRAVELLY, TRACE SILT	METHOD	WASHED
IN-SITU MOISTURE	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
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EXP Services Inc.
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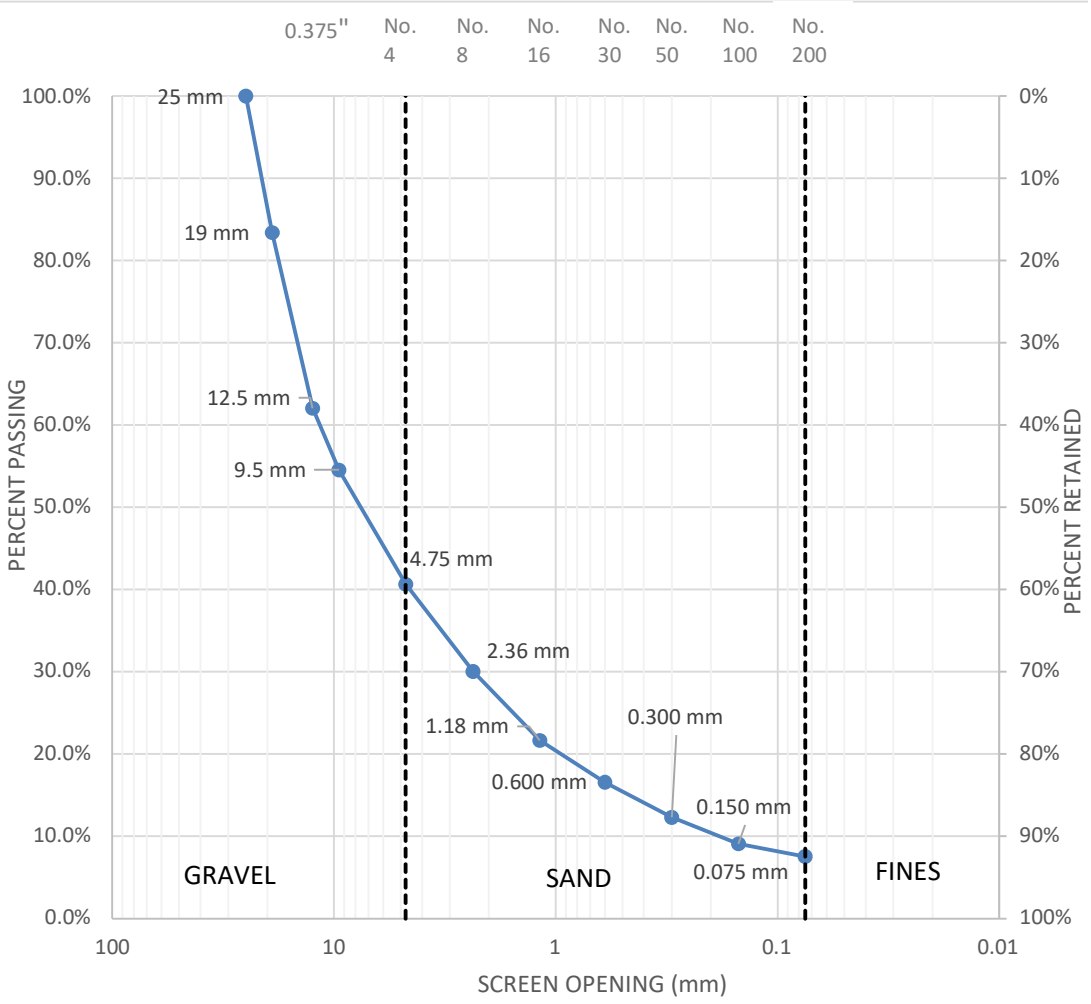
Telephone (604) 874-1245

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	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

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ASTM C136/C117

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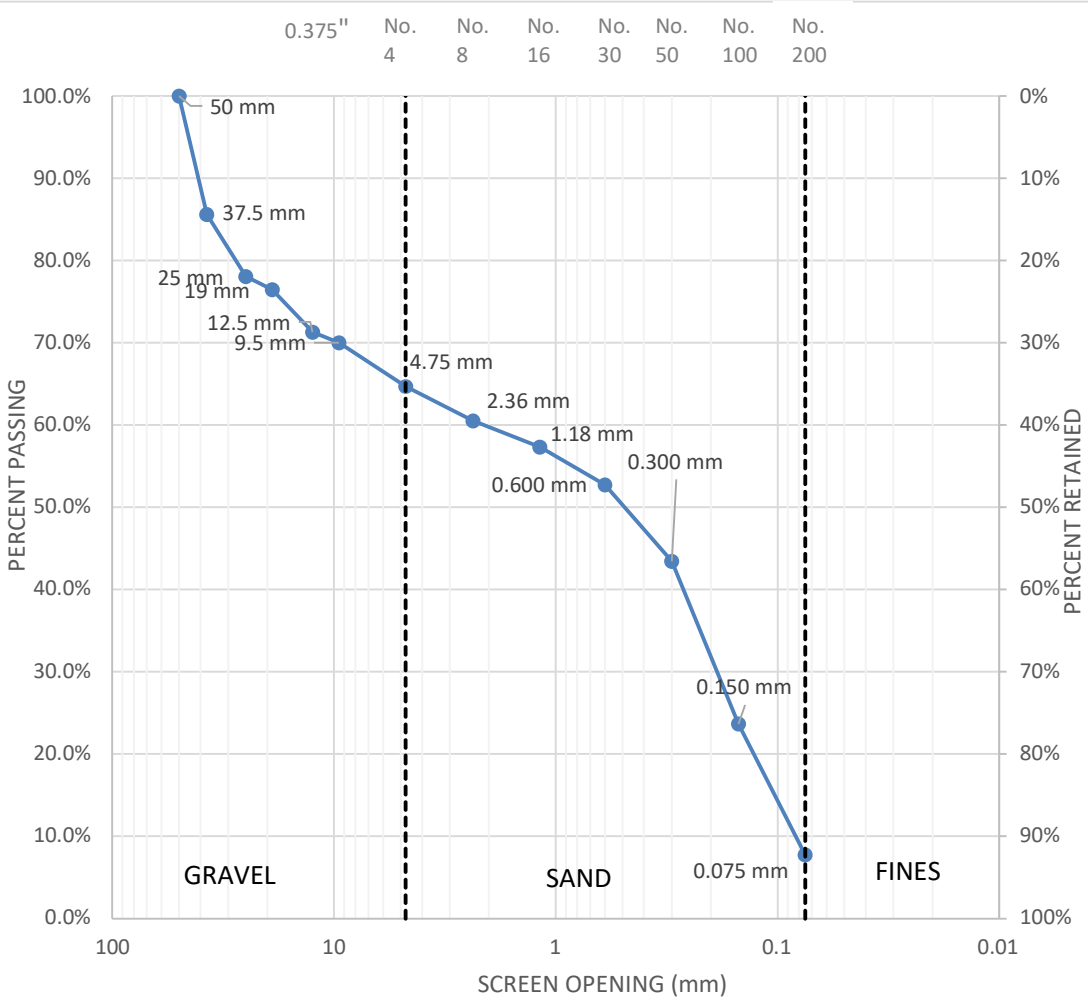
CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	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

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ISO 9001:2015 REGISTERED

SIEVE ANALYSIS
ASTM C136/C117

EXP Services Inc.
275 - 3001 Wayburne Drive
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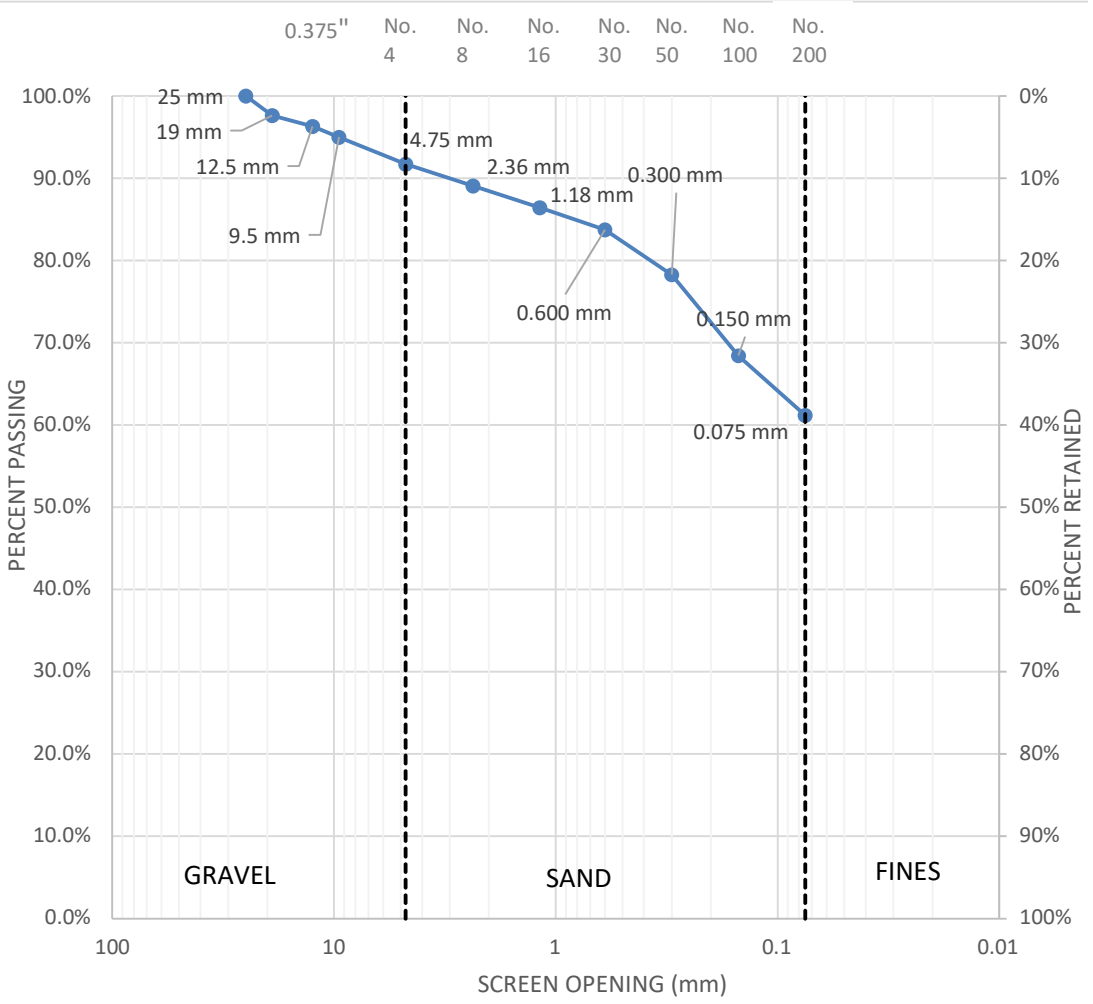
Telephone (604) 874-1245

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	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

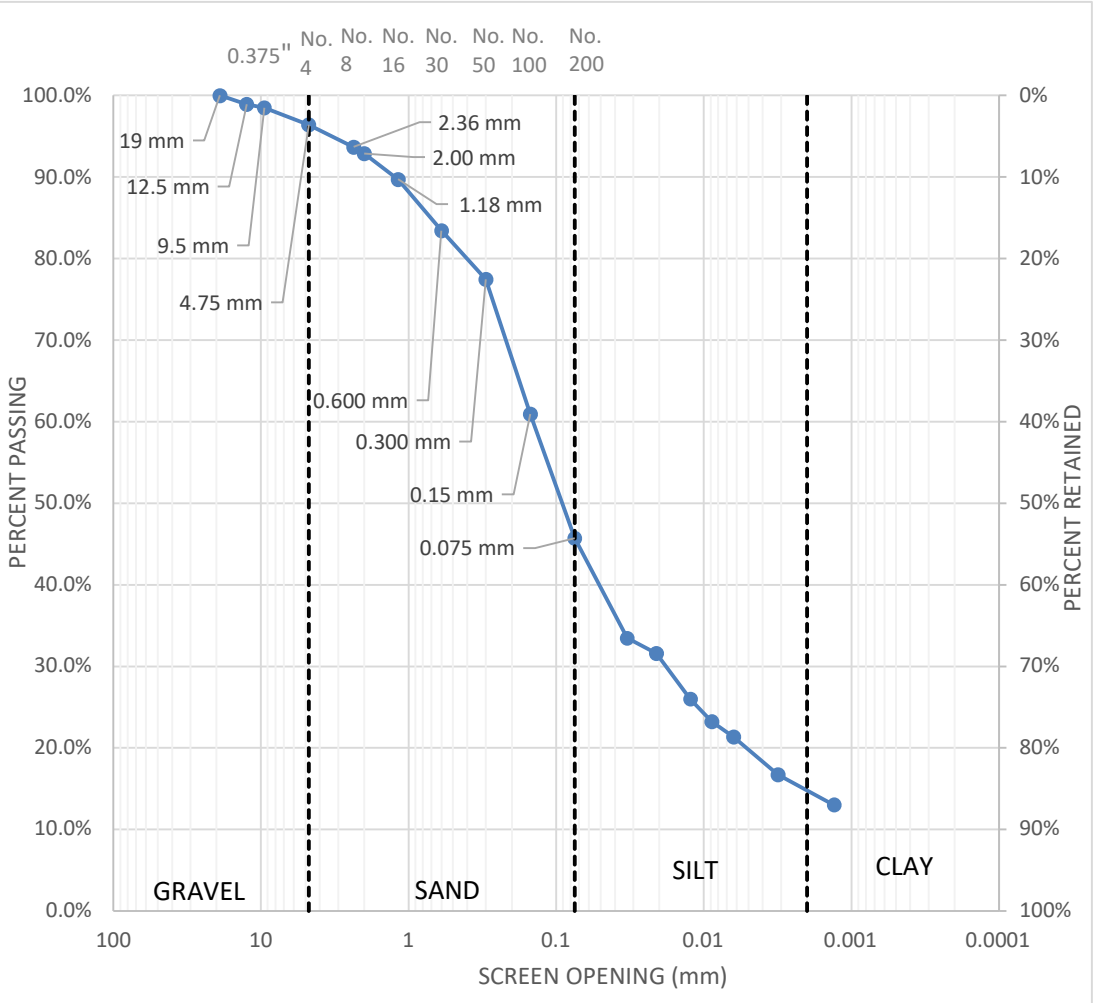
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

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

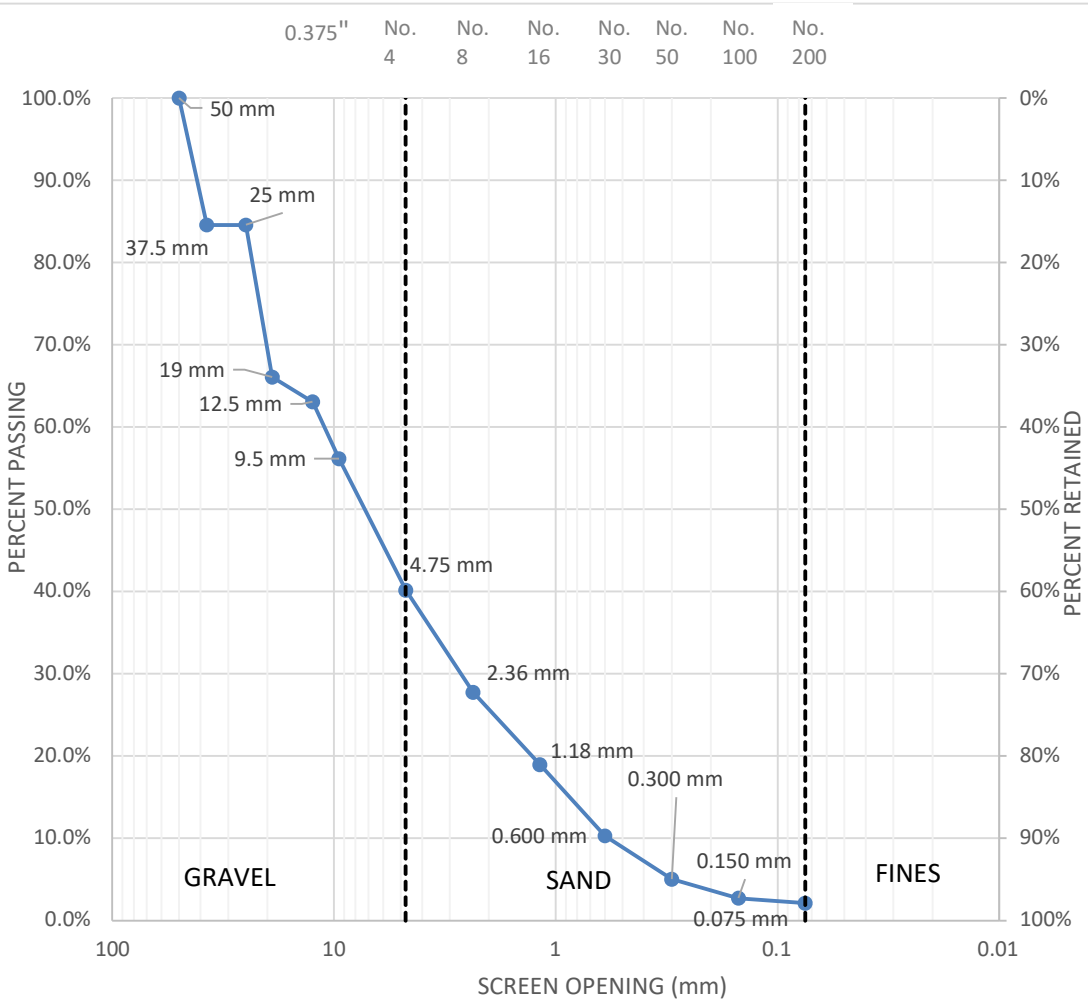
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

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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ASTM C136/C117

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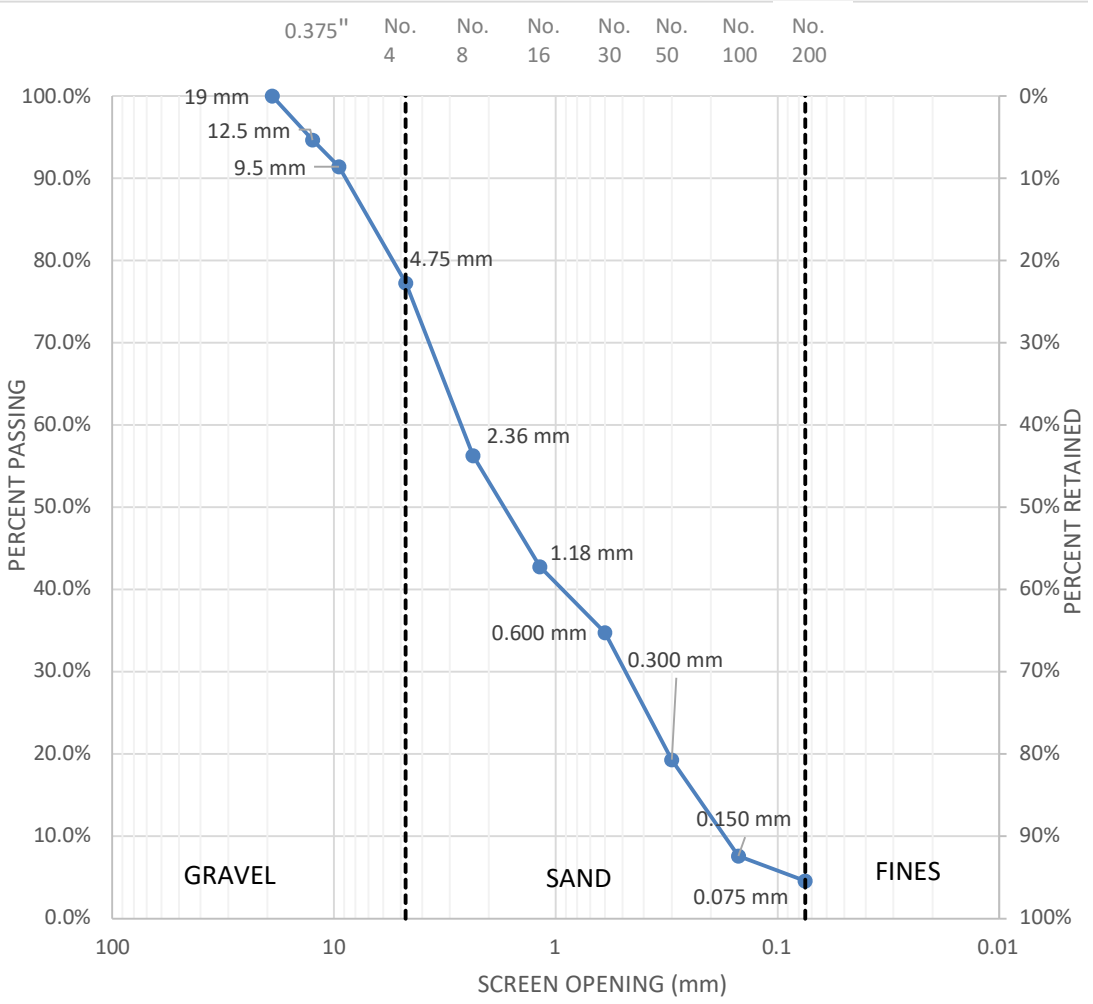
CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

SAMPLE INFORMATION

SAMPLE DESCRIPTION	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:

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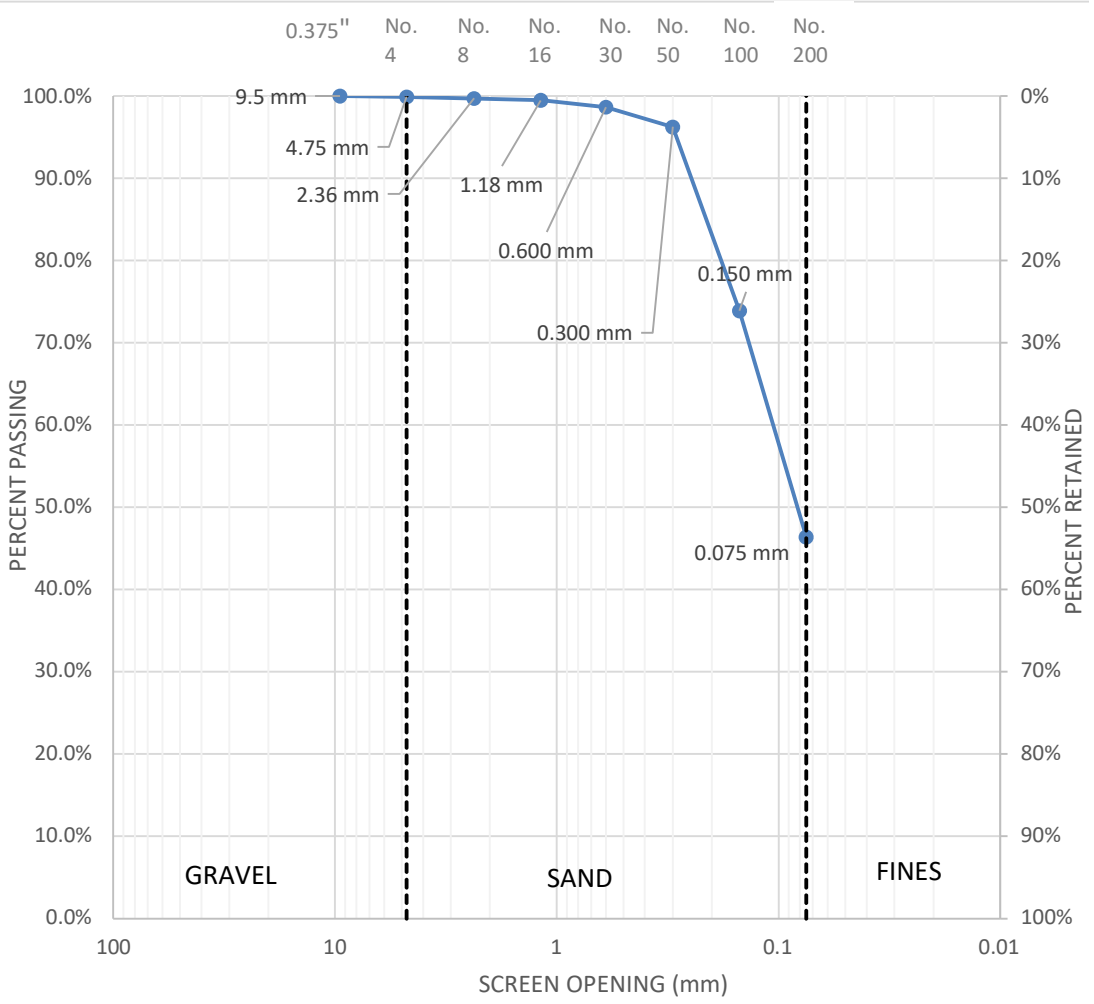
CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

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:

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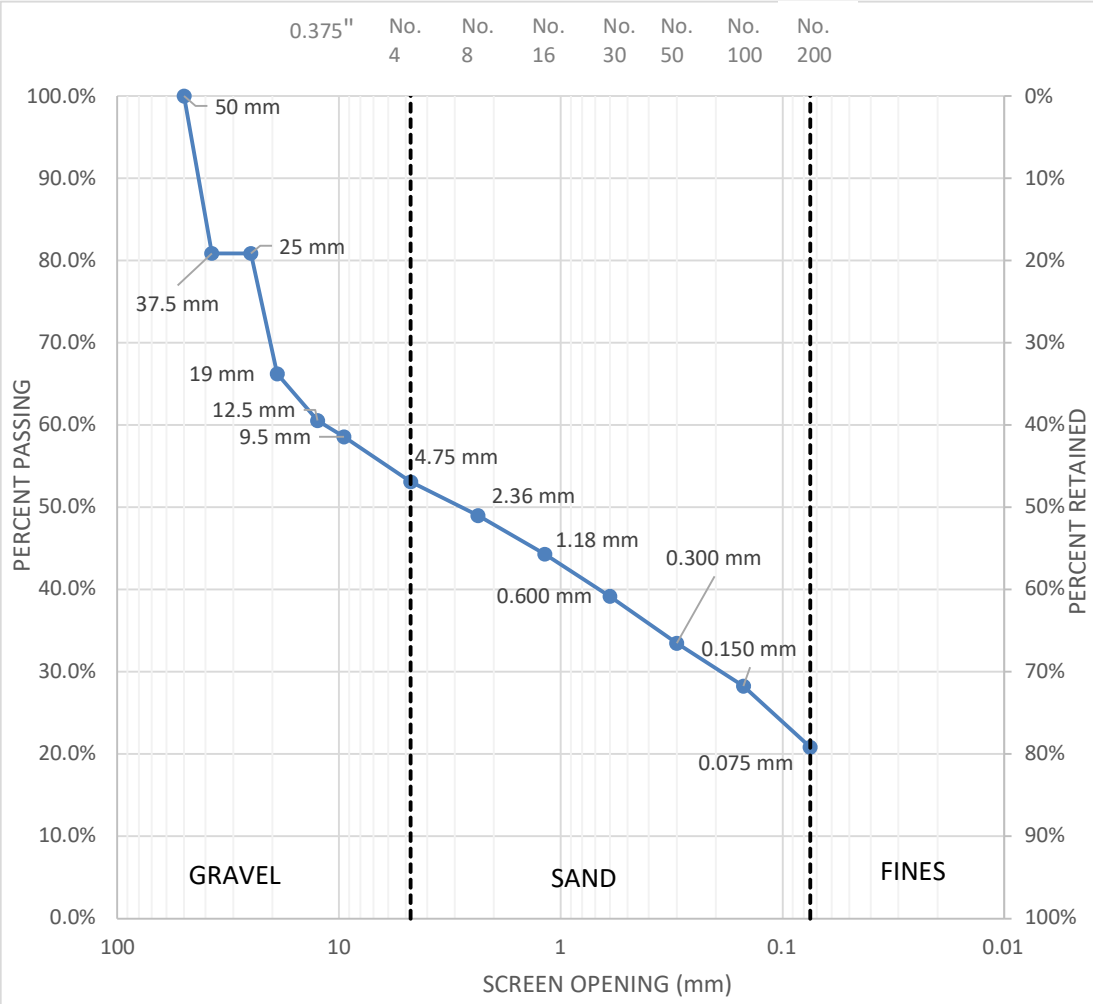
CLIENT	AECOM CANADA LTD.	PROJECT NUMBER	VAN-23002846-A0
PROJECT	RDN FCPCC STAGE 4 UPGRADES - GEOTECHNICAL	SAMPLE DATE	2023-06-30
ADDRESS	1236 ISLAND HIGHWAY WEST, PARKSVILLE, BC	TEST DATE	2023-07-20

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

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

SIEVE ANALYSIS
ASTM C136/C117

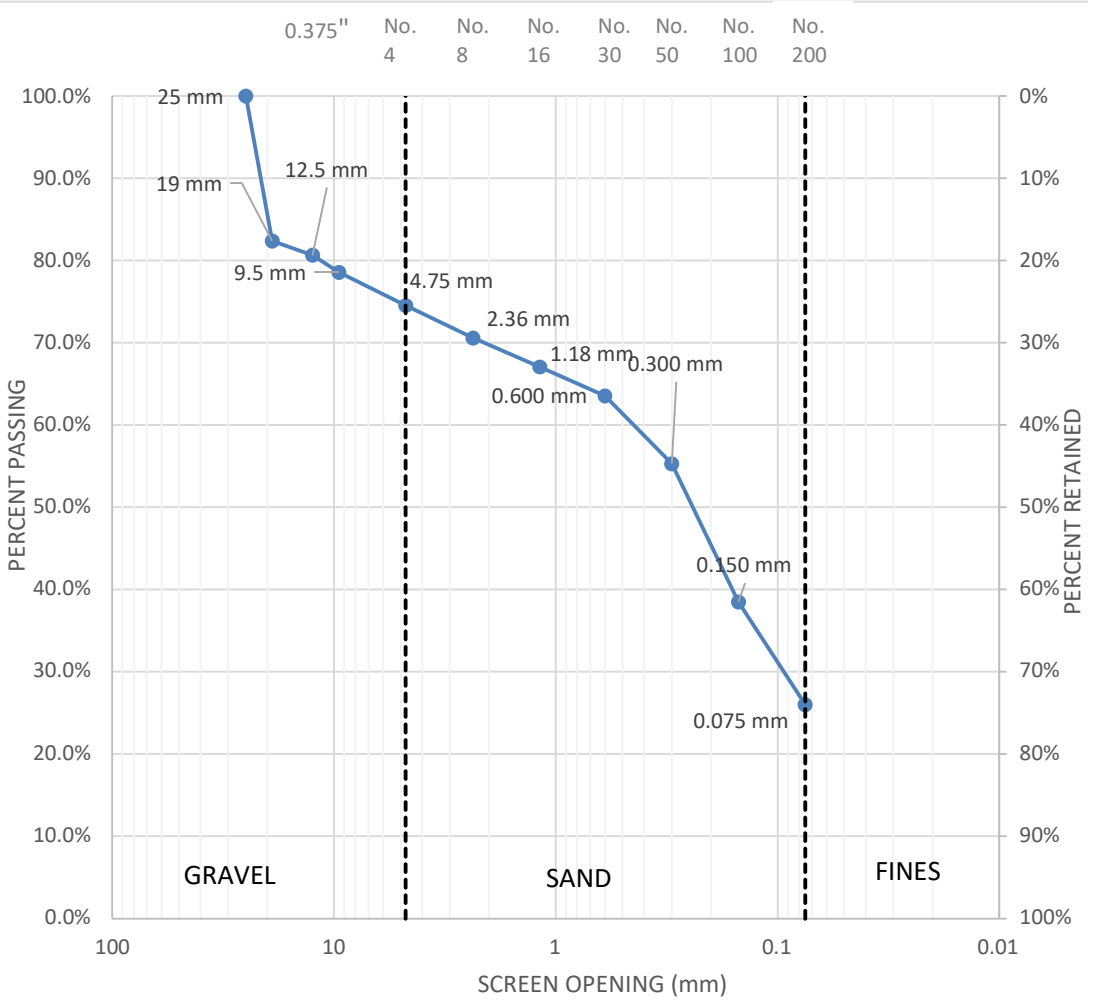
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

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, 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

CERTIFIED BY CCIL

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SIEVE ANALYSIS
ASTM C136/C117

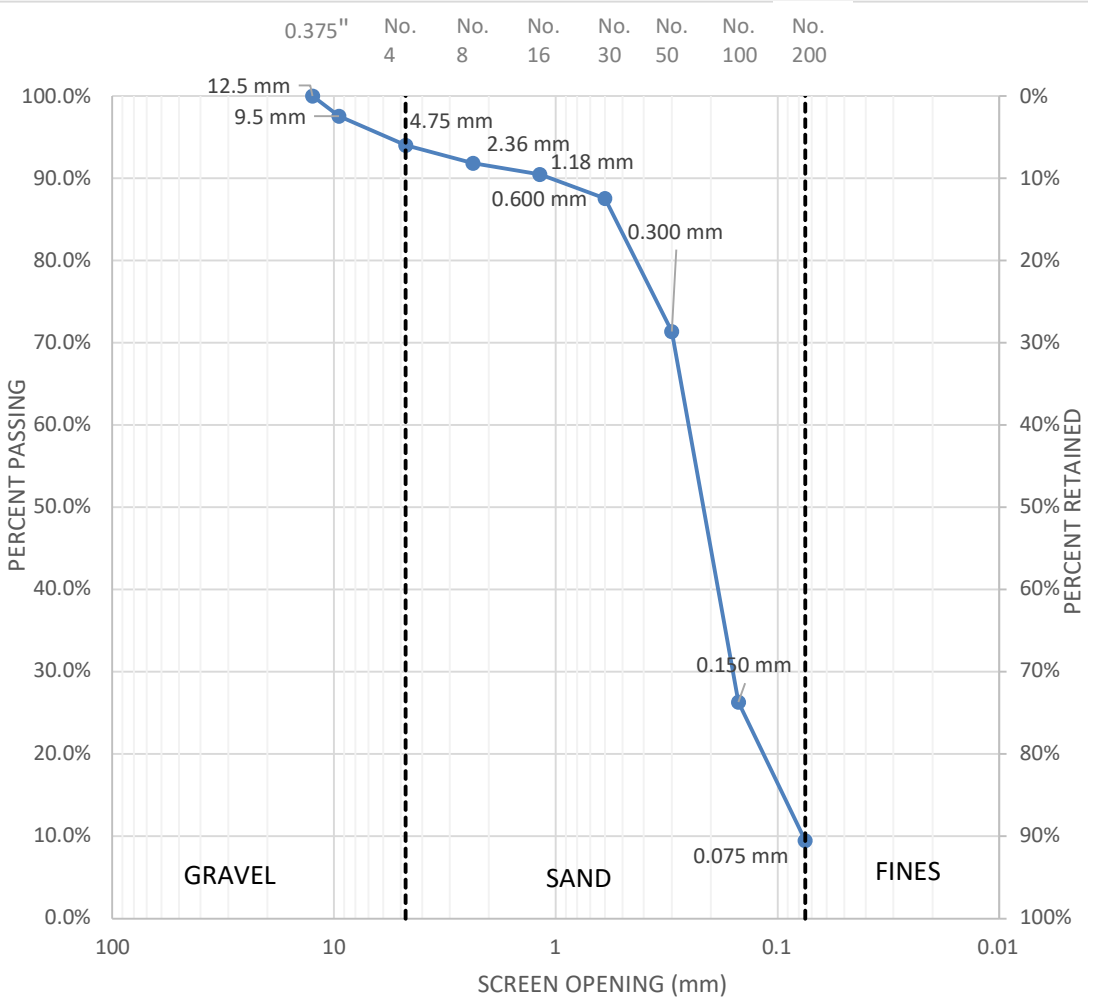
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

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

CERTIFIED BY CCIL

ISO 9001:2015 REGISTERED

SIEVE ANALYSIS
ASTM C136/C117

EXP Services Inc.
275 - 3001 Wayburne Drive
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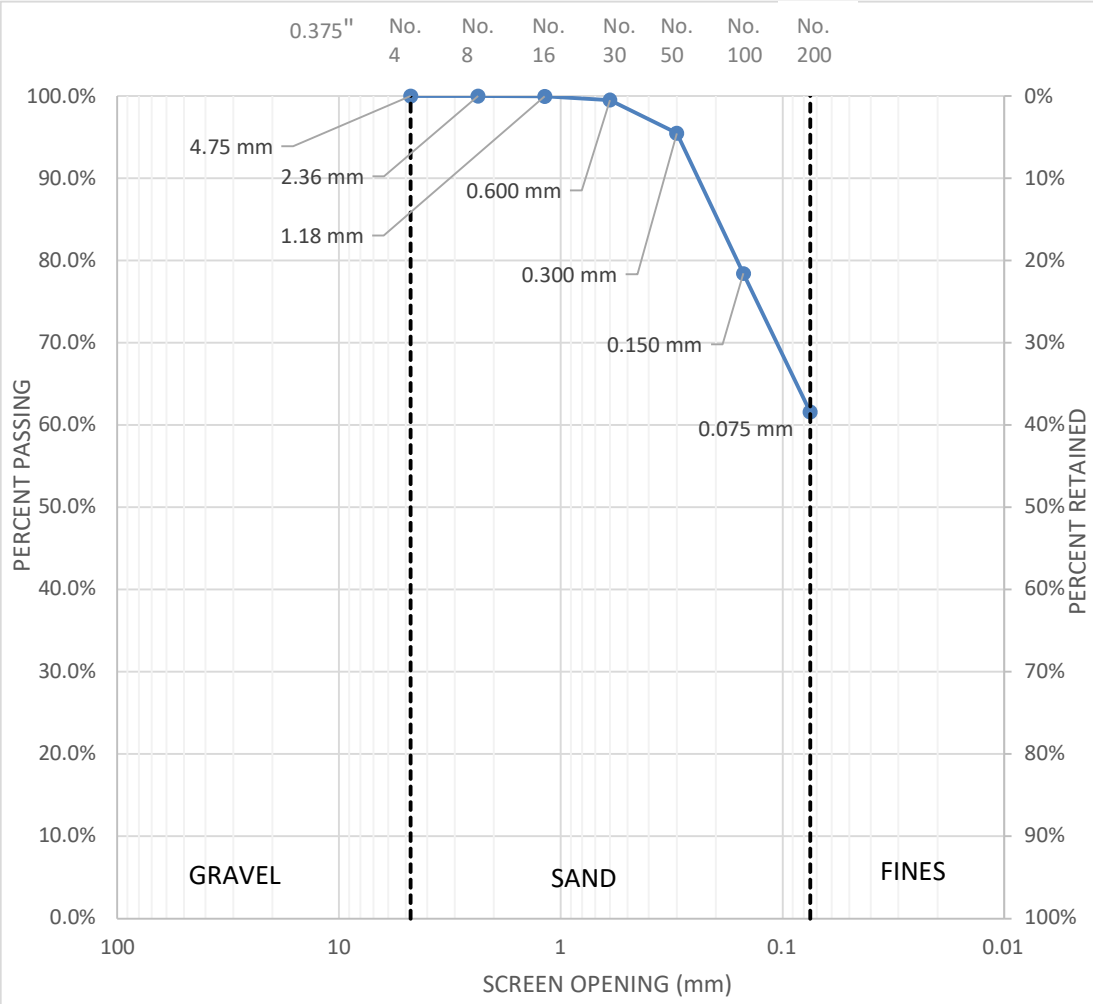
Telephone (604) 874-1245

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 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

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SIEVE ANALYSIS
ASTM C136/C117

EXP Services Inc.
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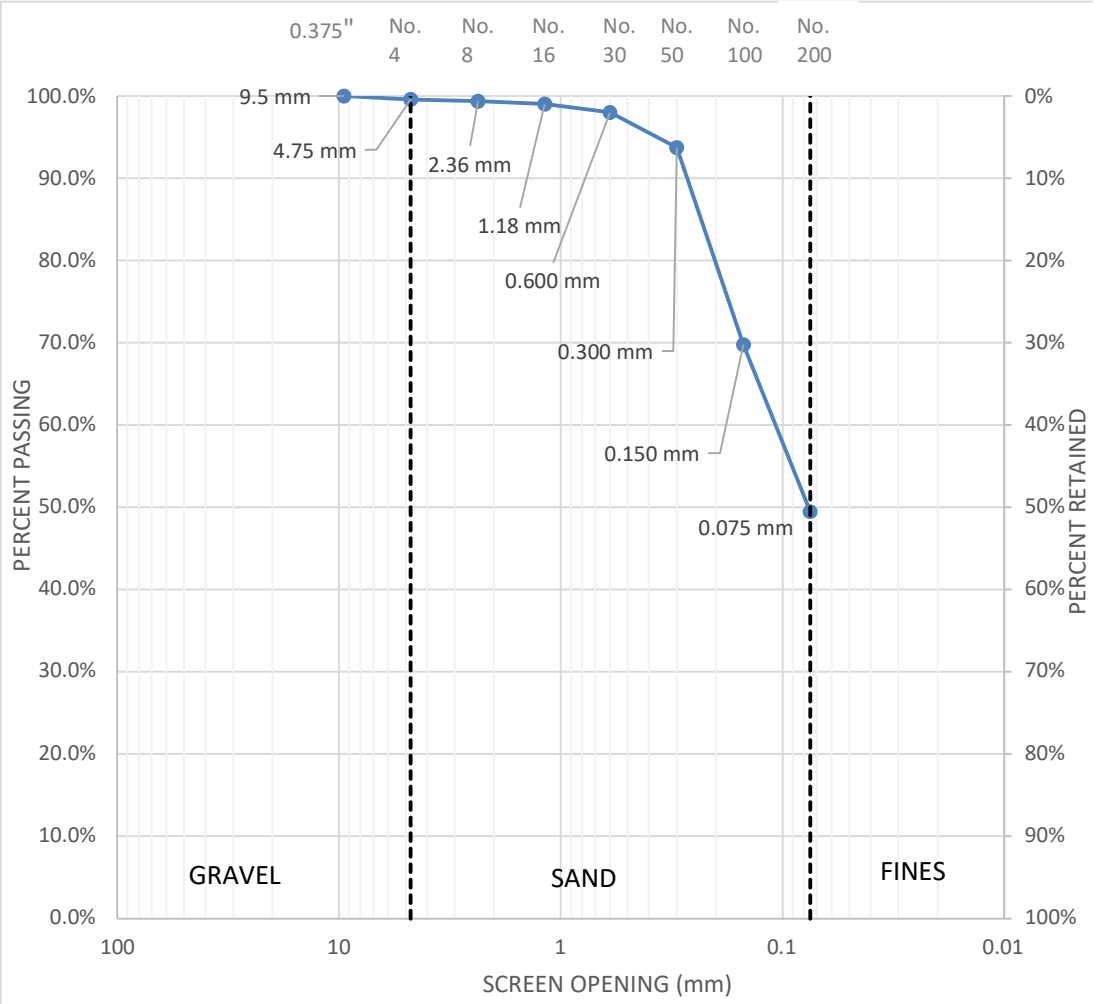
Telephone (604) 874-1245

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 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

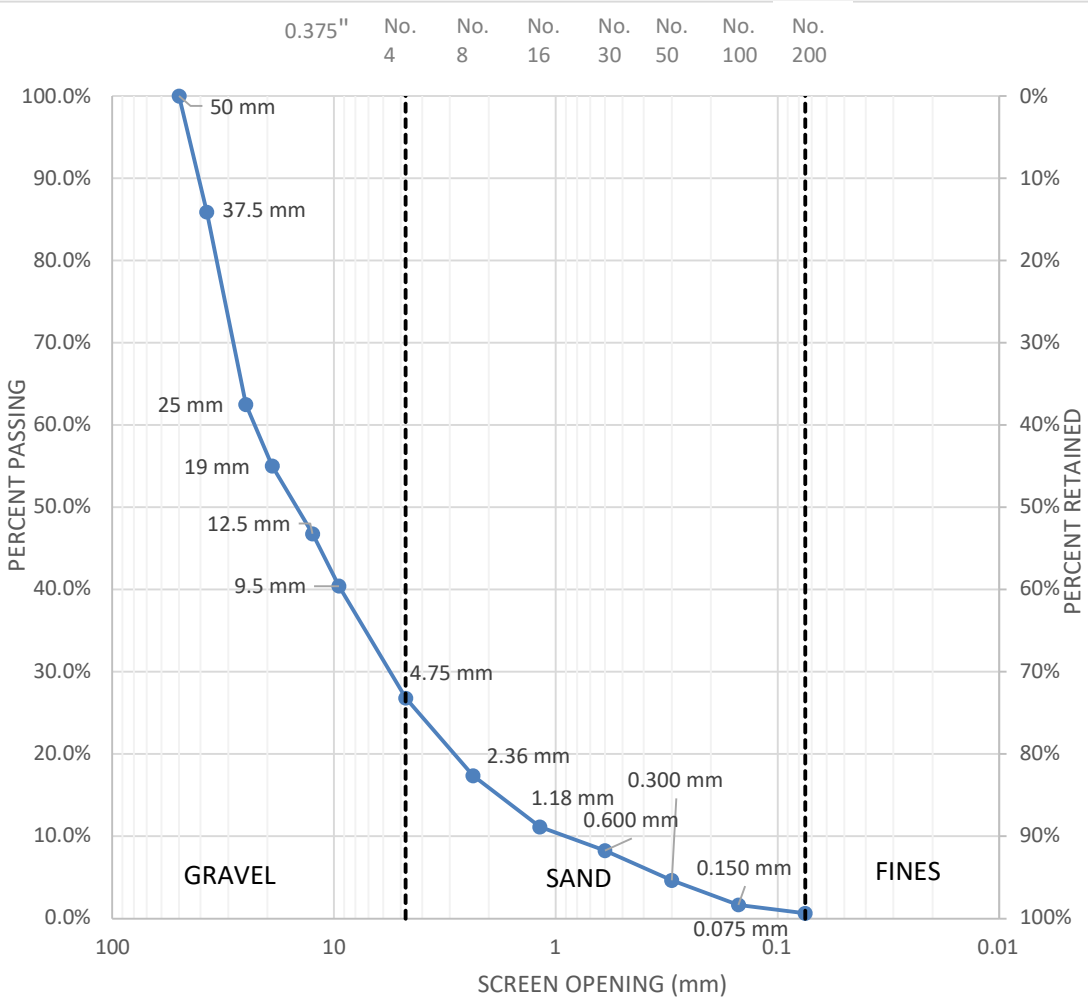
EXP Services Inc.
275 - 3001 Wayburne Drive
Burnaby, BC V5G 4W3
Telephone (604) 874-1245

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

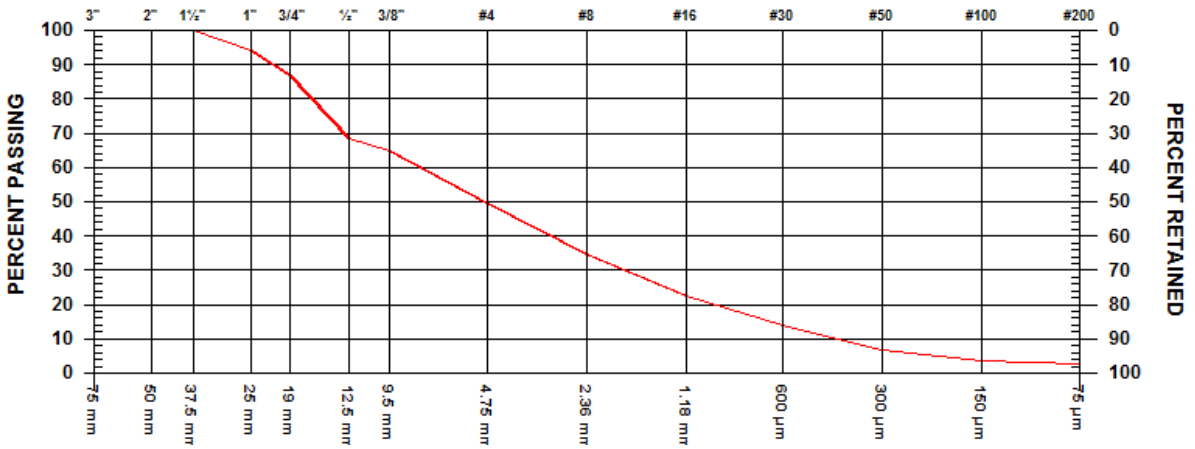
ATTN: MR. BEN WEISS

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

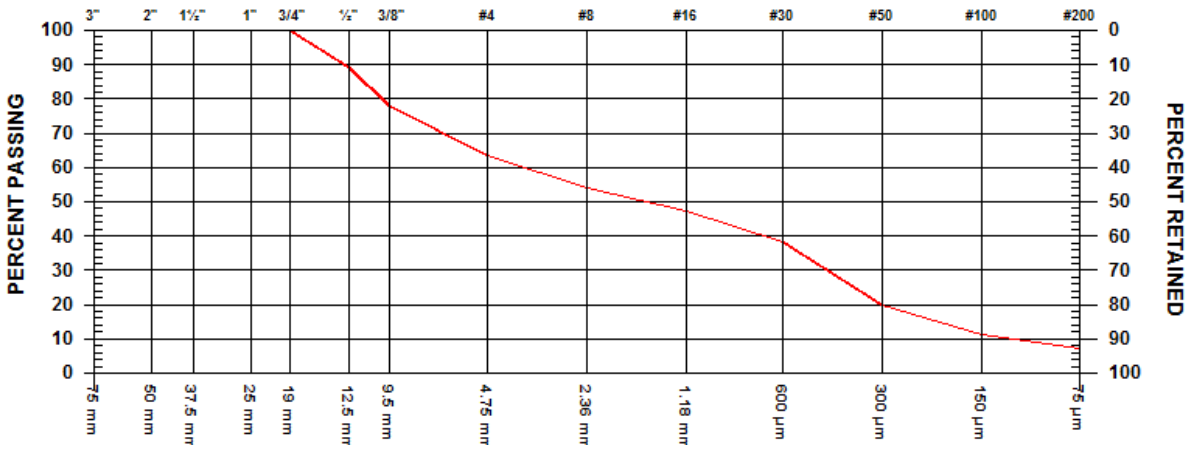
ATTN: MR. BEN WEISS

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

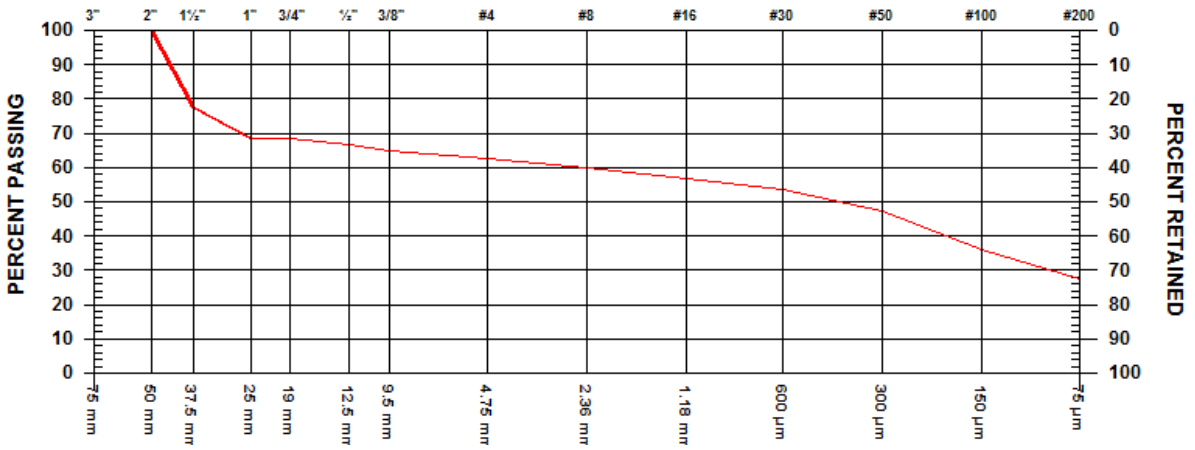
ATTN: MR. BEN WEISS

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

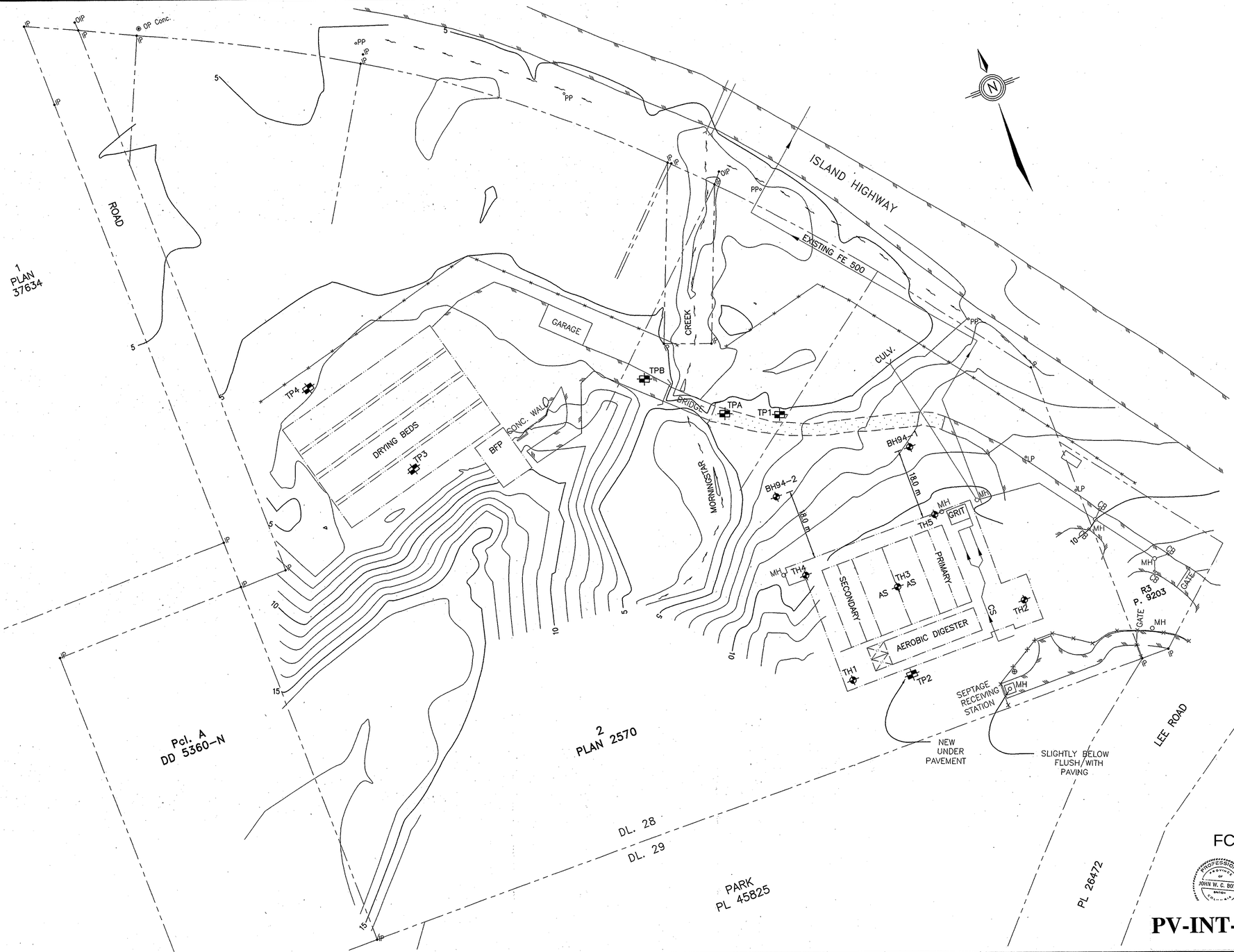
Additional Geotechnical Reference Information

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

REGIONAL DISTRICT OF NANAIMO

Appendix F
MoTI Permit

BRITISH COLUMBIA | Ministry of Transportation

Permit/File Number: 2020-01455 Revision 1
Office: Vancouver Island District

PERMIT TO CONSTRUCT, USE, AND MAINTAIN ACCESS TO A CONTROLLED ACCESS HIGHWAY

PURSUANT TO TRANSPORTATION ACT AND/OR THE INDUSTRIAL ROADS ACT AND/OR THE MOTOR VEHICLE ACT AND/OR AS DEFINED IN THE NISGA'A FINAL AGREEMENT AND THE NISGA'A FINAL AGREEMENT ACT.

BETWEEN:

The Minister of Transportation and Infrastructure
Vancouver Island District
Third Floor
2100 Labieux Road
Nanaimo, BC V9T 6E9
Canada

("The Minister")

AND:

Regional District of Nanaimo
6300 Hammond Bay Road
Nanaimo, British Columbia V9T 6N2

("The Permittee")

WHEREAS:

A. The Minister has the authority to grant permits for the auxiliary use of highway right of way, which authority is pursuant to both the Transportation Act and the Industrial Roads Act, the Motor Vehicle Act, as defined in the Nisga'a Final Agreement and the Nisga'a Final Agreement Act.

B. The Permittee has requested the Minister to issue a permit pursuant to this authority for the following purpose:

The installation, operation, and maintenance of a Controlled Industrial Road Access to serve Lot A, District Lot 28, Nanoose District, Plan EPP80238 for French Creek Pollution Control Center Access from Island Highway West, in accordance with Design Drawings 60590631-C-002; C-003; C-1015 to C-1020.

C. The Minister is prepared to issue a permit on certain terms and conditions.

ACCORDINGLY, the Minister hereby grants to the Permittee a permit for the Use (as hereinafter defined) of highway right of way on the following terms and conditions:

1. The Minister shall designate an official ("the Designated Ministry Official") who shall act as the Minister's agent in the administration of this permit in the manner hereinafter set out.
2. The Use shall be carried out according to the reasonable satisfaction of the Designated Ministry Official.
3. The Permittee shall indemnify and save harmless the Ministry, its agents and employees, from and against all claims, liabilities, demands, losses, damages, costs and expenses, fines, penalties, assessments and levies made against or incurred, suffered or sustained by the Ministry, its agents and employees, or any of them at any time or times, whether before or after the expiration or termination of this permit, where the same or any of them are based upon or arise out of or from anything done or omitted to be done by the Permittee, its employees, agents or Subcontractors, in connection with the permit.
4. The Permittee shall make diligent attempts to determine if there are other users of the right of way in the vicinity of the Permittee's location whose use may be affected. It shall be the responsibility of the Permittee to contact any such users before exercising any of the rights granted hereunder and to attempt to reach an accommodation.
5. The Minister shall take reasonable care to do as little damage or interference, as possible, to any Use authorized by this permit in the carrying out of the construction, extension, alteration improvement, repair, maintenance, or operation of any work adjacent thereto, but the Minister shall not be responsible for any damage regardless.

6. The Minister at the absolute discretion of the Minister may, at any time, cancel this permit for any reason upon giving reasonable notice; provided, however, that in the case of default by the Permittee or in the case of an emergency no notice shall be necessary. The Minister shall not be liable for any loss incurred as a result of permit cancellation.

7. Placing of speed arresters on the access (or accesses) or in the Permittee's property without the prior consent in writing of the Designated Ministry Official shall render the permit void.

8. The Permittee shall be responsible for replacing any survey monuments that may be disturbed or destroyed by the Use. Replacement must be by a British Columbia land surveyor at the Permittee's expense.

9. The Permittee shall remove any mud, soil, debris, or other foreign material tracked onto the highway from the access authorized herein. Such removal shall be at the Permittee's expense and shall be done at any time the material unduly inconveniences traffic and, in any event, daily.

10. The Permittee acknowledges that the issuance of this permit by the Minister is not a representation by the Minister that this permit is the only authority needed to carry out the Use. The Permittee shall give deference to any prior permission given for use of the right of way in the vicinity of the permit area, shall obtain any other permission required by law, and shall comply with all applicable laws regardless of their legislative origin.

11. At the end of the term of this permit, or when the permit is cancelled or abandoned, the Permittee shall, if so, requested by the Minister, remove all installations, and shall leave the site as near as reasonably possible in the condition it was in before this permit was issued, or such other condition as shall reasonably be required by the Designated Ministry Official. If the Permittee refuses to comply with these obligations, the Minister may perform them as required and the Permittee shall be liable to the Minister for the costs of doing so.

12. The rights granted to the Permittee in this permit are not assignable without the consent of the Minister.

13. As a condition of this permit, the permittee unconditionally agrees with the Ministry of Transportation and Infrastructure that the permittee is the prime contractor or will appoint a qualified prime contractor, as described in Section 118 of the Workers Compensation Act, for the purposes of the work described by this permit, at the work location described in this permit, and that the permittee or designated prime contractor will observe and perform all of the duties and obligations which fall to be discharged by the prime contractor pursuant to the Workers Compensation Act and the Occupational Health and Safety Regulation.

14. The Permittee is advised and acknowledges that the following hazards may be present at the work location and need to be considered in coordinating site safety: overhead hazards, particularly electrical or telecommunications lines; buried utilities, particularly electrical, telecommunication, and gas lines; traffic, danger trees, falling rocks, and sharp or infectious litter.

15. Any works within the Ministry right-of-way that fall within the scope of "engineering" under the Engineers and Geoscientists Act will be performed by a Professional Engineer and shall comply with this Ministry's "Professional Assurance Guidelines". The Guidelines can be viewed on the Ministry's website at https://www2.gov.bc.ca/assets/gov/driving-and-transportation/transportation-infrastructure/engineering-standards-and-guidelines/technical-circulars/2023/t01-23.pdf

16. The Permittee is responsible for preventing the introduction and spread of noxious weeds on the highway right-of-way as defined by the British Columbia Weed Control Act and Weed Control Regulation.

17. (a) The rights granted under this permit shall not be exercised before February 1, 2021.

    (b) The Construction and Installations must be completed on or before October 31, 2024.

18. A. LOCATION

19. The layout shown on the attached drawing is a condition of this permit, and any change in layout without the prior consent in writing of the Designated Ministry Official shall render the permit void.

20. B. CONSTRUCTION AND INSTALLATIONS:

21. The rights granted under this permit are for an indefinite period.

22. The Permittee shall take all reasonable precautions to attempt to ensure the safety of the public in connection with the Use. In particular, but not so as to limit this obligation, the Permittee shall, if so, required by the Designated Ministry Official on reasonable grounds, prepare and implement a traffic control plan. The contents of the plan and the manner in which it is implemented must meet the reasonable satisfaction of the Designated Ministry Official.

23. The Permittee shall, at their cost, supply, erect, and maintain standard traffic control devices in accordance with the Ministry of Transportation and Infrastructure Traffic Management Manual for Work on Roadways and Occupational Health and Safety Regulation.

24. A stop sign must be erected at the entrance to Island Highway 19A.

25. No Left Turn Signs (R-015-L) and any other signs as required by the Designated District Official to be erected either side of the access in accordance with the Ministry of Transportation and Infrastructure Manual of Standard Traffic Signs and Pavement Markings.

26. The access shall be paved with a 0.60m wide Stop Bar to the satisfaction of the Designated Ministry Official and in accordance with the Ministry of Transportation and Infrastructure Manual of Standard Traffic Signs and Pavement Markings.

27. The access (or accesses) shall be constructed with a minimum 500mm culvert pipe manufactured to CSA or ASTM standards and laid at ditch invert elevation. Maintenance and periodic cleaning of this culvert is the responsibility of the Permittee.

28. The profile of the access (or accesses) shall not exceed 2% grade from the ditchline for a distance of at least 10 metres as measured away from the highway along the centerline of the access.

29. The finished grade of the access (or accesses) at the ditch-line shall be 15 cm below the highway shoulder elevation.

30. Access to be constructed at 90 degrees to the highway for a distance of 10 metres from the highway shoulder.

31. The Permittee is responsible for ensuring that all works are contained to the highway right of way. Any works located within private property must have the owner's permission.

32. The Permittee is responsible for obtaining the necessary approvals from all other agencies whose interests are affected.

33. The Permittee will be responsible for any damage to existing overhead or underground utilities in the area covered by this permit.

34. Protection of Roads

    The Permittee shall ensure all equipment working on or hauling material on to and from the Site does not damage or deposit material onto any part of an existing roadway. Materials spilled onto the public roadways or driveways opened to public traffic shall be cleaned up immediately. The Permittee has the full responsibility to repair any damage to existing highways, local roads and driveways caused by its construction equipment and/or operations.

35. C. AUTHORIZED ACTIVITIES

36. The access (or accesses) shall be restricted to the following movements only: Right In and Right Out.

    The Permittee shall construct and erect all necessary channelization, signs, and other traffic-control devices at their cost.

37. This permit does not provide licensing and insurance and/or oversize, overweight authorization for a commercial vehicle to access a provincial highway from an industrial road. Commercial vehicle operators require authority pursuant to Section 8 of the Commercial Transport Act, R.S.B.C. 1996, and should contact the Provincial Permit Centre at 1-800-559-9688 to obtain a Highway Crossing Permit.

38. In accordance with Sections 000.03 Non-Ministry Developments on Ministry Land or That are Intended to Become Ministry Assets and 165.20 Archaeological and Paleontological Discoveries of the Design Build Standard Specification for Highway Construction - In the event that any item of archaeological, heritage, historical, cultural or scientific interest is found on the project site, the following Chance Find Procedure shall apply:

    Such item(s) shall remain the property of the Province and the Permittee shall, on making or being advised of such a find, immediately cease operations in the affected area, minimize activities which create ground disturbance in and adjacent to the affected area, and notify the District Official and the Archaeology Branch of the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development [Ministry of Forests]. Work shall not resume within 30 m of the discovery site until an appropriate directive has been received from that agency.

    To protect archaeological and paleontological sites that are situated within or adjacent to a project site, the Permittee may be required to use a variety of mitigative measures, including but not limited to drainage or erosion control, slope stabilization measures, or erecting fences or other suitable barriers to protect archaeological or paleontological sites that are situated within or adjacent to a project site. These measures, with any negotiated extensions of time for completion of the Works they require, will be determined, and adopted at the discretion of the District Official. The costs associated with such mitigative measures will be borne by the Permittee.

    A buffer zone, in which no land alteration or other activity is permitted, may be required to ensure adequate site protection. The width of this buffer zone shall be determined by the District Official in consultation with a representative of the Archaeology Branch of the British Columbia Ministry of Forests, Lands, Natural Resource Operations and Rural Development [Ministry of Forests]. The Permittee shall be responsible for the actions of employees and subcontractors with respect to site vandalism and the unlicensed collection of artifacts from Designated archaeological sites in and around the work location.

    The Permittee shall ensure that all workers and Subcontractors are fully aware of these requirements and processes.

39. D. OPERATION AND MAINTENANCE

40. The Minister is under no obligation, express or implied, to provide financial assistance or to contribute toward the cost of servicing, creating, or developing the Permit Area or the Improvements and the Permittee is solely responsible for all costs and expenses associated with their use of the Permit Area and Improvements.

41. The Permittee will ensure that the works do not, impair, impede, or otherwise interfere with:

I. public passage on the Highways.

II. the provision of highway maintenance services by the Province, or by its servants, contractors, agents or authorized representatives of the Province in connection with the Highways; or

III. the operation of the Highways;

42. That where the said works are in the proximity of any bridge, culvert, ditch or other existing work, such work shall be properly maintained and supported in such manner as not to interfere with its proper function, and on the completion of the said works any bridge, culvert, ditch, or other existing work interfered with shall be completely restored to its original condition.

43. That before opening up any highway or interfering with any public works, written notice of intention to do so must be given to the Designated Ministry Official at least 72 hours before the work is begun, except in the case of an emergency situation, the Permittee will immediately contact the Road & Bridge Maintenance Contractor or local RCMP.

44. That, when necessary, all excavations, materials, or other obstructions are to be efficiently fenced, lit, and watched, and at all times every possible precaution is to be taken to ensure the safety of the public.

45. The Permittee is responsible for maintaining positive drainage in the area covered by this permit.

46. The Permittee is responsible for keeping the area of the crossing clean and free of any debris tracked onto the roadway from the industrial road.

47. A copy of the permit is to be kept by the field supervisor, in order that he is aware of all permit conditions.

The rights granted to the Permittee in this permit are to be exercised only for the purpose as defined in Recital B on page 1.

Dated at Nanaimo, British Columbia, this 2nd day of April 2024

Tammy Thompson

On Behalf of the Minister

REGIONAL DISTRICT OF NANAIMO

Appendix G
DFO Permit

Fisheries and Oceans Canada | Pêches et Océans Canada

Pacific Region
Ecosystem Management Branch
417 2nd Avenue W
Prince Rupert, BC
V8J 1G8

Région du Pacifique
Gestion des ecosystems
417, 2e Avenue Ouest
Prince Rupert, (C.-B.)
V8J 1G8

February 20, 2021

Our file *Notre référence*

19-HPAC-00768

Regional District of Nanaimo
ATTENTION: Duncan Taylor
6300 Hammond Bay Road
Nanaimo, B.C.
V9T 6N2

Via-Email: dtaylor@rdn.bc.ca

Subject: Waste Treatment Facility Expansion, Morningstar Creek, Parksville – Implementation of Measures to Avoid and Mitigate the Potential for Prohibited Effects to Fish and Fish Habitat

Dear Mr. Taylor:

The Fish and Fish Habitat Protection Program (the Program) of Fisheries and Oceans Canada (DFO) received your proposal on November 13, 2019. We understand that you propose to:

- Replace a clear-span bridge over Morningstar Creek with an open-bottom arch culvert.
- The culvert causeway will support a paved access road as well as various utility pipes and an electrical duct bank.
- Conduct bank armouring, channel substrate replacement and riparian clearing.
- Storm drainages on site will be reconfigured in such a way as to direct water to an existing storm outfall, located upstream of the bridge crossing.

Our review considered the following information:

- *Request for Review Form* and Site Drawings, prepared by Aecom, received by email on November 13, 2019;
- *Environmental Overview Assessment Report,* prepared by Aecom, dated March 2019 and received by email on November 13, 2019;
- *Project Drawings and Figures,* prepared by Aecom, and received by email on November 13, 2019;
- Site Visits conducted by Michael Lockhart and Sandy Zhignesse on January 09, 2020 and then by Michael Lockhart, Hailey O'Neill, and Vincent Harper on December 17, 2020;

- *Culvert Design Memo*, prepared by Aecom, dated July 07, 2020 and received by email on July 20, 2020; and
- *Engineer's Analysis*, prepared by Aecom, and received by email on January 4, 2021.

Your proposal has been reviewed to determine whether it is likely to result in:

- the death of fish by means other than fishing and the harmful alteration, disruption or destruction of fish habitat which are prohibited under subsections 34.4(1) and 35(1) of the *Fisheries Act*; and
- effects to listed aquatic species at risk, any part of their critical habitat or the residences of their individuals in a manner which is prohibited under sections 32, 33 and subsection 58(1) of the *Species at Risk Act*.

The aforementioned outcomes are prohibited unless authorized under their respective legislation and regulations. As of the date of this letter, no individuals of any aquatic species listed under the *Species at Risk Act* were identified in the vicinity of the proposed works.

To avoid and mitigate the potential for prohibited effects to fish and fish habitat (as listed above), we recommend implementing the measures listed below:

- Retain a Qualified Environmental Professional to provide services as an Environmental Monitor during all project activities (e.g., bridge removal, site isolation/flow diversion, culvert installation, etc.) that may result in negative effects on fish and fish habitat.
- Conduct works during favourable weather conditions/low flow and suspend works during weather events that result in excessive surface erosion and run-off.
- Conduct fish salvages as required prior to site dewatering to ensure that no fish are present in the isolated areas.
- Isolate the work areas and divert flow around the site using effective methods to maintain downstream flow at all times (e.g., continuously monitor flow diversion pumps while in use to ensure continued operation and that flows to downstream areas are maintained).
- Monitor for fish presence in the area of works and implement contingency measures as required in order to prevent impacts to fish.
- Ensure that back-up flow management equipment is available on site at all times in the event that higher than expected flows occur or equipment malfunction.
- Maintain an appropriate depth and flow for the protection of fish and fish habitat downstream of the work sites at all times.
- Develop and implement a spill response plan to reduce the risk of deleterious substance discharge into fish habitat.
- Ensure that all heavy equipment is inspected and is free from leaks prior to conducting works in or near fish habitat.
- Revegetate and stabilize all exposed soils at the end of the project.
- Ensure that all concrete works are effectively contained to prevent the accidental spill of uncured concrete into the stream.

- Ensure that all rip rap is clean and free of dirt and debris before placing below the high water mark of the channel.
- Develop and effectively implement an erosion and sediment control plan to reduce the risk of sedimentation of fish habitat.
- Effective sediment and erosion control measures should be installed, inspected, and repaired, as required, to prevent the introduction of sediment into fish habitat.
- Revegetate disturbed areas with native seed mix and salvaged vegetation upon completion of the works.
- Adhere to measures found in the following DFO Interim Code of Practice including Notification to DFO:
  - End-of-pipe fish screens for small water intakes in freshwater.

Provided that you incorporate these measures into your plans, the Program is of the view that your proposal is not likely to result in the contravention of the above mentioned prohibitions and requirements.

Should your plans change or if you have omitted some information in your proposal, further review by the Program may be required. Consult our website (http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html) or consult with a qualified environmental consultant to determine if further review may be necessary. It remains your responsibility to remain in compliance with the *Fisheries Act*, the *Species at Risk Act* and the *Aquatic Invasive Species Regulations.*

It is also your *Duty to Notify* DFO if you have caused, or are about to cause, the death of fish by means other than fishing and/or the harmful alteration, disruption or destruction of fish habitat. Such notifications should be directed to the DFO-Pacific Observe, Record and Report phone line at 1-800-465-4336 or by email at DFO.ORR-ONS.MPO@dfo-mpo.gc.ca.

We recommend that you notify this office at least 10 days before starting your project and that a copy of this letter be kept on site while the work is in progress. It remains your responsibility to meet all other federal, territorial, provincial and municipal requirements that apply to your proposal.

Please note that this Letter of Advice does not provide relief from the obligations set out in the government of British Columbia's Riparian Areas Protection Regulations (RAPR), and cannot be construed to provide authorization pursuant to section 3(2) of the RAPR, for any work, undertaking or activity within the Riparian Assessment Area. For more information on the RAPR, including contacts, please visit: https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/fish/aquatic-habitat-management/riparian-areas-regulation.

Please note that the advice provided in this letter will remain valid for a period of one year from the date of issuance. If you plan to execute your proposal after the expiry of this letter, we recommend that you contact the Program to ensure that the advice remains up-to-date and accurate. Furthermore, the validity of the advice is also subject to there

being no change in the relevant aquatic environment, including any legal protection orders or designations, during the one-year period.

If you have any questions with the content of this letter, please contact the undersigned at our Nanaimo office at 778-268-2372 or by email at Michael.lockhart@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,

Ian Bergsma
A/Senior Biologist
Fish & Fish Habitat Protection Program

cc: Ian MacLeod, AECOM (Burnaby): ian.macleod@aecom.com

REGIONAL DISTRICT OF NANAIMO

Appendix H
Sample Form of Contract

REGIONAL DISTRICT OF NANAIMO

CONTRACTOR SERVICES AGREEMENT

THIS AGREEMENT made the _____ day of _____, 20_____.

BETWEEN:

REGIONAL DISTRICT OF NANAIMO
6300 Hammond Bay Road
Nanaimo, BC
V9T 6N2

(hereinafter called the "Regional District")

AND:

(hereinafter called the "Contractor")

NOW THIS AGREEMENT WITNESSETH:

THAT in consideration of the terms, conditions and covenants hereinafter set forth, the Regional District and the Contractor covenant and agree each with the other as follows:

1. Services

The Regional District retains the Contractor to provide the Services described in Schedule "A" (the "Contract Documents") and the Contractor agrees to provide the Services in a diligent manner.

2. Term

The Contractor will provide the Services during the period (hereinafter called the "Term") commencing on <Start Date> and ending on <End Date>, unless sooner terminated as hereinafter provided.

3. Payment

The Regional District will pay to the Contractor as full payment for the Services; the amount set out in Schedule 'B' at the times and in the manner therein set out.

4. Independent Contractor

The Contractor will always be an independent contractor and not the servant, employee, or agent of the Regional District.

5. Assignment and Sub-contracting

The Contractor will not, without the prior written consent of the Regional District, assign or subcontract this Agreement or any portion thereof.

6. Indemnity

The Contractor will indemnify and save harmless the Regional District from all losses, claims, damages, or expenses arising from or due to the negligence of the Contractor in performing the Services or the Contractor's breach of this Agreement.

7. Insurance

a) Prior to the commencement of the Services the Contractor shall provide a certificate of Commercial General Liability (CGL) insurance in the amount of $5,000,000 which shall provide coverage for property damage and third-party personal injury and death. The certificate shall name the Regional District as an additional insured. The certificate of insurance shall contain a clause requiring notification of the Regional District 30 days in advance if the insurance policy is cancelled.

b) Automobile Third Party Liability on all owned or leased vehicles in an amount not less than $5,000,000.

c) Contractor is responsible for any other insurance required to protect their interests.

d) The cost of any insurance and deductibles are the responsibility of the Contractor.

8. WSBC Coverage & Prime Contractor Designation

The Contractor must be registered with WorkSafe BC and be in good standing with remittance up to date throughout the agreement and is designated as the Prime Contractor and shall fulfill the Prime Contractor responsibilities as defined in:

a) WorkSafeBC Occupational Health and Safety Regulation, Notice of Project, Section 20.2, and Coordination of multiple employer workplaces, Section 20.3;

b) Workers Compensation Act (BC), Coordination at multiple-employer workplaces, Section 118, Subsections (1) & (2); and

c) General Requirements, Section 3.10 WorkSafeBC.

9. Termination

Notwithstanding any other provision of this Agreement:

If the Contractor fails to comply with any provision of this Agreement, then, and in addition to any other remedy or remedies available to the Regional District, the Regional District may, at its option, terminate this Agreement immediately by giving written notice of termination to the Contractor if there is supporting evidence of the Vendor becoming bankrupt or threatens bankruptcy, provides false declarations, documented significant deficiencies of any substantive requirements or obligations of the work, professional misconduct, violations of health and safety laws, or demonstrated abusive behavior towards the general public or RDN staff. The Regional District will be under no further obligation to the

Contractor except to pay the Contractor such amount as the Contractor may be entitled to receive, pursuant to Schedule 'B', for services properly performed and provided to the date notice is given to the Contractor less any amounts necessary to compensate the Regional District for damages or costs incurred by the Regional District arising from the Contractor's default.

10. Prior Dealings

All prior negotiations and agreements between the parties relating to the subject matter of this Agreement are superseded by this Agreement. There are no representations, warranties, understandings, or agreements other than those expressly set forth in the Agreement or subsequently agreed to in writing, which writing shall be executed by a duly authorized officer of the party to be bound thereby.

11. Waiver

The failure of either party at any time to require the other party's performance of any obligation under this Agreement shall not affect the right to require performance of that obligation in the future. Any waiver by either party of any such breach or any such provision hereof shall not be construed as a waiver or modification of this provision itself, or a waiver or modification of any other right under this Agreement.

12. Counterparts

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.

13. Dispute Resolution

If the parties to this Agreement are unable to agree on the interpretation or application of any provision in the Agreement, or are unable to resolve any other issue relating to this Agreement, the parties agree to the following process in the order it is set out:

a) the party initiating the process will send written notice to the other party (the "Dispute Notice"); and;
b) the parties will promptly, diligently and in good faith, including the senior management of both parties, take all reasonable measures to negotiate an acceptable resolution to the disagreement or dispute.
c) if the dispute is not resolved through collaborative negotiation within 30 Business Days of the dispute arising, the parties must then attempt to resolve the dispute through mediation under the rules of the Mediate BC Society and will be held in Nanaimo, BC.

14. Freedom of Information

The Contractor acknowledges and agrees that any Confidential Information disclosed by it to the RDN under this Agreement may be subject to a request for public disclosure under the Freedom of Information and Protection of Privacy Act, R.S.B.C. 1996, c.165, as amended from time to time.

15. Governing Law

This Agreement is governed by and is to be interpreted and construed in accordance with, the laws applicable in British Columbia.

16. Delay in Performance

Neither the RDN nor the Service Provider shall be deemed to be in default of this Agreement for delays in performance caused by circumstances beyond the reasonable control of the non-performing party. For purposes of this Agreement, such circumstances include, but are not limited to abnormal weather conditions, flood, earthquake, fire, pandemic, epidemic, war, riot and other civil disturbance, strike, lockout, work slowdown and other labour disturbances, sabotage, judicial restraint and inability to procure permits, licenses or authorizations from any local, provincial or federal agency for any of the supplies, materials, accesses or services required to be provided by either the RDN or the Service Provider under this Agreement. If any such circumstances occur, the non-performing party shall, as soon as possible after being prevented from performing, give written notice to the other party describing the circumstances preventing continued performance and the efforts being made to resume performance of this Agreement.

17. Amendment

This Agreement may not be modified or amended except by the written agreement of the parties.

18. Judge of Work and Materials

The REGIONAL DISTRICT shall be the final judge of all work and materials in respect of both quality and quantity and their decisions of all questions in dispute with regard thereto will be final. All materials shall be subject to inspection and test by and shall meet the approval of the REGIONAL DISTRICT.

In case any materials, equipment and supplies are defective in material or quality or otherwise not in conformity with the specifications of the contract, the REGIONAL DISTRICT shall have the right either to reject them or to require their correction. Acceptance or rejection of the materials, equipment, supplies, etc. shall be made as promptly as practicable after delivery, but failure to inspect and accept or reject supplies shall not relieve the contractor from responsibility for such supplies as are not in accordance with the specifications.

19. CSA Seal or Provincial Certificate Approval

All electrical material and equipment, and all manufacturing and assembling procedures and workmanship, shall be in accordance with the requirements of the current edition and revisions of the Canadian Electrical Code Part 1 (CSA Standard C22.1 – 2012) as adopted and amended by the Province of British Columbia (hereinafter referred to as the "Electrical Code"), as amended from time to time.

Only approved materials and equipment shall be used and where specified materials and equipment do not have current approval, as required by the Electrical Code, the Contractor shall offer approved substitutes.

Each completed assembly shall carry the approval seal either of the Inspection Department, and where alterations are required by the Department the Contractor shall make these at his own expense. The Contractor shall pay all fees and costs incurred in obtaining the required approvals.

20. Rectification of Damage and Defects

The Contractor shall rectify any loss or damage for which, in the opinion of the REGIONAL DISTRICT, the Contractor is responsible, at no charge to the REGIONAL DISTRICT and to the satisfaction of the REGIONAL DISTRICT. In the alternative, the REGIONAL DISTRICT may repair the loss or damage and the Contractor shall pay to the REGIONAL DISTRICT the costs of repairing the loss or damage

forthwith upon demand from the REGIONAL DISTRICT. Where, in the opinion of the REGIONAL DISTRICT, it is not practical or desirable to repair the loss or damage, the REGIONAL DISTRICT may estimate the cost of the loss or damage and deduct such estimated amount from the amount owing to the Contractor hereunder.

21. Warranty and Guarantee

The work shall be warranted to be free of defects and shall be guaranteed by the Contractor for a period of one (1) year from the date of acceptance. On receipt of notice from the REGIONAL DISTRICT the Contractor shall promptly make all repairs arising out of defective work or any equipment or materials supplied by him.

The REGIONAL DISTRICT is hereby authorized to make such repairs if, ten (10) days after the giving of such notice to the Contract, the Contractor has failed to make or undertake with due diligence said repairs; provided, however, that in the case of an emergency, where, in the opinion of the REGIONAL DISTRICT delay would cause serious loss or damage, repairs may be made without notice being sent to the Contractor, and all expense in connection therewith shall be charged to the Contractor.

22. Statutes, Bylaws, Regulations and Permits

Unless otherwise noted, the Contractor shall take out all necessary permits and licenses required to permit the Contractor to perform its obligations under the Contract. The Contractor shall give all notices and comply with all REGIONAL DISTRICT regulations, all laws, by-laws, ordinances, rules, and regulations, whether federal, provincial, or municipal, relating to the business it carries on and the services provided pursuant to the Contract, including the Workers' Compensation Act and the Employment Standards Act.

23. Site Inspection

The Contractor shall make site inspections of all appropriate areas to determine their general condition and to ensure the fulfillment of the contract requirements.

24. Use of Premises

The Contractor shall abide by, and shall ensure its employees abide by, all appropriate regulations, including but not limited to regulations relating to fire, safety, parking, traffic control and health. The Contractor will ensure that all of its employees are aware of the applicable regulations.

25. Clean Up

The Contractor shall at all times conduct the work in an orderly and reasonably tidy manner and shall at suitable intervals remove any accumulation of rubbish or refuse materials. At no time shall any person employed by the Contractor or by any of his Subcontractors discard any litter or garbage on or adjacent to the site, except into a suitable container. Upon completion and before final acceptance of the work, the Contractor shall remove all rubbish, surplus, or discarded materials and equipment and shall leave the site in a clean and neat condition.

26. Change Orders

If for any reason it may become desirable during the course of the work to change the alignment, dimensions, or design, or to add to or to omit portions thereof, the REGIONAL DISTRICT reserves the right to issue change orders to give effect to such changes as may, in the opinion of the REGIONAL DISTRICT be necessary or desirable.

The change may or may not result in a change in the amount of the work. If the changes do, in the opinion of the REGIONAL DISTRICT, change the amount of the work, the contract price shall be adjusted as mutually agreed between the Contractor and the REGIONAL DISTRICT.

The adjustment for the Contract Price shall not exceed the actual cost of the Contractor's work for the change in the Work, plus an allowance for overhead and profit as follows:

.1 For Contractor, for overhead and profit, 10% of the actual cost of the Contractor's work;

.2 For Contractor, for overhead and profit, 10% of the amount for Subcontractor's work, being the actual cost of the Subcontractor's work plus the amount determined as set out in .3 below;

.3 For Subcontractor, for overhead and profit, 10% of the actual cost of the Subcontractor's work."

If a change in the Work results in a net decrease in the Contract Price, the amount of the credit shall be the net cost, without deduction for overhead and profit. When both additions and deletions covering related work or substitutions are involved in a change in the Work, the allowance for overhead and profit shall be calculated on the basis of the net increase, if any, with respect to that change in the Work."

27. Collection of Personal Information

Unless the Agreement otherwise specifies or the Regional District otherwise directs in writing, the Contractor may only collect or create Personal Information that is necessary for the performance of the Contractor's obligations, or the exercise of the Contractor's rights, under the Agreement.

Unless the Agreement otherwise specifies or the Regional District otherwise directs in writing, the Contractor must collect personal information directly from the individual the information is about.

Unless the Agreement otherwise specifies or the Regional District otherwise directs in writing, the Contractor must tell an individual from whom the Contractor collects personal information:

a) the purpose for collecting it;

b) the legal authority for collecting it; and

c) the title, business address and business telephone number of the person designated by the Regional District to answer questions about the Contractor's collection of personal information.

28. Competency and Qualifications

The Contractor will employ properly licensed, trained, and unimpaired workers throughout the duration of the contract.

29. Utility Location

It is the responsibility of the Contractor to locate any utilities in the vicinity of any construction, exploration, or investigation if required.

30. Builder's Lien

The Contractor shall, at its own expense, cause any and all builders liens and other liens for labour, services or materials alleged to have been furnished with respect to the lands comprising the work site or

the work which may be registered against or otherwise affect the lands or the work, except liens properly filed by the Contractor on its own behalf, to be paid, satisfied, released or vacated forthwith after the REGIONAL DISTRICT has sent written notice of any claim for any such lien. In the event of a bona fide dispute regarding the validity or correctness of any claim for such lien, the Contractor shall be entitled to defend against a claim for such lien in any proceedings brought in respect therefor after first paying into court the amount claimed plus any interest payable, or providing sufficient security therefor and such cost as the court may direct and registering all such documents as may be necessary to cancel such lien, or providing such other reasonable security in respect of such claims as the REGIONAL DISTRICT may in writing approve. Upon receiving satisfactory security for any costs and an indemnity in writing from the Contractor, the REGIONAL DISTRICT may authorize the Contractor to apply to the court in the name of the REGIONAL DISTRICT to have any lien removed upon payment into court or deposit in court of satisfactory security therefor.

31. Bonding

The successful Proponent must provide a Performance Bond and Labour and Material Payment Bond each of which shall equal fifty percent (50%) of the Total Contract Price, issued by a Surety licensed to transact the business of suretyship in the Province of British Columbia. The Performance Bond shall encompass the Warranty and Guarantee period and shall, in any event, be in effect for no less than two (2) years from the date of issuance of the Notice of Acceptance.

SIGNATURES

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

For the Regional District of Nanaimo:

_____
Signature

_____
Printed Name

For the Contractor:

_____
Signature

_____
Printed Name

SCHEDULE "A"

SCOPE OF WORK

“Contract Documents” consist of the following documents which copies are attached to this Agreement:

(1) This duly executed Agreement

(2) The duly executed Tender Form

(3) All Addenda

(4) Drawings

(5) Written Specifications

(6) The Tender Documents

(7) Other relevant documents.

SCHEDULE "B"

CONTRACT PRICE

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

(a) Up to the Price of $_____ and;

(b) Payments made on account of change orders, as may be required by the Contract Documents.

The Contract Price shall be the entire compensation owing to the Contractor by the REGIONAL DISTRICT for the Work and shall cover and include all supervision, labour, materials, Contractor's Plant and Equipment, overhead, profit, financing costs and all other costs and expenses whatsoever incurred in performing the Contract excluding GST.

The Contractor will be solely responsible for invoicing the REGIONAL DISTRICT ensuring to include the REGIONAL DISTRICT's Purchase Order number on all invoices to assure timely payment.
All invoices are subject to prior review and approval by the REGIONAL DISTRICT and approved invoices will be paid on a net 30 days' basis from date of receipt unless otherwise agreed to in writing.

If the REGIONAL DISTRICT does not approve of the services or part of them which are the subject of the invoice, the REGIONAL DISTRICT shall advise the Contractor in writing of the reasons for non-approval and the Contractor shall remedy at no additional cost to the REGIONAL DISTRICT before the REGIONAL DISTRICT shall be obliged to pay the invoice or any part of it, as the case may be.

REGIONAL DISTRICT OF NANAIMO

Appendix I
WWS-COM-10.1 Contractor-Supplier Package – EMS Requirements

WWS-COM-10.1 Contractor-Supplier Package

The purpose of this package is to convey the requirements of Regional District of Nanaimo Wastewater Services' (WWS) Environmental Management System (EMS) to contractors and suppliers. This package is applicable to all wastewater treatment facilities and pump stations.

As a contractor or supplier to WWS, you have a responsibility to comply with all provisions identified in the Contract Documents regarding Environmental Protection. Where Contract Documents do not exist, the service provider will comply with Sections Two, Three and Four.

Please retain a copy for your records.

PACKAGE CONTENTS:

I, _____ of _____
(please print name) (please print company name)

acknowledge that I have received a Contractor-Supplier Package (ISO 14001 Contractor Supplier Environmental Performance Requirements) containing the materials listed above.

_____ _____
(Date) (Supplier/Contractor Employee's Signature)

_____ _____
(Date) (WWS Project Manager's Signature)

1.0 GENERAL OVERVIEW: ISO 14001

1.1 Environmental Management System (EMS)

- An EMS is the part of an organization's management system, used to develop and implement its environmental policy and manage its environmental aspects.
- It includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources.

1.2 Environmental Policy and ISO Clause

- An Environmental Policy is a statement by the organization of its overall intentions and direction related to its environmental performance. It provides a framework for action and for the setting of environmental objectives and environmental targets.
- It is a driver for implementing and maintaining our EMS and reflects commitment to continual improvement, legal compliance and prevention of pollution
- The Environmental Policy is posted at each of the WWS wastewater treatment facilities and pump stations, and is available on the RDN website: www.rdn.bc.ca
- Uncontrolled copy of the Environmental Policy attached (Section 5.0 of this package)
- Uncontrolled copy of WWS' ISO Clause (Section 5.0 of this package)

1.3 Environmental Aspects and Impacts

- Environmental Aspect: element of an organization's activities, products or services that can interact with the environment.
- Environmental Impacts: any changes to the environment whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects.
- Environmental impacts include:
    - Air Pollution and Odour
    - Depletion of Natural Resources (Energy Use)
    - Landfill (Garbage)
    - Noise
    - General Repairs-Construction (Sensitive Areas)
    - Sewage Bypass (Leak/Spill)
    - Treatment Disposal (Hazardous Waste)

1.4 Environmental Objectives and Actions

- Environmental Objective: overall environmental goal consistent with the environmental policy, that an organization sets itself to achieve.
- Environmental Target: a detailed performance requirement that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.
- Objective and Targets are set to minimize environmental impacts.
- Any legal requirements that must be met by the organization (i.e. permit requirements) help create the objectives and targets.

2.0 OPERATING PROCEDURES

- All WWS wastewater treatment facilities have Operating Procedure Manuals.
- Procedures applicable to contractors and suppliers will be supplied by the WWS Project Manager at pre-construction meetings or prior to the work commencing.
- Contractors and Suppliers will be required to sign a Procedure Checklist acknowledging that they have received copies of applicable procedures at a pre-construction meeting or prior to commencing work on site.
- The WWS Project Manager will ensure that a site induction is completed prior to work commencing as per the ISO Clause attached. (Section 5.0 of this package)

3.0 EMERGENCY PREPAREDNESS AND RESPONSE PROCEDURES

- All WWS wastewater treatment facilities have Emergency Preparedness and Response Procedure Manuals.
- Procedures applicable to contractors and suppliers will be supplied by the WWS Project Manager at pre-construction meetings or prior to the work commencing.
- Contractors and Suppliers will be required to sign a Procedure Checklist acknowledging that they have received copies of applicable procedures at a pre-construction meeting or prior to commencing work on site.
- The WWS Project Manager will ensure that a site induction is completed prior to work commencing as per the ISO Clause (Section 5.0 of this package).

4.0 ENVIRONMENTAL SPECIFICATIONS

Contractors and suppliers must abide by the following environmental specifications while working on site, as applicable.

4.1 Air Emissions

- Contractors and Suppliers will ensure that excess vehicle idling is minimized.
- Contractors will ensure that their staff are trained in the proper use and handling of all materials and chemicals to ensure air emissions/odours are minimized.
- No open burning of waste materials is permitted.

4.2 Cleaning Equipment

- Do not clean equipment in streams/rivers or lakes.
- Clean construction equipment prior to entering roadways.
- Do not clean equipment in locations where debris can gain access to sewers, watercourses or aquifers.

4.3 Dust Control

- Transport dusty materials in covered haulage vehicles.
- Public roadways shall be kept clean and free of mud.

4.4 Energy Consumption

- Contractors and Suppliers will use energy efficient equipment when undertaking any work on a job site, where practical.
- Contractors and Suppliers staff will turn off lights and equipment when not in use and where practical when on a job site.

4.5 Hazardous Materials

- Hazardous materials brought on site and removed shall be managed in accordance with current MOE Regulations current at the time of work.
- Governing Ministry of Labour Regulations respecting protection of works, remedial handling and disposition of Designated Substances encountered shall be followed.
- Do not empty fuel, lubricants, herbicides, pesticides, fungicides, paint materials, solvents or other chemicals into sewers or watercourses (only legally acceptable disposal methods are acceptable).

4.6 Noise

- Use vehicles and equipment with efficient muffling devices.
- Provide and use devices that will minimize noise levels in construction areas.
- Minimize noise resulting from activities while on-site whenever practical.

4.7 Sensitive Areas

- Inform WWS staff in writing of the particular schedule for each river crossing, channelizing or other work in the designated sensitive areas.
- Avoid encroachment on unique natural areas and establish boundary protection and signage to avoid encroachment.
- Do not disturb habitats of rare or endangered species. Agree and implement mitigative measures with WWS staff.
- Protect wetland sites used as feeding or breeding areas by migratory fowls or as habitats for other animals and establish boundary protection and signage to avoid such encroachment.
- Schedule construction in sensitive areas so that there will be minimal interference with water uses including fish migration or spawning, or disruption of incubation periods for eggs.
- Keep removal of vegetation to a minimum.
- Contain and deposit on land all aquatic plants uprooted or cut prior to or during construction.

4.8 Spills

- If requested, the contractor will provide to the WWS Project Manager for approval an Environmental Plan which addresses spill prevention, and spill response and communication.
- The contractor will be provided with a WWS Spill Response procedure in the event an Environmental Plan is not requested by WWS. If the contractor is provided with a WWS Spill Response procedure, the contractor will be required to follow instructions assigned to 'operator' in the procedure.
- Spill containment must be provided for any equipment containing fuel.
- Be prepared at all times to intercept, clean up and dispose of any spillage that may occur whether on land or water.
- Keep all materials required for clean-up of spills readily accessible on-site (e.g. spill kit)
- The contractor must dispose of all spillage and contaminated material the contractor generates. Contaminated material may not be stored on site.
- Report spills to EMBC at 1-800-663-3456 as per the *BC Spill Reporting Regulation*, which applies for the purposes of the *BC Environmental Management Act*.
- Notify WWS staff immediately if there are any spills and provide the EMBC confirmation number, where one has been provided.
- Results of all spill investigations must be forwarded to the WWS Project Manager and Chief Operator of the facility at which the spill occurred.

- Reporting of releases is also a requirement of federal and other provincial legislation, including the Canadian Environmental Protection Act, and the Transportation of Dangerous Goods Act.

4.9 Sediment and Erosion Control

- The contractor, where ground work is required, will follow the project's sediment and erosion control plans.
- If no sediment and erosion control plan is in place the following procedures should be used:
  - Control all surface water and groundwater including rainfall and run-off. Ensure that erosion is controlled and that flooding of excavations or damage to structures does not occur.
  - Intercept surface drainage as far back from excavations as practical by means of ditches, berms or other interception methods as may be required for effective control.
  - Direct pumped water or run-off to settling ponds or sediment basins prior to discharge to adjacent storm sewers or watercourses as per provincial and federal regulations
  - The contractor is to discharge only to RDN approved discharge point(s).
  - Intercept and divert concentrated run-off from unstable areas under sheet flow conditions, as directed by the Engineer.
  - Do not direct any flow of water across or over pavements, except through approved pipes or properly constructed troughs.
  - Keep gutters and drainage ditches open at all times to provide adequate surface drainage.
  - Maintain all existing storm sewers clean and free of deleterious materials and blockages.
  - Provide splash pads where water is discharged to the watercourse.
  - Dispose of water so as not to be injurious to public health or safety, to property or to any part of work completed of under construction.
- The contractor must follow any other requirements identified in the contract document with WWS.

4.10 Waste Management – Solid Non-Hazardous Waste

- No open burning is permitted.
- All wastes generated by contractors will be cleaned-up and disposed of as per BC Ministry of Environment Regulations.
- Whenever possible Contractors and Suppliers should utilize recycling opportunities for the disposal of waste.

5.0 ATTACHMENTS

REGIONAL DISTRICT OF NANAIMO

RDN Wastewater Services Environmental Policy

The Regional District of Nanaimo's (RDN) Wastewater Services (WWS) Environmental Policy reflects the values and priorities of the RDN's Board Strategic Plan 2019 - 2022, Regional Growth Strategy and Liquid Waste Management Plan.

The RDN's WWS is committed to providing reliable, high quality, and cost-effective wastewater services to the people and communities we serve. We strive to optimize our treatment and re-use processes and employ proven pollution prevention strategies at our facilities to protect and enhance the natural environment for future generations. In fulfillment of this commitment, it is the WWS policy:

- To do our utmost to comply with the letter and spirit of relevant environmental laws and regulations. There shall be thorough and accurate measurement and reporting of our environmental compliance.
- To prevent pollution. This includes improving the quality of treated wastewater and avoiding or reducing environmental pollution produced directly from WWS operations, or indirectly by the consumption of power, fuel, chemicals, and other resources.
- To identify and monitor environmental impacts and set measurable objectives and targets to reduce those impacts on the environment.
- To foster openness and dialogue with employees, First Nations and the public, including community engagement and public outreach, and respond to their concerns about potential hazards and impacts of our operations.
- To continually improve our performance relevant to this environmental policy.

This policy will be communicated regularly to all WWS staff and will be made available to regulatory agencies, the public, or other interested parties upon request.

Randy Alexander

General Manager, Regional and Community Utilities
Date: 20 November 2019

Document #: PM-03.2
Revision #: 11

ISO CLAUSE

Whereas the Regional District of Nanaimo's Wastewater Services (WWS) is operating to the ISO 14001:2015 standard, it is a condition of this contract that the Contractor comply with the WWS' Environmental Management System (EMS).

As per PM-08.0 Element 7.2 Competence and Element 7.3 Awareness, paragraph 5.11 of the WWS' EMS Policy and Procedure Manual:

1. Any contracted personnel whose activities can create a significant impact (as defined by the WWS' EMS) on the environment are required to undergo training. Such training will require one session of approximately one half hour.

2. While the Regional District of Nanaimo (the RDN) will provide the initial training to a representative Contractor, it is the responsibility of the Contractor to train the Contractor's own personnel, as well as any personnel of the Contractor's Subcontractor who will be working on a site of WWS.

3. The Contractor hereby warrants that it will provide any ISO 14001 related training which the RDN deems necessary to the Contractor's own personnel and any personnel of the Contractor's Subcontractor and will forward records thereof to the RDN at no additional charge to the RDN.

REGIONAL DISTRICT OF NANAIMO

Appendix J
Prime Contractor Preconstruction Meeting Form

REGIONAL DISTRICT OF NANAIMO

Prime Contractor Preconstruction Meeting Form

Date		Meeting Location	
Contract #		WSBC Firm #	
Prime Contractor Company Name			
Prime Contractor's Superintendent			
Description of Designated Workplace			
Description of Work			
RDN Contract Representative			

Agreement

The Prime Contractor:

Check	
☐	Acknowledges appointment as Prime Contractor defined by WorkSafeBC OH&S Regulation Sections 20.2 and 20.3, and in the Workers' Compensation Act, Sections 118 Clauses 1 and 2.
☐	Understands the Owners duties as defined in the Workers' Compensation Act, Section 119.
☐	Understands for any discrepancy establishing health and safety protocol, WorkSafeBC OH&S Regulation and/or the Workers' Compensation Act (Part 3) shall prevail.
☐	Acknowledges being informed of any known workplace hazards by the owner or owner's delegate, by signing attached "Existing Known Hazard Assessment" form.
☐	Shall communicate known hazards to any persons who may be affected and ensure appropriate measures are taken to effectively control or eliminate the hazards.
☐	Shall ensure all workers are suitably trained and qualified to perform the duties for which they have been assigned.
☐	Shall ensure or coordinate first aid equipment and services as required by WorkSafeBC OH&S Regulation.
☐	Shall coordinate the occupational health and safety activities for the project.
☐	Assumes responsibility for the health and safety of all workers and for ensuring compliance by all workers with the Workers Compensation Act (Part 3) and WorkSafeBC OH&S Regulation.
☐	Understands any WorkSafeBC violation by the Prime Contractor may be considered a breach of contract resulting in possible termination or suspension of

	the contract and/or any other actions deemed appropriate at the discretion of the RDN.
☐	Understands any penalties, sanctions or additional costs levied against the Prime Contractor will be the responsibility of the Prime Contractor.
☐	Confirms the Prime Contractor's Safe Work procedures and risk assessments were prepared by, or approved by, a Qualified Person as defined by WorkSafeBC OH&S Regulation.
☐	Accepts the following required documents shall be maintained and made available upon request from the RDN and/or WorkSafeBC Prevention Officer at the workplace

Documents required to be maintained and available by the Prime Contractor will include, but not be limited to:

Check	
☐	All notices which the Prime Contractor is required to provide to WorkSafeBC as per WorkSafeBC OH&S Regulation.
☐	Any written summaries of remedial action taken to reduce occupational health and safety hazards within the area of responsibility.
☐	All directives and inspection reports issued by WorkSafeBC.
☐	Records of any incidents and accidents occurring within the Prime Contractor's area of responsibility.
☐	Completed accident investigations for any incidents and accidents occurring within the Prime Contractor's area of responsibility

On a **construction project** workplace, these additional documents are required to be maintained and available by the Prime Contractor:

• Records of all orientation and regular safety meetings held between contractors and their workers, including topics discussed, worker names and companies in attendance.
• Written evidence of regular inspections within the workplace.
• Occupational first aid records.
• Worker training records.
• Current list of the name of a qualified person designated to be responsible for each subcontractor (employer's) site health and safety activities.
• Diagram of the emergency route to the hospital.

The following information must be **provided** to the RDN Contract Representative:

Check	
☐	WorkSafeBC Notice of Project (if applicable)
☐	WorkSafeBC Clearance Letter
☐	Prime Contractor's OH&S Safety Program
☐	Prime Contractor's Site/Project Specific Hazard Identification and Risk Assessments, Safe Work Procedures, etc.

☐	First Aid Attendant(s)	
☐	Safety Supervisor(s)	
☐	Location of First Aid Station	

Signature of Prime Contractor	
Signature of RDN Contract Representative	

Pre-Existing and Known Hazard Identification

Discussion between the Prime Contractor and the RDN Contract Representative

Date		Meeting Location	
Prime Contractor Company Name			
Prime Contractor's Superintendent			
RDN Contract Representative			

- RDN Contract Representative to make the Prime Contractor aware of any known extraordinary pre-existing hazards specific to the contract.
- It is recognized the pre-existing and known hazards identified may not be a comprehensive list and due caution is always required.
- Use additional pages if necessary.

Identified Extraordinary Hazards	Action required to eliminate or control hazards and ensure worker safety

Prime Contractor Representative (signature)	RDN Contract Representative (signature)
Prime Contractor Representative (print name)	RDN Contract Representative (print name)