Public Works and Government Services Canada

Requisition No: _____

DRAWINGS & SPECIFICATIONS
for
Esquimalt Graving Dock, Esquimalt, BC
East End Dock Extension and
Section 3 Dock Floor and Wall Refurbishment

Project No. R.096320.002 Issued for Tender

APPROVED BY:

Digitally signed by: Burger, Mark
DN: CN = Burger, Mark C = CA O = GC OU = PWGSC-TPSGC
Date: 2021.02.25 13:16:14 -08'00'

Regional Manager, ___ Date

Chris Patterson
Digitally signed by Chris Patterson
Date: 2021.01.14 04:31:28 -08'00'

Construction Safety Coordinator Date

TENDER:

Tam, Philip
Digitally signed by: Tam, Philip
DN: CN = Tam, Philip C = CA O = GC OU = PWGSC-TPSGC
Date: 2021.02.26 11:46:36 -08'00'

Project Manager Date

Real Property Services Branch, Professional and Technical Services, Pacific Region
Room 219 - 800 Burrard Street, Vancouver, B.C., V6Z 0B9

Division 1 GENERAL REQUIREMENTS

01 11 55	General Instructions	22
01 31 19	Project Meetings	4
01 32 16.06	Construction Progress Schedule (Critical Path Method)	13
01 33 00	Submittal Procedures	17
01 35 13.43	Special Procedures for Contaminated Sites	11
01 35 33	Health and Safety Requirements	15
01 35 43	Environmental Procedures and Sustainability	12
01 45 00	Quality Control	4
01 50 00	Mobilization and Demobilization	2
01 51 01	Temporary Facilities	6
01 61 10	Product Requirements	4
01 74 11	Cleaning	2
01 74 21	Waste Management and Disposal	2
01 78 00	Closeout Submittals	6
01 91 13	Commissioning Requirements	5

Division 2 EXISTING CONDITIONS

02 41 13	Selective Site Demolition	5
02 41 13.14	Asphalt Paving Removal	2
02 41 16.01	Structure Demolition	6
02 55 10	Dust Control	2

02 61 00.01	Contaminated Sites Water Treatment	5

Division 3 CONCRETE

03 01 31	Dock Floor Concrete Topping	13
03 01 32	Dock Walls Concrete Repair	11
03 10 00	Concrete Forming and Accessories	3
03 15 13	Waterstops	5
03 20 00	Concrete Reinforcing	5
03 30 00	Cast-in-Place Concrete	16
03 37 13	Shotcrete	12
03 39 00	In-Situ Concrete Structures	7

Division 4 MASONRY

04 03 41	Stone Repair	12
04 05 12	Grout	4

Division 5 METALS

05 12 33	Structural Steel for Bridges	6
05 50 00	Metal Fabrications	7
05 56 00	Crane Rails	6

Division 9 FINISHES

09 97 19	Painting Exterior Metal Surfaces	5

Division 20 MECHANICAL

20 05 05	Mechanical Work General Instructions	12
20 05 10	Basic Mechanical Materials and Methods	13

20 05 15	Seismic Control and Restraint	6
20 05 40	Demolition and Revision Work	1
20 05 55	Testing, Adjusting and Balancing	4

Division 21 FIRE PROTECTION

21 11 16	Fire Hydrants	3

Division 22 PLUMBING

22 11 16	Domestic Water Piping and Valves	6
22 13 16	Drainage Waste and Vent Piping and Valves	3
22 13 29	Drainage Pumps and Accessories	5
22 20 00	Site Services	6
22 42 00	Plumbing Fixtures and Fittings	1

Division 26 ELECTRICAL

26 05 00	Common Work Results – Electrical	8
26 05 20	Wire and Box Connectors (0-1000 V)	2
26 05 21	Wires and Cables (0-1000 V)	5
26 05 27	Grounding	3
26 05 29	Hangers and Supports for Electrical Systems	2
26 05 31	Splitters, Junction, Pull boxes and Cabinets	2
26 05 32	Outlet Boxes, Conduit Boxes and Fittings	2
26 05 34	Conduits, Conduit Fastenings and Fittings	5
26 05 43.01	Installation of Cables in Trenches and in Ducts	3

26 28 21	Moulded Case Circuit Breakers	2
26 28 23	Disconnect Switches Fused and Non-Fused	1
26 29 23.01	Digital Metering	3

Division 27 COMMUNICATIONS

27 05 13	Communications Services	1
27 05 14	Communication Cables	5
27 05 15	Fibre Optic System	4
27 05 28	Pathways for Communications Systems	1

Division 28 ELECTRONIC SAFETY AND SECURITY

28 31 00	Fire Detection and Alarm	6

Division 31 EARTHWORK

31 23 16.26	Rock Excavation	8
31 23 33.01	Excavation, Trenching and Backfilling	10
31 24 15	General Fill	5
31 68 00	Rock Anchors	11

Division 32 EXTERIOR IMPROVEMENTS

32 11 16.01	Granular Sub-Base	5
32 11 23	Aggregate Base Courses	5
32 12 13.16	Asphalt Tack Coat	3
32 12 13.23	Asphalt Prime Coat	3
32 12 16	Asphalt Paving	17

Division 33 UTILITIES

33 05 13	Manholes and Catch Basins	5
33 11 16	Water Utility Distribution Piping	12
33 34 00	Sanitary Sewer Force Main	5
33 41 00	Storm Utility Drainage Piping	8
33 65 73	Concrete Duct Banks and Vaults	6
33 71 73.02	Underground Electrical Services	3

Division 35 WATERWAY AND MARINE CONSTRUCTION

35 59 29	Mooring Devices	6

APPENDIX A - PRELIMINARY HAZARD ASSESSMENT FORM 3

APPENDIX B - EGD STANDARDS FOR SURVEY 8

APPENDIX C – DATA REPORTS 655

Esquimalt Graving Dock –East End Dock Extension Environmental Management Plan, SLR, July 24, 2020 – (163 pages)

EGD East End Extension Geotechnical Summary Report, WSP Canada Inc, August 31, 2020 – (95 pages)

EGD East End GPR and Air Track Investigation, Klohn Crippen Berger, Sept 5th 2008 – (13 pages)

EGD East Slope Stability Investigation, Klohn Crippen Berger, Sept 17th 2008 – (13 pages)

EGD East End Extension Geotechnical Data Report, Klohn Crippen Berger, Feb 25th 2010 – (55 pages)

EGD East End Extension Project, Environmental Assessment Screening Report, Golder Associates, Jun 10th 2010 – (110 pages)

Soil Excavation Quality for the East End Dock Extension Construction Project at the Esquimalt Graving Dock, SLR, July 3rd, 2020 – (188 pages)

Assessment of Graving Dock Slab, Levelton Consultants Limited, February 7th, 2013 – (18 pages)

APPENDIX D – EGD ENVIRONMENTAL BEST MANAGEMENT PRACTICES 51

APPENDIX E – EGD DOCKING SCHEDULE 9

APPENDIX F – REFERENCE DRAWINGS 81

EGD General Plans, ca 1925 (53 Sheets)

EGD East End Retaining Wall, Mar 8th 2012 (26 Sheets)

EGD Retaining Wall Steel Stairs, Feb 20th 2012, (4 Sheets)

APPENDIX G – COVID-19: PSPC STANDARD PROTOCOLS FOR REAL PROPERTY CONSTRUCTION PROJECTS 30

DRAWINGS (bound separately)

S000	COVER SHEET AND DRAWING LIST
S001	GENERAL NOTES
S100	EXISTING SITE PLAN - SHEET 1
S101	EXISTING SITE PLAN - SHEET 2
S103	GENERAL ARRANGEMENT - SHEET 1
S104	GENERAL ARRANGEMENT - SHEET 2
S105	CONTRACTORS WORK AREA
S108	DEMOLITION PLANS
S109	DEMOLITION - PHOTOS
S120	EXCAVATION – POTENTIAL SEQUENCE PHASE 1 PLANS
S121	EXCAVATION – POTENTIAL SEQUENCE PHASE 2 PLANS
S122	EXCAVATION – PLAN AND SECTIONS
S123	EXCAVATION – CONDITIONS AT EXISTING WALLS
S201	ROCK ANCHORS - SHEET 1
S202	ROCK ANCHORS - SHEET 2
S203	CONCRETE OUTLINE - SHEET 1
S204	CONCRETE OUTLINE - SHEET 2
S205	CONCRETE OUTLINE - SHEET 3
S206	CONCRETE REINFORCEMENT - SHEET 1
S207	CONCRETE REINFORCEMENT - SHEET 2
S208	CONCRETE REINFORCEMENT - SHEET 3
S209	CONCRETE REINFORCEMENT - SHEET 4
S210	CONCRETE REINFORCEMENT - SHEET 5
S211	WALL ELEVATIONS
S250	NORTH ACCESS CHAMBER – CONCRETE OUTLINE
S251	SOUTH ACCESS CHAMBER – CONCRETE OUTLINE
S252	NORTH AND SOUTH ACCESS CHAMBERS – REINFORCEMENT DETAILS
S253	ACCESS CHAMBER DETAILS
S260	CONSTRUCTION RETAINING WALL
S300	HANDRAIL LOCATION PLAN
S301	HANDRAIL DETAILS
S302	ACCESS CHAMBER SHIP LADDER

S303	ACCESS CHAMBER – LADDER OPENING COVER, HATCH COVER AND HATCH GRATE
S304	CRANE RAIL AND BEAM
S400	REMOVEABLE BRIDGE – SHEET 1
S401	REMOVEABLE BRIDGE – SHEET 2
S500	CONCRETE REFURBISHMENT - GENERAL ARRANGEMENT SHEET 1
S510	CONCRETE REFURBISHMENT - DEMOLITION PLAN
S520	FLOOR REPAIR PLAN - SHEET 1
S521	FLOOR REPAIR PLAN - SHEET 2
S522	FLOOR REPAIR PLAN - SHEET 3
S530	NORTH WALL REPAIR
S540	SOUTH WALL REPAIR
S550	STAIRWELL REPAIR
S560	FLOOR REPAIR GRADING PLAN - SHEET 1
S561	FLOOR REPAIR GRADING PLAN - SHEET 2
S562	FLOOR REPAIR GRADING PLAN - SHEET 3
S570	FLOOR AND SERVICE SILL REPAIR DETAILS - SHEET 1
S571	FLOOR AND SERVICE SILL REPAIR DETAILS - SHEET 2
S580	WALL AND STAIR REPAIR DETAILS - SHEET 1
S581	WALL AND STAIR REPAIR DETAILS - SHEET 2
S582	WALL AND STAIR REPAIR DETAILS - SHEET 3
S590	STEEL DETAILS
C001	EXISTING SERVICES
C002	TEMPORARY SERVICES
C003	NEW SERVICES
C004	SITE GRADING
E100	LEGEND, AND EXISTING SITE PLAN NEAR DOCK END
E200	EXISTING SITE PLAN POWER AND DATA END TO END CONNECTIONS ROUTING
E300	REVISED SITE PLAN EAST END DUCT BANK RECONNECTIONS
E301	DUCT BANK SECTIONS DETAILS
E302	DUCT BANK TUNNEL CONNECTION DETAILS AND DOCKSIDE MANHOLE DETAILS
E303	EXPLODED MANHOLE DETAILS

E400	REVISED SITE PLAN POWER AND DATA END TO END CONNECTIONS ROUTING
E401	EXISTING COMMUNICATIONS NEW CONNECTIONS RISER DIAGRAM
M100	COVERSHEET – SANITARY, WATER AND COMPRESSED AIR RENOVATIONS
M200	EXISTING SITE PLAN – SANITARY WATER, AND COMPRESSED AIR
M201	NEW SITE PLAN – SANITARY, WATER AND COMPRESSED AIR, RENOVATIONS
M202	GRAVING DOCK – WATER LINE REPLACEMENT
M300	MECHANICAL LARGE SCALE PLANS AND SECTIONS
M301	MECHANICAL DETAILS

CONSULTANTS – SEAL & SIGNATURE

Prime Consultant **Discipline: STRUCTURAL/MARINE**  	**Discipline: ELECTRICAL** 
Discipline: MECHANICAL  	**Discipline:**

Part 1 General

1.1 DESCRIPTION OF WORK

.1 Work under this Contract covers construction of a 36 m eastward extension to the Esquimalt Graving Dock (EGD) and associated civil, structural, electrical and mechanical works. Work under this Contract also covers the refurbishment of the walls and floor in Section 3 of the existing Graving Dock.

.2 The EGD facility is actively used for ship repair and maintenance. Numerous vessels of varying sizes will call at the EGD facility throughout this Contract. EGD Operations maintains a vessel booking list that will be made available to Contractor following Notice of Award. The vessel booking list is an active working document, and is subject to change on a daily basis. Contractor shall closely coordinate with the Departmental Representative to understand the EGD facility usage and frequency of vessel calls, and to coordinate its work with EGD operations.

.3 Contractor shall provide all supervision, labour, materials, supplies, tools, equipment, hoisting, transportation, receiving, handling, storage, quality control, environmental protection, and all other services necessary for the proper execution of the work.

.4 Work to be performed under this Contract includes, but is not limited to, the following summary of principal items covered further in the Contract documents. This list of principal items is presented for Contractor convenience only, and does not represent the full list of work required, nor the required sequence of work:

.1 Assume responsibility as Prime Contractor on the Contractor's Work Site.

.2 Environmental protection responsibilities provided in Sections 01 35 43 (Environmental Procedures and Sustainability), 01 35 13.43 (Special Procedures for Contaminated Sites), and other Sections of the Specification. Environmental protection responsibilities also include compliance with all EGD Environmental Best Management Practices (EBMPs), EGD Environmental Policy, the Environmental Management Plan (EMP) and other environmental protection requirements to comply with Project Permit conditions.

.3 Complying with all submissions and documentation requirements.

.4 Coordination with Departmental Representative (and designated alternates) in performance of all work.

.5 Demolition of the existing dry dock east end concrete wall and other miscellaneous concrete structures.

.6 Selective site demolition, salvage, disposal, storage and reinstatement of miscellaneous items related to the dock extension work.

.7 Demolition, salvage and disposal of existing electrical and mechanical services in the east end service tunnel, including ductile iron fire water main, HDPE sanitary sewer line, mechanically coupled steel compressed air line, storm water and sewer line, various cables, grounding, lighting, communication and fire alarm systems.

.8 Supply, preparation, installation, testing, and subsequent removal of temporary mechanical and electrical services connections for the period of construction.

.9 Blasting and excavation of rock, and excavation of overburden materials.

.10 Construction of temporary shoring for excavations.

.11 Construction of a cast-in-place concrete dry dock extension and service tunnel modifications, complete with reinforcement and rock anchors.

.12 Construction of cast-in-place crane beams, complete with crane rails.

.13 Construction of service tunnel drainage pump system.

.14 Construction of access chambers from the existing service tunnel to the dock apron at the North and South sides of the dock.

.15 Supply, preparation, installation and testing of a sanitary lift station in the access chamber at the end of the existing service tunnel North side of the dock.

.16 Construction of a removable bridge at the east end of the dock extension.

.17 Dock Wall Refurbishment work: concrete removal and repairs to Section 3 North and South Dock Walls including alter repairs, pipe recess repairs, granite repointing, granite alter block repairs.

.18 Dock Floor Refurbishment work: removal and replacement of a layer of the existing Section 3 dock floor concrete, repair of the existing granite floor blocks, installation of new trench drains, grit channels, grate covers.

.19 Selective site demolition, salvage, disposal, storage and reinstatement of miscellaneous items related to the dock wall and dock floor refurbishment work.

.20 Backfilling, asphalt paving and road markings.

.21 Construction of fire water mains, hydrants, valves, and valve boxes around the extended dock section.

.22 Construction of sanitary sewer line around the extended dock section.

.23 Construction of compressed air line around the extended dock section.

.24 Construction of electrical vaults and duct banks around the extended dock section.

.25 Supply preparation, installation and testing of permanent electrical services and associated equipment.

.26 Supply, installation and testing of communications cables.

.27 Supply, installation and testing of fire alarm system cables and equipment.

.5 Contractor becomes the owner of, and is responsible for disposing off-site, any demolished concrete including reinforcing steel or embedded timber. Excavated material, soil or sediment will be transported and disposed off-site. Contractor shall assume responsibility and include all costs for excavation, testing (as necessary), transport and disposal of all excavated and demolished materials as part of the project.

.6 Contractor shall comply with "Sustainable" requirements provided in Section 01 35 43 (Environmental Procedures and Sustainability). The list of principal sustainable requirement items presented here is for Contractor convenience only, as these items must be included as a section of the Contractor's Environmental Protection Plan (EPP), and is not intended to provide detailed requirements:

.1 Management of energy and air emissions.

.2 Water management approach.

.3 Waste management plan including material consumption, waste generation, waste reduction, and disposal procedures. This shall consider both Contractor and project-generated waste.

.4 Consideration of ecological impacts (including on-site traffic pattern and speed control management).

.5 Post-construction documentation.

.7 The work will require a planned, careful, and flexible approach by an experienced Contractor to ensure that structures are constructed carefully, contaminated soil is handled, stored, transported and disposed of in accordance with Contractor's Environmental Protection Plan, the EMP, and applicable regulations and requirements, existing structures to remain are not disturbed, and that water management is performed according to the methods described in the Contract Documents in order to maintain environmental quality throughout completion of the work.

.8 The Work to be performed by Contractor shall include all of the requirements specified in the Contract Documents unless otherwise expressly stated to be performed by PWGSC, Departmental Representative, or other named entities. To fully comprehend the work, the Specification and Appendices shall be read in conjunction with the Drawings, the Unit Price Table included in the Tender documents, site information (including Reference Drawings, documents, surveys, and other data), and other Contract documents.

1.2 CODES

.1 Perform work to current Codes, Construction Standards, Standards and Bylaws.

1.3 RELATED SECTIONS

.1 All Sections of the Specification shall be read together. The Sections listed below are specifically referenced from this Section.

.2 Section 01 32 16.06 (Construction Progress Schedule - Critical Path Method)

.3 Section 01 33 00 (Submittal Procedures)

.4 Section 01 35 13.43 (Special Procedures for Contaminated Sites)

.5 Section 01 35 43 (Environmental Procedures and Sustainability)

.6 Section 01 78 00 (Closeout Submittals)

.7 Section 02 41 16.01 (Structure Demolition)

1.4 CONTRACT DOCUMENTS

.1 The Contract documents, Drawings, and Specifications are intended to complement each other, and to provide for and include all elements necessary for the completion of the work.

.2 Drawings are, in general, diagrammatic and are intended to indicate the scope and general arrangement of the work.

1.5 DEFINITIONS

.1 Chart Datum: Permanently established plane from which soundings or tide heights are typically referenced for marine construction works, as shown on the Drawings.

.2 Construction Quality Control Plan: The Construction Quality Control Plan describes Contractor's means and methods by which construction activities will be monitored for technical compliance with the Contract.

.3 Coordinates:

.1 U.T.M.: Universal Transverse Mercator projection.

.2 U.T.M. Coordinates: Plane rectangular coordinates used in grid system in which grid network is applied to U.T.M. projection. Horizontal control information as indicated.

.4 Daily Construction Report: The Daily Construction Report will be submitted by Contractor to Departmental Representative on a daily basis and will document all activities associated with the work that are completed each day. Specific submittal requirements for the Daily Construction Report are described in the individual Sections of the Specification.

.5 Deleterious Substance: A Deleterious Substance is as defined by the Federal Fisheries Act. Generally, a deleterious substance can be any substance that if added to any water would degrade or alter the water quality such that it could directly or indirectly harm fish, fish habitat, or use of fish by humans.

.6 Demolition Debris: Demolition Debris shall be defined as incidental material arising as a result of selective site demolition or structure demolition activities, as described in Section 02 41 16.01 (Structure Demolition). All costs associated with

removal and disposal of Demolition Debris shall be included within the unit rate for Structure Demolition.

.7 Directed Move: A Directed Move is when an emergency vessel access, or unforeseen or planned vessel access need occurs and Departmental Representative advises Contractor to stop work and move Contractor's equipment to another location to provide vessel access. Directed Moves are solely at the discretion of Departmental Representative and do not include regular Contractor operational moves, planned moves, or when Contractor is given notice at least eight (8) hours in advance of the need to provide vessel access.

.8 Disposal Facility: An existing facility located in Canada where waste is placed in or on land and that is designed, constructed, and operated to prevent any pollution from being caused by the facility outside the area of the facility. The facility must hold a valid and subsisting permit, certificate, approval, or any other form of authorization issued by a province or territory for the disposal of soil or other material that is not suitable for industrial, commercial, urban park, residential, agricultural, wildlands, or any other land use specified in the BC Contaminated Sites Regulation. The facility must comply with federal, provincial, municipal, local, or other legislation, regulations, codes, by-laws, zoning, or other requirements.

.9 Drawings: Where the term is capitalized, Drawings are defined as the Contract Drawings for the work. Elsewhere, the term refers to other drawings (e.g. shop drawings).

.10 Contractors Work Site: The Contractors Work Site is defined as the boundaries within which work will be completed under this Contract and as the boundaries by which the Contractor shall assume responsibilities as Prime Contractor. The Contractor's on-site equipment, materials and facilities shall be located within the Contractor's Work Site as shown on the drawings and described herein.

.11 EGD Facility: The EGD Facility is defined as the legal boundaries of lands and waterlot owned and administered by PWGSC inclusive of the Contractor's Work Area.

.12 Environmental Management Plan (EMP): The EMP identifies components of the work that could present a hazard to the environment and, therefore, require environmental management and monitoring. The overall objective of the EMP is to provide a framework through which potential environmental risks will be managed during implementation of the construction activities. The EMP provides guidance and generally accepted best management practices (BMPs) and mitigation measures, to assist the Contractor in preparation of the EPP. The Contractor shall adhere to the EMP and Departmental Representative-accepted EPP. In the event of a discrepancy between the EMP and provisions of federal, provincial, municipal legislation, regulations or by-laws, the more stringent provisions resulting in the higher protection of the environment and lower discharge of contaminants will prevail. Although provincial laws and municipal

by-laws generally do not apply on federal lands, the Contractor will respect provincial laws and municipal bylaws and rules at the Contractor's Work Site.

.13 Environmental Pollution and Damage: Environmental Pollution and Damage includes the presence of chemical, physical, or biological elements or agents that substantially alter or impair human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade environment aesthetically, culturally, and/or historically.

.14 Environmental Protection: Prevention and control of pollution and habitat or environment disruption during construction. Control of environmental pollution and damage requires consideration of land, water, air, and biological and cultural resources; it also includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; and radiant energy, as well as other pollutants.

.15 Environmental Protection Plan (EPP): The EPP identifies Contractor's means and methods for complying with the environmental protection requirements of the Specification, the requirements outlined in the Environmental Management Plan (EMP), the standards and other requirements of the EGD EBMP, and any other environmental requirements under federal, provincial, municipal, local, or other legislation, regulations, codes, or by-laws. The EPP also identifies the procedures by which Contractor will establish and maintain quality control for environmental protection of all items of the work. Although provincial laws and municipal by-laws generally do not apply on federal lands, the Contractor will respect provincial laws and municipal bylaws and rules at the Contractor's Work Site. This plan shall address all construction activities.

.16 Hazardous Waste Quality : All sediment, soil, and groundwater demonstrated to meet the definition of Hazardous Waste in the Hazardous Waste Regulations.

.17 Hazardous Waste Management Facility: An existing facility located in Canada where Hazardous Waste is placed in or on land and that is designed, constructed, and operated to prevent any pollution from being caused by the facility outside the area of the facility. The facility must hold a valid and subsisting permit, certificate, approval, or any other form of authorization issued by a province or territory for the disposal of Hazardous Waste Quality Sediment that is not suitable for industrial, commercial, urban park, residential, agricultural, wild-lands, or any other land use specified in the BC CSR.

.18 Health and Safety Plan: the site-specific and Contract-specific Health and Safety plan, prepared by the Contractor, as fully described in Section 01 35 33 Health and Safety Requirements.

.19 Horizontal Datum: Universal Transverse Mercator (UTM) North American Datum (NAD) 83, in metres (m).

.20 IL+: IL+ refers to soil classification for material containing concentrations greater than the British Columbia Contaminated Sites Regulation Industrial Land Use

standards but does not meet the criteria for Hazardous Waste in the Hazardous Waste Regulations.

.21 Materials Source Separation Program (MSSP): Consists of a series of ongoing activities to separate re- usable and recyclable waste material into material categories from other types of waste at the point of generation.

.22 Mooring Device: Each mooring device shall comprise a cast steel twin horn/post mooring bollard/cleat, anchor bolts, nuts, washers and anchor plate, all as shown on the Drawings. Reinforcing bars required for anchorage are not considered part of the mooring device.

.23 Lay-Down Area: The Lay-Down Area is located in and around Section 3 and to the East of the dry dock, as shown on the Drawings, and may be used for on-site offices and staging of equipment, but shall not be used for stockpiling of soil materials and debris.

.24 Pre-Construction Meeting: The Pre-Construction Meeting is defined as the coordination meeting between Departmental Representative and Contractor, prior to the start of work. Departmental Representative will schedule the Pre-Construction Meeting following award of Contract.

.25 Pre-Construction Survey : The Pre-Construction Survey will be completed by Contractor to document the conditions of all existing infrastructure within the work area, complete with photographic record of any existing damage. Any damage not documented and photographed will be considered the Contractors responsibility to repair.

.26 Progress Meeting: Progress Meeting is defined as a meeting between Departmental Representative and Contractor that will occur on a weekly basis throughout the duration of the work, except where alternate timing arrangements are made by mutual agreement. The Contractor is responsible for scheduling Progress Meetings with Departmental Representative. Superintendent shall attend weekly meetings.

.27 Progress Surveys: Progress Surveys will be completed by Contractor on a daily basis to document progress of construction activities completed as part of the Contract. Progress Surveys will be used for progress payment to Contractor

.28 Project Permits: Project Permits are the permits, licenses, certificates, authorizations, or any other form of approval required by, or provided by municipal, provincial, federal, regulatory, permitting, or other agencies and authorities or commercial facilities, that provide the permissions to complete the work as described in the Contract Documents and to address Contractor’s means and methods in carrying out that work. Copies of key Project Permits that have been obtained by Canada are provided in the appendices to the Specification. All other Project Permits are the sole responsibility of Contractor, and must be obtained by Contractor prior to the start of the work to which the Permit applies,

unless otherwise allowed by the permitting authority and accepted by Departmental Representative.

.29 Record Drawings: Record Drawings are defined as completion records that document conditions by which construction activities are completed at the Contractor's Work Site. Record Drawings will serve as the final record of conditions at completion of the work.

.30 Stand-by Time:

.1 Stand-by Time is defined as the time during which Contractor is unable to perform work identified on Contractor's progress schedule due to unanticipated conditions associated with operational needs or activities of the EGD facility, and that has been approved as such by Departmental Representative.

.2 Contractor shall be compensated for approved Stand-by Time, under the Tender Item identified as STAND-BY TIME in the Unit Price Table. Stand-by Time will not be approved or paid for under the following conditions:

.1 If adverse weather conditions, equipment breakdown or damage, or other unforeseen causes of delay (except for operational needs or activities of the EGD facility) are encountered during the work.

.2 If Contractor's approved progress schedule does not show work to be performed during the period affected by the change in vessel arrival or departure times.

.3 If Contractor does not have the claimed crews and equipment on site ready to work, unless Contractor has received prior approval from Departmental Representative to send the crews home early or bring them in late due to the schedule impact.

.4 If Contractor is given a minimum of eight (8) hours advanced notice of a change in vessel arrival or departure time that may affect Contractor's work schedule.

.5 If Contractor does not immediately notify Departmental Representative in writing of an unanticipated operational event that is preventing scheduled work from being completed, and the number of hours of delay.

.6 If Contractor could continue working at another area of the Contractor's Work Site that is not affected by the unanticipated condition. In this case, payment for a Directed Move may apply.

.7 If Contractor cannot adjust its work activities with eight (8) hours advance notice to accommodate the vessel arrival or departure, Contractor shall substantiate this in writing to the satisfaction of Departmental Representative. Contractor's justification for Stand-

by Time must be approved by Departmental Representative in order to be considered as payable Stand-by Time.

.8 If the request for compensation for Stand-by Time has not received the pre-approval of Departmental Representative.

.3 Notification: Notify Departmental Representative in writing immediately in advance of all conditions for which Contractor may request payment for Stand-by Time. Immediately following the impact event, Contractor shall provide Departmental Representative with the number of hours of delay. If the time is approved by Departmental Representative, then Departmental Representative will notify Contractor of approval for payment under Stand-by Time. Departmental Representative has sole discretion as to whether a Stand-by Time event is approved or not, to the extent allowed by the Specification.

.31 Tailgate Meeting: Tailgate Meeting is defined as a meeting between the Contractor and the Contractor's crew (including subcontractors) that will occur on a daily basis throughout the duration of the work, and will focus on daily Health and Safety considerations associated with planned construction activities. The Contractor is responsible for scheduling daily Tailgate Meetings.

.32 Tender Item: Tender Item is defined as a measure of work presented on the Unit Price Table by which the Contractor shall provide cost to complete the work as part of the tender process.

.33 Vertical Datum: Vertical datum for this work shall be Chart Datum, as shown on the Drawings.

.34 Waste Audit (WA): Relates to projected waste generation, and involves controlled separation of waste.

.35 Waste Reduction Work Plan (WRWP): A written report that addresses opportunities for reduction, re-use, or recycling of materials.

.36 Wastewater Treatment and Disposal Facility: A facility designed, constructed, and operated for the primary purpose of treating and disposing of wastewater, including groundwater, precipitation, and infiltration into excavations. The facility must be permitted under provincial law for the operation of the facility, treatment, and disposal of the treated wastewater.

.37 Weekly Construction Report: The Weekly Construction Report is to be submitted by Contractor to Departmental Representative each week and shall provide a summary of the week's construction activities that were completed under the Contract. Specific submittal requirements for the Weekly Construction Report are described in the individual Sections of the Specification.

.38 Working Day Durations (working days) : Working Day Durations refer to Monday through Friday, not including statutory holidays. The project working days are defined for submittal timeline purposes and do not preclude Contractor

from performing work on other days provided the schedule meets the requirements of the Specification.

.39 Treatment Facility: An existing off-site facility located in Canada that is designated, constructed, and operated for the handling or processing of waste in such a manner as to change the physical, chemical, or biological character of composition of the waste. The facility must hold a valid and subsisting permit, license, certificate, approval, or other form of authorization issued by a province or territory for the treatment of soil or other material that is not suitable for industrial, commercial, urban park, residential, agricultural, wildlands, or any other land use specified in the British Columbia Contaminated Sites Regulation. The facility must comply with Laws and Regulations.

.40 Laws and Regulations: All laws, regulations, by-laws, orders, codes, rules, standards, guidelines, or other lawful requirements of any federal, provincial, municipal, local, or other government authority.

1.6 ADDITIONAL DEFINITIONS

.1 Some Sections of the Specification contain additional definitions (of capitalized terms) that are directly related to the scope of that Section. An example is the list of additional definitions contained in Section 01 32 16.06 (Construction Progress Schedule – Critical Path Method).

1.7 PUBLIC NOTIFICATION

.1 Prepare a public notification plan as part of the Construction Work Plan that provides all construction details pertinent to the public (or First Nations) interest and the methods to be used to provide this information to the public. Initial public notifications shall be executed by the Contractor prior to the start of work on site, and shall continue on a regular basis as necessary throughout the Project. Separate notifications shall be issued for different locations and activities, to properly target the information, and to provide adequate advance notice prior to the start of each activity in each location.

.2 Public notification is required for all work under the Contract pertinent to the public (or First Nations) interest, including: Contractor's Work Site work hours; Contractor's Work Site noise and dust control measures; off-site staging and stockpile area; off-site material source locations/facilities; in-water transportation timing, methods and routing; upland transportation timing, methods and routing; treatment; disposal; and notifications required by regulations/permits.

.3 Submit proposed notifications and communication materials to Departmental Representative for approval prior to issuance or use. Communications materials shall include a list of typical questions and answers that may be used in responding to the public and media.

.4 Have suitable trained staff available to respond to public communications / inquiries or media inquiries related to Contractor’s operations.

.5 Notify Departmental Representative of any public / media inquiries or communications received, and provide documentation of every such communication, including Contractor's response.

.6 Any communications / inquiries received related to the project, any specifics of the project, or to EGD operations, shall be promptly forwarded to the Departmental Representative for response.

.7 Maintain a log of all public/media communications sent and received by Contractor, and the updated log shall be submitted to the Departmental Representative on a monthly basis.

.8 Acceptable notification methods may include: attendance and presentations at Municipal / Local council meetings; newspaper advertisements; door to door distribution of notices; and Project specific public / town hall meetings or open houses organized by Contractor, including poster presentations.

1.8 OTHER CONTRACTS

.1 Other contractors operate at the EGD facility.

.2 General contractors may include:

.1 Victoria Ship Yards Co. Ltd. (Seaspan Marine Corporation);

.2 Ralmax Group

.3 Other ship repair / maintenance contractors; and,

.3 Further Contracts may be awarded while this contract is in progress.

.4 Coordinate with other contractors in carrying out their respective works and comply with instructions from Departmental Representative.

1.9 ESQUIMALT GRAVING DOCK OPERATIONS

.1 The Esquimalt Graving Dock shall remain fully operational for the duration of the Contract..

.1 An example representation of vessel calls at the EGD facility can be found at: https://cse-egd.tpsgc-pwgsc.gc.ca/reserve-book-eng.cfm.

.2 An example of vessel calls at the EGD facility is also provided in the appendices to the Specification.

.3 Information found on the website and in the Specification appendices will vary from actual booking list conditions at the time of the work in this Contract, and is intended only to provide a general representation of vessel calls at the EGD facility.

.4 Contractor shall not use these reference sources as the basis for Tender. A booking list of planned vessels that will call at the EGD facility will be provided to Contractor following award of Contract. Changes to the

booking list will occur and shall not be considered as a basis for any claim under the Contract.

.2 Ship repair contracts, tenant operations and EGD operations and other on-going contracts shall take priority over Contractor's Work. Contractor shall conduct its operations in a manner that will minimize interference with commercial vessel activities.

.3 Contractor shall coordinate construction planning and sequencing of work with Departmental Representative. The Construction Work Plan shall provide a schedule and sequence for all construction activities associated with this work, based on the access requirements to maintain facility operations. Access requirements are described in the Specification.

.4 Contractor's work requires modifications to critical utilities that impact the EGD site. Temporary water, sanitary, air and electrical services must be installed and commissioned prior to demolition of existing services.

.5 Contractor shall provide updates in its Weekly Construction Reports regarding planned locations for marine construction activities, and marine transportation activities within the subsequent reporting period.

.6 Any damage to Contractor's equipment due to Contractor's failure to move when required shall be at Contractor's sole risk and expense.

.7 Contractor shall complete all construction activities in a manner to minimize disruption to EGD operations.

.8 Contractor shall accommodate planned / scheduled vessels that will be entering or exiting the EGD facility, with a minimum of four (4) hours' notice.

.9 Contractor shall be compensated for Directed Moves when advised to move construction equipment by Departmental Representative to accommodate facility emergency or operational needs. Directed Moves only apply when Departmental Representative gives less than eight (8) hours advanced notice.

.10 Departmental Representative shall notify Contractor when a Directed Move is required to accommodate EGD facility emergency or routine vessel call operations. Payment for Directed Move(s) will be made as indicated on the Unit Price Table.

1.10 DIVISION OF SPECIFICATIONS

.1 The Specification is subdivided into Divisions (e.g. Division 01, 02, 03 etc.) and Sections (e.g. this Section 01 11 55) in accordance with the current 6-digit National Master Specifications System.

.2 A Division or Section may consist of the work of more than one (1) subcontractor or trade. Responsibility for determining which subcontractor or trade provides the labour, material, equipment, and services required to complete the work rests solely with the Contractor.

.3 In the event of discrepancies or conflicts when interpreting the Drawings and Specification, the Specification governs.

1.11 TIME OF COMPLETION AND CONSTRUCTION WINDOWS

.1 The following schedule conditions are fundamental to the Contract:

.1 Complete the work of this Contract with the Esquimalt Graving Dock Section 3 ready for use within **forty-seven (47) weeks**

1.12 HOURS OF WORK

.1 Restrictive as follows:

.1 Normal work hours are between 07:00 to 23:00 Monday through Friday (i.e. working days for submittal purposes) and Saturday, not including statutory holidays.

.2 Contractor may request to work outside the above-mentioned normal work hours. Submit written request to Departmental Representative to work outside of the normal work hours a minimum of forty-eight (48) hours in advance of all requested after-hours work, including Sundays and statutory holidays.

1.13 CONSTRUCTION WORK SCHEDULE AND PROGRESS DOCUMENTATION

.1 Prepare, update and submit a construction Detail Schedule, Master Plan, "month-by-month" cash flow estimate, and associated documents per the requirements of Section 01 32 16.06 (Construction Progress Schedule – Critical Path Method). The construction work schedule format shall be a network analysis of the critical path method.

.2 The updated construction Detail Schedules and "month-by-month" cash flow estimates shall identify the work clearly, showing the detailed items of work.

.3 Additional definitions and requirements related to scheduling activities are provided within Section 01 32 16.06 (Construction Progress Schedule – Critical Path Method).

1.14 MEASUREMENT AND PAYMENT

.1 Before submitting the first progress claim, submit a breakdown of the Contract unit rates and lump sum prices in detail as requested by Departmental Representative, aggregating to the Contract price.

.2 Measurement and payment for work completed to Departmental Representative's satisfaction will be made as stipulated in the relevant technical Section of the Specification for that work item and the Unit Price Table.

.3 Measurement for Departmental Representative-advised Directed Moves shall be through formal documented communications (i.e., letters or emails) with Contractor.

.4 Measurement for approved Stand-by Time shall be through formal documented communications (i.e., letters or emails) with Contractor.

.5 Payment for Departmental Representative-advised Directed Moves shall be made by each required Directed Move event under the Tender Item for DIRECTED MOVE, as described in the Unit Price Table.

.6 Payment for approved Stand-by Time shall be made on a per hour basis under the Tender Item for STAND-BY TIME, as described in the Unit Price Table.

.7 Payment for the pre-construction survey shall be made under the tender item for PRE-CONSTRUCTION SURVEY.

1.15 CODES, BYLAWS AND STANDARDS

.1 Perform work in accordance with indicated codes and regulations, construction standards, and/or any other code or Bylaw of local application.

.2 Comply with local bylaws, and all Esquimalt Graving Dock rules, and regulations enforced at the location concerned.

.3 Meet or exceed requirements of the Contract Documents, specified standards, codes, and referenced documents.

.4 In any case of conflict or discrepancy, the most stringent requirements shall apply.

1.16 DOCUMENTS REQUIRED

.1 Maintain one (1) copy of each of the following documents and any other applicable documents at the Contractor's Work Site:

.1 Contract Drawings.

.2 Contract Specification and Appendices.

.3 Addenda to Contract documents (as applicable).

.4 Copy of accepted work schedule and most recent version of construction work schedule.

.5 Health and Safety Plan and other safety related documents.

.6 Notice of Project (NOP).

.7 EMP

.8 Copies of Contractor bid bonds.

.9 Required pre-construction submittals that have been reviewed and accepted by the Departmental Representative.

.10 Permits and acceptances.

.11 Required construction submittals (e.g., shop drawings, materials data, product data, samples, MSDS data sheets, Contractor’s daily and weekly construction reports).

.12 Environmental Protection Plan (EPP)

.13 Change orders.

.14 Other modifications to the Contract.

.15 Quality control test reports.

.16 Manufacturers' installation and application instructions.

.17 One set of Drawings and Specifications marked-up for "as-built purposes."

.18 Current construction standards of workmanship listed in each Section of the Specification (these can be in electronic format).

1.17 REGULATORY REQUIREMENTS

.1 Contractor is responsible for all Project Permits, with the exception of those provided as part of the Tender package.

.2 Obtain and pay for any additional permits (including Building Permit), certificates, licenses and other approvals that have not been provided by Departmental Representative and that are required by regulatory, municipal, provincial, or federal authorities, and commercial facilities to be used to complete the work.

.3 Obtain and pay for any additional permits, certificates, licenses and other approvals that have not been provided by Departmental Representative and that are required by Contractor to suit Contractor's means and methods to complete the work.

.4 The transportation of materials and equipment by barge requires Contractor to coordinate with the Queens Harbour Master (QHM) pursuant to the Canada Marine Act.

.5 If any portion of off-site work is conducted on federal lands not administered by PWGSC, Contractor is required, as part of its operations, to contract the federal custodian to confirm the applicable regulatory or other requirements, that may apply to Contractor's operations.

.6 Provide inspection authorities with plans and information required for issue of acceptance certificates.

.7 Furnish inspection certificates in evidence that the work installed conforms to the requirements of the authority having jurisdiction.

1.18 CONTRACTOR'S USE OF SITE

.1 The Esquimalt Graving Dock shall be assumed to be operational for the duration of the Contract.

.2 The Contractor's Work Site is indicated on the Drawings.

.3 Contractor is designated as Prime Contractor on the Contractor's Work Site and assumes all responsibilities of Prime Contractor as per relevant acts and

regulations. Contractor shall be responsible for all work conducted by Contractor and Contractor's subcontractors on the Contractor's Work Site.

.4 Use of Contractor's Work Site:

.1 The Contractor's Work Site will be made available completely and exclusively to Contractor for execution of the work, (except where indicated otherwise on the Drawings) to suite the timing for the work as shown on Contractor's construction work schedule that has been accepted by the Departmental Representative.

.2 Assume responsibility for assigned premises for performance of the work.

.3 Coordinate with Departmental Representative all work activities associated with this Contract.

.4 Provide security of Contractor's Work Site and all Contractor's and subcontractors' equipment and material. Secure Contractor's Work Site at the end of each work day.

.5 Perform work in accordance with Contract documents

.6 Do not unreasonably encumber the Contractor's Work Site with material and equipment.

.7 Any area in the EGD property to which access is restricted by signage is a secured or restricted area and shall not be entered, unless otherwise approved by Departmental Representative.

.8 Do not obstruct access to the EGD facility outside of the Contractor's Work Site. Maintain overhead clearances, keep roadways and walkways clear, maintain vessel navigation as described in the Specification, and maintain routes for emergency response vehicles.

.9 The Contractor shall comply with all loading limitations in force at EGD facility.

1.19 EXAMINATION

.1 Examine the Contractor's Work Site and be familiar and conversant with existing conditions likely to affect the work.

.2 Provide photographs of surrounding properties, objects, and structures liable to be damaged or be the subject of subsequent claims.

1.20 EXISTING SERVICES

.1 Where work involves breaking into, disconnecting, or connecting into existing services, carry out work at time as advised by Departmental Representative and as stipulated in the Specification.

.2 Except where connection into (or other similar disturbance of) utilities is required for the work, do no damage to existing utilities at the EGD facility. If any damage

to EGD utilities occurs, and is attributable to Contractor's actions, immediately repair any such damage to satisfaction of Departmental Representative.

1.21 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space, and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform Departmental Representative of impending installation and obtain Departmental Representative's acceptance for actual locations if different from locations shown on the Drawings.

.4 Submit field drawings or shop drawings to indicate the relative position of various services and equipment when required by Departmental Representative.

1.22 SETTING OUT OF WORK

.1 Assume full responsibility for, and execute complete layout of, work to locations, lines, and elevations indicated.

.2 Provide all equipment, devices, materials, labour, and supplies needed to layout and construct the work.

.3 Facilitate the Departmental Representative's inspection of the work.

1.23 ACCEPTANCE OF SUBSTRATES

.1 Contractor shall examine existing surfaces, surfaces prepared by other contractors, and job conditions that may affect the work, and shall report defects to Departmental Representative. Commencement of work shall imply acceptance of prepared work or substrate surfaces.

1.24 QUALITY OF WORK

.1 Ensure that quality workmanship is performed through use of skilled tradesmen, under supervision of qualified journeyman.

.2 Workmanship, accuracy, erection methods and procedures shall meet minimum standards set out in the applicable codes and standards for that part of the work.

.3 In cases of dispute, decisions as to standard, accuracy or quality of work rest solely with Departmental Representative, whose decision is final.

1.25 WORKS COORDINATION

.1 Coordinate work of sub-trades.

.1 Designate one person to be responsible for review of Contract documents and shop drawings and managing coordination of work.

.2 Convene meetings between subcontractors whose work interfaces and ensure awareness of areas and extent of interface required.

.1 Provide each subcontractor with a complete set of the Drawings and Specification for the Contract, to assist them in planning and carrying out their respective work.

.2 Develop coordination drawings when required to facilitate the work, illustrating potential interference between the work of various trades, and distribute to affected parties.

.1 Pay particular close attention to overhead work and work within or near to structural elements.

.2 Identify on coordination drawings the structural elements, service lines, and location of external tie-in to existing EGD services.

.3 Facilitate meeting and review coordination drawings. Ensure subcontractors agree and sign off on drawings.

.4 Plan and coordinate work in such a way to construct the work as shown on the Drawings, with minimum number of service line offsets and bends.

.5 Submit copy of coordination drawings to Departmental Representative for information purposes.

.6 Submit shop drawings and product data only after coordination meeting for such items has taken place and coordination drawings have been prepared and issued to Departmental Representative.

.3 Work coordination:

.1 Ensure cooperation between trades in order to facilitate general progress of work and avoid situations of spatial interference.

.2 Ensure that each trade provides all other trades reasonable opportunity for completion of work and in such a way as to prevent unnecessary delays, cutting, patching and removal or replacement of completed work.

.3 Ensure disputes between subcontractors are resolved.

.4 Departmental Representative is not responsible for, or accountable for extra costs incurred as a result of Contractor’s failure to coordinate work among trades and subcontractors.

1.26 SUBMITTALS

.1 In accordance with Section 01 33 00 (Submittal Procedures), submit the requested shop drawings, materials data, product data, MSDS sheets and samples indicated in each Section of the Specification.

.2 Allow sufficient time for the following:

.1 Review of shop drawings.

.2 Review of material / product data and MSDS sheets and samples.

.3 Review of re-submissions as necessary for acceptance by Departmental Representative.

.4 Ordering of accepted materials and/or products.

.3 Refer to Section 01 33 00 (Submittal Procedures) for review periods and other requirements for submittals.

1.27 RELICS AND ANTIQUITIES

.1 Relics and antiquities may be encountered during the work under the Contract. Contractor shall protect such articles and notify Departmental Representative immediately if they are encountered, as described in Section 01 35 43 (Environmental Procedures and Sustainability).

.2 Relics and antiquities and items of historical or scientific interest shall remain property of the Crown. Protect such articles and request course of action from Departmental Representative.

.3 Give immediate notice to Departmental Representative if evidence of archeological finds are encountered during excavation, and await Departmental Representative's written instructions before proceeding with work in this area.

1.28 PRODUCTS SUPPLIED BY DEPARTMENTAL REPRESENTATIVE

.1 No products will be supplied by Departmental Representative, other than items to be re-used in the work, and are as indicated on the Drawings and in relevant Sections of the Specification.

1.29 EGD SITE ACCESS AND SECURITY

.1 Contractor's personnel (and his subcontractors' personnel) employed on this project will be subject to security check at entry into, and exit from, the EGD Facility. Obtain requisite clearances, as instructed, for each individual required to enter the EGD facility.

.2 Personnel will be checked provided with a pass that must be worn at all times.

.3 Contractor shall secure Contractor's equipment and staging areas and its contents throughout the construction period.

1.30 TESTING AND INSPECTION

.1 Requirements for testing and inspection to be carried out by Contractor's Quality Control testing service or laboratory accepted by Departmental Representative are specified in the Contract documents.

.2 Contractor shall appoint and pay for the services of a Quality Control testing agency or testing laboratory to perform Quality Control testing as required in each Section of the Specification, and also where required for the following:

.1 Inspection and testing required by laws, ordinances, rules, regulations, or orders of public authorities.

.2 Tests specified to be carried out by Contractor under the supervision of Departmental Representative.

.3 Inspection and testing performed exclusively for Contractor's convenience.

.3 Where tests or inspections by Contractor's Quality Control testing agency or testing laboratory reveals that work is not in accordance with the Contract requirements, Contractor shall pay costs for additional tests or inspections as Departmental Representative may require to verify acceptability of corrected work.

.4 Notify the Departmental Representative in advance of planned tests or inspections.

.5 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.

.6 Pay costs for uncovering and make good work that is covered before required inspection or testing is completed and accepted by Departmental Representative.

.7 Provide Departmental Representative with Quality Control reports from testing agency or laboratory as soon as they are available.

.8 Departmental Representative may require, and pay for, additional inspection and testing services beyond those specified or otherwise required.

1.31 SURVEYING AND RECORDING CHANGES IN THE WORK

.1 Within ten (10) working days after Notice of Award, submit to Departmental Representative the name of the licensed surveyor (member of the Association of British Columbia Land Surveyors, ABCLS) or Professional Engineer registered to practice in the Province of British Columbia, who is employed by the Contractor, who will be responsible for the preparation and submittal of the hardcopy Record Documents (for "as-built" purposes) for the constructed works, as appropriate to the portion of the work under consideration.

.2 Record Documents, describing the final accurate "as-built" condition of the constructed works, prepared by the Contractor's licensed surveyor or Professional Engineer as appropriate to the portion of the work under consideration, shall be submitted to Departmental Representative as required by Section 01 78 00 (Closeout Submittals).

.3 Contractor to provide survey data in accordance with EGD Standards for Survey (see Specification Appendix).

1.32 RECORD DOCUMENTS (FOR "AS-BUILT PURPOSES")

.1 The Departmental Representative will provide two (2) sets of hardcopy Contract Drawings and two (2) sets of hardcopy Specifications, for Contractor to annotate for Record Document purposes.

.2 The Departmental Representative will provide one (1) set of the original AutoCAD files of the Contract Drawings, for Contractor's general use during construction at his own risk. No representation is made as to the correctness or completeness of these AutoCAD Drawings. These AutoCad drawings are provided for informational purposes only, and do not replace or supersede the Contract Drawings.

.3 As work progresses, maintain accurate records to show all deviations from the Contract documents. Annotate the Specifications, Contract Drawings and shop drawings as changes occur. Record changes in red ink.

.4 Review all annotations (draft Record Document information) with Departmental Representative during every project progress meeting to ensure up-to-date documentation at the completion of project.

.5 Refer to Section 01 78 00 (Closeout Submittals) for submittal of Record Documents.

.6 Contractor to submit AutoCAD versions of all record drawings.

1.33 ADDITIONAL DRAWINGS

.1 Departmental Representative may furnish additional drawings for clarification. These additional drawings have the same meaning and intent as if they were included with the Contract Drawings.

.2 Upon request, Departmental Representative may furnish up to a maximum of ten sets of Contract documents for use by Contractor at no additional cost. Of these ten (10) sets, only two (2) sets will include full-size prints of the Drawings, the remainder being half-size prints. Should more than ten (10) sets of documents be required, Departmental Representative will provide them at additional cost.

1.34 CLEANING

.1 Conduct cleaning and disposal operations daily. Comply with local ordinances and anti-pollution laws.

.2 Ensure cleanup of the work areas each day after completion of work.

1.35 MAINTENANCE MATERIALS, SPECIAL TOOLS AND SPARE PARTS

.1 Specific requirements for maintenance materials, tools, and spare parts are specified in individual Sections of the Specifications.

1.36 BUILDING SMOKING ENVIRONMENT

.1 Smoking within any building is not permitted.

.2 Comply with EGD Smoking Policy and smoke only at designated smoking areas.

1.37 SYSTEM OF MEASUREMENT

.1 The metric system of measurement (SI) will be employed on this Contract.

1.38 FAMILIARIZATION OF CONTRACTOR'S WORK SITE

.1 Before submitting tender, attend tender site meeting as indicated in the Tender documents and become familiar with all conditions likely to affect the cost of the Work. Access to the EGD facility will be made available only during the Tender site meeting and not at the Contractor's discretion.

.2 No claims or change orders will be entertained by PWGSC in regard to existing conditions due to lack of familiarity with the Contractor's Work Site.

1.39 SUBMISSION OF TENDER

.1 Submission of a Tender is deemed to be confirmation of the fact that the Tenderer has analyzed the Contract documents and inspected the site, and is fully conversant with all conditions.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Meetings shall be required throughout the duration of the work as described in the Specification.

.2 Contractor shall attend all required meetings and provide required preparation and follow-up materials.

1.2 MEASUREMENT AND PAYMENT

.1 No separate payment will be made for effort associated with project meetings.

1.3 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 01 33 00 (Submittal Procedures)

1.4 DEFINITIONS

.1 Refer to Section 01 11 55 (General Instructions) for all definitions related to the Contract.

1.5 SUBMITTALS

.1 Contractor shall provide pre-construction, progress, and post-construction submittals in accordance with the requirements of Section 01 33 00 (Submittal Procedures).

1.6 REFERENCES

.1 NOT USED

1.7 ADMINISTRATIVE

.1 Contractor shall complete the following activities regarding administration of meetings throughout the progress of the work:

.1 Schedule and administer Progress Meetings and Tailgate Meetings as required, or at the request of Departmental Representative.

.2 Prepare agendas for Progress Meetings.

.3 Distribute written notice of each Progress Meeting two (2) working days in advance of meeting date to Departmental Representative.

.4 Provide physical space and make arrangements for Progress Meetings and Tailgate Meetings.

.5 Preside at Progress Meetings and Tailgate Meetings.

.2 Contractor will record the Progress Meeting minutes, including significant proceedings and decisions, and identify actions by parties.

.1 Contractor will reproduce and distribute copies of Progress Meeting minutes within three (3) working days after meetings and transmit to the meeting participants. Departmental Representative will review meeting minutes and request changes as applicable. Contractor shall provide a final copy of meeting minutes within three (3) days after receipt of comments from Departmental Representative.

.3 Representatives of Contractor, subcontractors, and suppliers attending Progress Meetings shall be qualified and authorized to act on behalf of the party each represents.

1.8 PRECONSTRUCTION MEETING

.1 Within ten (10) working days after award of Contract, Departmental Representative will request a meeting of parties involved in the Contract to discuss and resolve administrative procedures and responsibilities.

.2 PWGSC and its project team, Departmental Representative, Contractor, and major subcontractors will be in attendance.

.3 Departmental Representative will incorporate mutually agreed variations to Contract documents into agreement, prior to signing.

.4 Contractor shall be prepared to discuss and/or provide, at a minimum, the following information at the Pre-Construction Meeting:

.1 Appointment of official representative of participants in the work.

.2 Contractor Health and Safety.

.3 Construction Work Schedule.

.4 Construction Work Plan (in outline only).

.5 Environmental Management.

.6 Schedule of submissions, including but not limited to, Construction Work Plan, Health and Safety Plan, Quality Control Plan, and Environmental Protection Plan.

.7 WorkSafe BC Notice of Project.

.8 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, and fences.

.9 Daily Tailgate Meeting.

.10 Progress Meetings.

.11 EGD Work Site security.

.12 Project administration, including:

.1 Proposed changes, change orders, procedures, acceptances required, time extensions, and administrative requirements.

.2 Monthly progress claims, administrative procedures, photographs, and hold backs.

.3 Appointment of inspection and testing agencies or firms.

.4 Insurances and transcripts of policies.

1.9 PROGRESS MEETINGS

.1 During the course of the work, Contractor shall schedule Progress Meetings at least once per week.

.2 Contractor, major Subcontractors involved in the work, PWGSC and its project team, and the Departmental Representative are to be in attendance.

.3 Contractor shall notify parties a minimum of two (2) working days prior to Progress Meetings.

.4 Contractor will reproduce and distribute copies of Progress Meeting minutes within three (3) working days after meetings and transmit to the meeting participants. Departmental Representative will review Progress Meeting minutes and request changes as applicable. Contractor shall provide a final copy of Progress Meeting minutes within three (3) days after receipt of comments from Departmental Representative.

.5 Progress Meeting agendas shall include, at a minimum, the following:

.1 Review and acceptance of minutes from previous meeting.

.2 Health and Safety considerations.

.3 Review of work progress since previous meeting.

.4 Field observations, problems, or conflicts.

.5 Environmental Management.

.6 Problems that impede the construction schedule.

.7 Corrective measures (action items) and procedures to regain the projected schedule.

.8 Revisions to the Construction Work Schedule.

.9 Progress schedule, during succeeding work period.

.10 Review submittal schedules: expedite as required.

.11 Maintenance of quality standards.

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

.13 Current or Potential Change Order discussion.

.14 Other business.

.6 Departmental Representative may schedule additional project meetings as necessary.

1.10 TAILGATE MEETINGS

.1 During the course of the work, Contractor shall hold daily Tailgate Meetings to occur at the start of each work shift. Multiple Tailgate Meetings shall be held if Contractor intends to work multiple shifts within a 24-hour period.

.2 Tailgate Meeting agenda shall include, at a minimum, the following:

.1 Sign-in of all attendees.

.2 Planned work activities and environmental considerations for that shift.

.3 Hazards associated with these work activities, including environmental hazards (e.g., potential for hypothermia, heat exhaustion, or heat stroke).

.4 Appropriate job-specific safe work procedures.

.5 Required personal protective equipment (PPE).

.6 Appropriate emergency procedures.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes general requirements and procedures for preparation of the Contractor's construction Master Plan, construction Detail Schedule (CPM logic diagram), cash flow estimates, and associated documents. Additional requirements are provided for ongoing progress monitoring and reporting throughout the project.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 11 55 (General Instructions)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 No measurement or payment will be made under this Section. All costs for execution, preparation, reproduction, submittal and re-submittal (as stipulated by the Specification) of schedule submittals are deemed incidental to the work.

1.4 REFERENCES

.1 Not used

1.5 DEFINITIONS

.1 Activity: Element of Work performed during course of Project. Activity normally has expected duration and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Actual Finish Date (AF): Point in time that Work actually ended on activity.

.3 Actual Start Date (AS): Point in time that Work actually started on activity.

.4 Bar Chart (Gantt chart): Graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars.

.5 Baseline: Original approved plan (for Project, work package, or activity), plus or minus approved scope changes.

.6 Completion Milestones: Completion of major components of work, Substantial Completion and Total Completion.

.7 Constraint: Applicable restriction that will affect performance of Project. Factors that affect activities can be scheduled.

.8 Control: Process of comparing actual performance with planned performance, analyzing variances, evaluating possible alternatives, and taking appropriate corrective action as needed.

.9 Critical Activity: Any activity on a critical path; most commonly determined by using critical path method.

.10 Critical Path: Series of activities that determines duration of Project. In deterministic model, critical path is usually defined as those activities with float less than or equal to specified value, often zero. It is longest path through Project.

.11 Critical Path Method (CPM): Network analysis technique used to predict Project duration by analyzing which sequence of activities (which path) has least amount of scheduling flexibility (least amount of Float).

.12 Data Date (DD): Date at which, or up to which, Project's reporting system has provided actual status and accomplishments.

.13 Detail Schedule: The detailed CPM logic diagram describing the work, as explained elsewhere in this Section of the Specification.

.14 Duration: Number of work periods (not including holidays or other non-working periods) required to complete activity or other Project element; usually expressed as workdays or work weeks.

.15 Early Finish Date (EF): In critical path method, earliest possible point in time on which uncompleted portions of activity (or Project) can finish, based on network logic and schedule constraints. Early finish dates can change as Project progresses and changes are made to Project plan.

.16 Early Start Date (ES): In critical path method, earliest possible point in time on which uncompleted portions of activity (or Project) can start, based on network logic and schedule constraints. Early start dates can change as Project progresses and changes are made to Project Plan.

.17 Finish Date: Point in time associated with activity's completion. This is usually qualified by one of following: actual, planned, estimated, scheduled, early, late, baseline, target, or current.

.18 Float: Amount of time that activity may be delayed from its early start without delaying Project finish date. Float is a mathematical calculation, and can change as Project progresses and changes are made to Project plan.

.19 Lag: Modification of logical relationship that directs delay in successor task.

.20 Late Finish Date (LF): In critical path method, latest possible point in time that activity may be completed without delaying specified milestone (usually Project finish date).

.21 Late Start Date (LS): In critical path method, latest possible point in time that activity may begin without delaying specified milestone (usually Project finish date).

.22 Lead: Modification of logical relationship that allows acceleration of successor task.

.23 Logic Diagram: See definition of Project Network Diagram.

.24 Master Plan: Summary-level schedule that identifies major activities and key Milestones.

.25 Milestone: Significant event in Project, usually completion of major deliverable.

.26 Monitoring: Capture, analysis, and reporting of Project performance, usually as compared to plan.

.27 Near-Critical Activity: Activity that has low total float.

.28 Non-Critical Activities: Activities which when delayed, do not affect specified Contract duration.

.29 Project Control System: Fully computerized system, utilizing Microsoft Project software package, showing specific tasks, dates, critical path of anticipated stages of work, and final completion of the work within the time period required by the Contract documents.

.30 Project Network Diagram: Schematic display of logical relationships of Project activities. Always drawn from left to right to reflect Project chronology.

.31 Project Plan: Formal, approved document used to guide both Project execution and Project control. Primary uses of Project plan are to document planning assumptions and decisions, facilitate communication among stakeholders, and document approved scope, cost, and schedule baselines. Project plan may be summary or detailed.

.32 Project Planning: Development and maintenance of Project Plan.

.33 Project Planning, Monitoring and Control System: overall system operated by Departmental Representative to enable monitoring of Project Work in relation to established milestones.

.34 Project Schedule: Planned dates for performing activities and planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy project objectives. Monitoring and control process involves using project schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.35 Quantified Days Duration: Working days based on 5 day work week, discounting statutory holidays.

.36 Risk: Uncertain event or condition that, if it occurs, has positive or negative effect on Project's objectives.

.37 Scheduled Finish Date (SF): Point in time that work was scheduled to finish on activity. Scheduled finish date is normally within range of dates delimited by early finish date and late finish date.

.38 Scheduled Start Date (SS): Point in time that work was scheduled to start on activity. Scheduled start date is normally within range of dates delimited by early start date and late start date.

.39 Start Date: Point in time associated with activity's start, usually qualified by one of following: actual, planned, estimated, scheduled, early, late, target, baseline, or current.

.40 Work Breakdown Structure (WBS): Deliverable-oriented grouping of project elements that organizes and defines total work scope of Project. Each descending level represents increasingly detailed definition of Project work.

1.6 SYSTEM DESCRIPTION

.1 Construction progress schedule: Describes processes required to ensure timely completion of Project. These processes ensure that various elements of Project are properly coordinated. It consists of planning, time estimating, scheduling, progress monitoring and control.

.2 Planning: This is most basic function of management, that of determining presentation of action and is essential.

.1 It involves focusing on objective consideration of future, and integrating forward thinking with analysis; therefore, in planning, implicit assumptions are made about future so that action can be taken today.

.2 Planning and scheduling facilitates accomplishment of objectives and should be considered continuous interactive process involving planning, review, scheduling, analysis, monitoring and reporting.

.3 Ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made. This implies progressively more reliability of scheduling data. The construction Detail Schedule is used for analysis and progress monitoring.

.4 Ensure project schedule efficiencies through monitoring.

.1 When activities begin on time and are performed according to estimated durations without interruptions, original Critical Path will remain accurate. Changes and delays will however, create an essential need for continual monitoring of Project activities.

.2 Monitor progress of Project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that has started but are not yet completed.

.5 Monitoring should be done sufficiently often so that causes of delays are immediately identified and removed if possible.

.6 Project monitoring and reporting: As Project progresses, keep team aware of changes to schedule, and possible consequences. In addition to Bar Charts and CPM networks, use narrative reports to provide advice on seriousness of difficulties and measures to overcome them.

.1 Narrative reporting begins with statement on general status of Project followed by summarization of delays, potential problems, corrective measures and Project status criticality.

1.7 CPM REQUIREMENTS

.1 Ensure Master Plan and construction Detail Schedule are practical and remain within specified Contract duration.

.2 Master Plan and construction Detail Schedule deemed impractical by Departmental Representative are to be revised and re-submitted for review and acceptance by Departmental Representative.

.3 Acceptance of Master Plan and construction Detail Schedule showing scheduled Contract duration shorter than specified Contract duration does not constitute change to Contract. Duration of Contract may only be changed through bilateral Agreement.

.4 Consider Master Plan and construction Detail Schedule deemed practical by Departmental Representative, showing Work completed in less than specified Contract duration, to have float.

.5 First Milestone on Master Plan and construction Detail Schedule will identify start Milestone with an “ES” constraint date equal to Award of Contract date.

.6 Calculate dates for completion milestones from Plan and Schedule using specified time periods for Contract.

.7 Substantial Completion and Total Completion with "LF" constraint equal to calculated date.

.8 Delays to non-critical activities, those with float may not be basis for time extension.

.9 Do not use float suppression techniques such as software constraints, preferential sequencing, special lead/lag logic restraints, extended activity times or imposed dates other than required by Contract.

.10 Allow for and show Master Plan and construction Detail Schedule adverse weather conditions normally anticipated. Specified Contract duration has been predicated assuming normal amount of adverse weather conditions.

.11 Provide necessary crews and manpower to meet schedule requirements for performing Work within specified Contract duration. Simultaneous use of multiple crews on multiple fronts on multiple critical paths may be required.

.12 Arrange participation on and off site of subcontractors and suppliers, as required by Departmental Representative, for purpose of network planning, scheduling, updating and progress monitoring. Approvals by Departmental Representative of original networks and revisions do not relieve Contractor from duties and responsibilities required by Contract.

.13 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, and Final Certificate as defined times of completion are of essence to this contract.

1.8 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 (Submittal Procedures).

.2 Submit to Departmental Representative the Contractor's Project Control System for planning, scheduling, monitoring and reporting of project progress.

.3 Submit letter confirming that schedule has been prepared in co-ordination with major sub-contractors.

.4 Submit Project planning, monitoring and control system data as part of initial schedule submission and status reporting as required by Departmental Representative in following form:

.1 CD files in original scheduling software (Microsoft Project) containing schedule and cash flow information, labelled with data date, specific update, and person responsible for update.

.2 Master Plan Bar Chart.

.3 Construction Detail Schedule Bar Chart.

.4 Listing of project activities including milestones and logical connectors, networks (sub-networks) from Project start to end. Sort activities by activity identification number and accompany with descriptions. List early and late start and finish dates together with durations, codes and float.

.5 Criticality report listing activities and milestones with negative, zero and up to five (5) days total float used as first sort for ready identification of critical or near critical paths through entire project. List early and late starts and finishes dates, together with durations, codes and float for critical activities.

.6 Progress report in early start sequence, listing for each trade, activities due to start, underway, or finished within two (2) months from update date. List activity identification number, description and duration. Provide columns for entry of actual start and finish dates, duration remaining and remarks concerning action required.

.7 Initial "month-by-month" cash flow estimate for all construction works, as outlined elsewhere in this Section of the Specification.

.5 Submit construction Detail Schedule updates (and companion schedules) and monthly cash flow estimates as outlined elsewhere in this Section of the Specification.

1.9 QUALITY ASSURANCE

.1 Use experienced personnel, fully qualified in planning and scheduling to provide services from start of construction to Final Certificate, including Commissioning.

1.10 PROJECT MEETING

.1 Meet with Departmental Representative during Pre-Construction Meeting, to establish work requirements and approach to project construction operations.

1.11 WORK BREAKDOWN STRUCTURE

.1 Prepare construction Work Breakdown Structure (WBS) within twenty-one (21) calendar days of Award of Contract date. The breakdown of work shall, at a minimum, show all of the items identified in the Unit Price Table and significant design, manufacturing, construction, and installation activities.

1.12 CASH FLOW ESTIMATES

.1 Prepare and submit an initial "month-by-month" cash flow estimate for all construction works within twenty-one (21) calendar days of Award of Contract date. The breakdown of work shall, at a minimum, show all of the items identified in the Unit Price Table and significant design, manufacturing, construction, and installation activities. Detailed format for cash flow estimates shall be determined by Departmental Representative, in consultation with Contractor.

.2 Prepare and submit with each monthly progress draw an updated "month-by-month" cash flow estimate for all construction works. The month-by-month cash flow estimates shall:

.1 Be based on the contract Unit Price Table, and the current approved Contractor's construction schedule.

.2 Be consistent with progress payment claims submitted to date.

.3 Include most up to date confirmed, actual quantities, as well as most up to date and accurate estimate of remaining quantities.

.4 Include Change Orders for additional cost items that have been incorporated into the Contract.

.5 If work is conducted in more than one fiscal year (i.e. April 1st to March 31st), include a separate sub-total for each fiscal year.

.6 Provide an updated total estimated final Contract value, excluding and including applicable taxes.

1.13 MASTER PLAN

.1 Structure and base CPM construction networks system on WBS coding in order to ensure consistency throughout Project.

.2 Prepare comprehensive construction Master Plan (CPM logic diagram) and dependent Cash Flow Projection within twenty-one (21) calendar days of Award of Contract date to confirm validity or alternates of identified milestones. Master Plan will be used as baseline.

.1 Revise baseline as conditions dictate and as required by Departmental Representative.

.2 Departmental Representative will review and return revised baseline within seven (7) calendar days.

.3 Reconcile revisions to Master Plan and Cash Flow Projections with previous baseline to provide continuous audit trail.

.4 Initial and subsequent Master Plans will include:

.1 CD containing schedule and cash flow information, clearly labelled with data date, specific update, and person responsible for update.

.2 Bar chart identifying coding, activity durations, early/late and start/finish dates, total float, completion as percentile, current status and budget amounts.

.3 Network diagram showing coding, activity sequencing (logic), total float, early / late dates, current status and durations.

.4 Actual / projected monthly cash flow: expressed monthly and shown in both graphical and numerical form.

1.14 CONSTRUCTION DETAIL SCHEDULE

.1 Provide construction Detail Schedule (CPM logic diagram) within twenty-one calendar days of Award of Contract date showing activity sequencing, dates, interdependencies, equipment resourcing and assumed working hours / shifts / days. Include listed activities as follows:

.1 Submission of shop drawings, materials data, product data, MSDS data sheets and samples.

.2 Approvals.

.3 Procurement (including off-site prefabrication activities, and items with long lead time).

.4 Construction.

.5 Installation.

.6 Site works.

.7 Commencement and completion of work.

.8 Allowable in-water construction time periods and indicate on construction work schedule when in-water work cannot be performed.

.9 Other specified scheduling constraints.

.10 Final completion date within the time period required by the Contract documents.

.11 Commissioning and acceptance.

.2 Detail CPM schedule to cover in detail complete project life cycle beginning from Award of Contract to completion of the work.

.1 Detail activities completely and comprehensively throughout duration of project.

.3 Relate construction Detail Schedule activities to basic activities and milestones developed and approved in Master Plan.

.4 Clearly show sequence and interdependence of construction activities and indicate:

.1 Start and completion of all items of the work, their major components, and interim milestone completion dates.

.2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:

.1 Time for submittals, resubmittals and review.

.2 Time for fabrication and delivery of manufactured products for the work.

.3 Interdependence of procurement and construction activities.

.3 Include sufficient detail to assure adequate planning and execution of the work. Activities should generally range in duration from three (3) to fifteen (15) workdays each.

.5 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated and allow co-ordination and control of project activities. Show continuous flow from left to right.

.6 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being, whenever possible, continuous series of activities throughout length of Project to form "Critical Path". Increased number of critical activities is seen as indication of increased risk.

.7 Insert Change Orders in appropriate and logical location of Detail Schedule. After analysis, clearly state and report to Departmental Representative for review effects created by insertion of new Change Order.

.8 The construction Detail Schedule shall include sufficient time for Departmental Representative review and acceptance of all work, Contractor corrective work if determined necessary by Departmental Representative, and cleaning / equipment decontamination, where required, prior to the designated substantial completion date.

1.15 REVIEW OF THE CONSTRUCTION DETAIL SCHEDULE

.1 Allow seven (7) calendar days for review by Departmental Representative of proposed construction Detail Schedule.

.2 Upon receipt of reviewed Detail Schedule make necessary revisions and resubmit within seven (7) calendar days to Departmental Representative for review and acceptance.

.3 Promptly provide additional information to validate practicability of construction Detail Schedule as required by Departmental Representative.

.4 Submittal of construction Detail Schedule indicates that it meets Contract requirements and will be executed generally in sequence.

.5 The construction Detail Schedule, as reviewed and accepted by Departmental Representative, will be an integral part of the Contract and will establish interim completion dates for the various activities under the Contract.

1.16 COMPLIANCE WITH (AND ADJUSTMENT OF) CONSTRUCTION DETAIL SCHEDULE

.1 Comply with the reviewed construction Detail Schedule.

.2 Proceed with significant changes and deviations from scheduled sequence of activities that cause delay, only after written receipt of approval by Departmental Representative.

.3 Identify activities that are behind schedule and causing delay. Should any activity not be completed by the stated scheduled date, Departmental Representative will have the right to require Contractor to expedite completion of the activity by whatever means appropriate and necessary, without additional compensation to Contractor. Corrective measures may include:

.1 Increase of personnel on site for effected activities or work package.

.2 Increase in materials and equipment.

.3 Overtime work / additional work shifts.

.4 Submit to Departmental Representative, justification, project schedule data and supporting evidence for approval of extension to Contract completion date or interim milestone date when required. The construction Detail Schedule shall be used to justify time extension days requested by Contractor. Include as part of supporting evidence:

.1 Written submission of proof of delay based on revised activity logic, duration and costs, showing time impact analysis illustrating influence of each change or delay relative to approved contract schedule.

.2 Prepared schedule indicating how change will be incorporated into the overall logic diagram. Demonstrate perceived impact based on date of occurrence of change and include status of construction at that time.

.3 Other supporting evidence requested by Departmental Representative.

.4 Do not assume approval of Contract extension prior to receipt of written approval from Departmental Representative.

.5 In event of Contract extension, display in the construction Detail Schedule that scheduled float time available for work involved has been used in full without jeopardizing earned float.

.1 Departmental Representative will determine and advise Contractor number of allowable days for extension of Contract based on project schedule updates for period in question, and other factual information.

.2 Construction delays affecting project schedule will not constitute justification for extension of contract completion date.

1.17 PROGRESS MONITORING AND REPORTING

.1 Requirements for progress monitoring and reporting are basis for progress payment request.

.2 On an ongoing basis, the construction Detail Schedule must show “Progress to Date”.

.3 Arrange participation on and off site of subcontractors and suppliers, as, and when necessary, for purpose of network planning, scheduling, updating and progress monitoring.

.4 Inspect Work with Departmental Representative at least once (1) monthly to establish progress on each current activity shown on applicable networks.

.5 Update and reissue project Work Breakdown Structure and relevant coding structures as project develops and changes.

.6 Review, update and submit the construction Detail Schedule to Departmental Representative **at or just before each weekly construction progress meeting.** The updated construction Detail Schedule shall reflect activities completed to date, activities in progress, logic and duration changes. The weekly update of the construction Detail Schedule shall be submitted in paper and electronic formats (source file and PDF formats).

.7 Upon Departmental Representative's request, issue a companion schedule (in source file and PDF formats) showing all sequencing logic, dependencies, equipment resourcing and assumed working hours / shifts / days.

.8 Provide a short-term "2-week look ahead schedule" based on the updated construction Detail Schedule at weekly intervals. The short-term "2-week look ahead schedule" shall be submitted in paper and electronic formats (source file and PDF formats).

.9 All changes to the construction Detail Schedule of more than three (3) working days shall be documented on the updated schedule and shall be submitted both in writing and electronic format (e-mailed) to Departmental Representative.

.10 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.

.11 Interim reviews of work progress based on the construction Detail Schedule will be conducted as decided by Departmental Representative, and the schedule shall be updated by Contractor in conjunction with, and to the acceptance of Departmental Representative.

.12 Submit monthly written report based on construction Detail Schedule, showing Work to date performed, comparing Work progress to planned, and presenting current forecasts. Report must summarize progress, defining problem areas and anticipated delays with respect to Work schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate any potential delay. Include in report:

.1 Description of progress made.

.2 Pending items and status of: permits, shop drawings, Change Orders and possible time extensions.

.3 Status of Contract completion date and milestones.

.4 Current and anticipated problem areas, potential delays and corrective measures.

.5 Review of progress and status of Critical Path activities.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes general requirements and procedures for Contractor's submissions of all required submittals following award of the Contract (including the Construction Work Plan, other plans, construction schedule, cash flow estimate, shop drawings, product samples, and product testing data) to Departmental Representative for review.

.2 Contractor is to provide submittals to Departmental Representative in advance of, and throughout the duration of the work.

.3 Detailed requirements for each submittal are stipulated in the related Sections of the Specification.

1.2 MEASUREMENT AND PAYMENT

.1 No separate payment will be made for required submittals or for re-submittals, as described in this Section, except as described in Clauses 1.2.3 and 1.2.4 of this Section.

.2 Pre-construction and post-construction submittals will not be measured for payment.

.3 Pre-construction submittals and re-submittals will be paid for at the Lump Sum price tendered for PRE-CONSTRUCTION SUBMITTALS. Payment shall include for all costs in connection with pre-construction submittals and re-submittals. The Lump Sum tendered for pre-construction submittals will be paid on completion of all applicable items listed in this Section to the satisfaction of Departmental Representative.

.4 Post-construction submittals and re-submittals will be paid for at the Lump Sum price tendered for POST-CONSTRUCTION SUBMITTALS. Payment shall include for all costs in connection with post-construction submittals and re-submittals. The Lump Sum tendered for post-construction submittals shall be paid on completion of all applicable items listed in this Section to the satisfaction of Departmental Representative.

.5 Construction submittals and re-submittals shall be considered as incidental to the work.

1.3 RELATED SECTIONS

.1 All Sections of the Contract documents shall apply to requirements for submittals associated with the work. The Contractor shall review and be familiar with the structure and contents of all required submittals.

1.4 DEFINITIONS

.1 Refer to Section 01 11 55 (General Instructions) for all definitions related to the work.

1.5 SUBMITTALS

.1 This summary list (**Tables 1, 2 and 3**) is presented for the Contractor's convenience only, and no warranty is given to its accuracy or completeness. In the event of any discrepancies with individual Sections of the Specification, the requirements of the individual Section of the Specification apply.

SUMMARY LIST OF SUBMITTALS

Table 1 – Pre-Construction Submittals

SPEC ID	Clause	Submittal	Submittal Schedule
01 11 55	1.31.1	Name of Licensed Surveyor or Professional Engineer	Within Ten (10) Working Days After Notice of Award
01 11 55 01 32 16.06 01 32 16.06 01 32 16.06	1.13.1 1.8.5 1.17.6 1.14.1	Construction Detail Schedule	Within Twenty-One (21) Calendar Days of Award of Contract
01 32 16.06	1.15.2	Resubmit of Reviewed Construction Detail Schedule	Within Seven (7) Calendar Days of Receiving Review
01 32 16.06	1.11.1	Work Breakdown Structure (WBS)	Within Twenty-One (21) Calendar Days of Award of Contract Date
01 11 55 01 32 16.06 01 32 16.06	1.13.1 1.7.2 1.13.2	Master Plan	Within Twenty-One (21) Calendar Days of Award of Contract
01 11 55 01 32 16.06 01 32 16.06	1.13.1 1.12.1 1.12.2	Initial Cash-Flow Estimate	Within Twenty-One (21) Calendar Days of Award of Contract

SPEC ID	Clause	Submittal	Submittal Schedule
01 11 55	1.14.1	Contract Unit Rates and Lump Sum Prices	Prior to Submitting the First Progress Claim
01 32 16.06 01 32 16.06	1.8.2 1.8.4	Project Control System	Per the Specifications
01 32 16.06	1.8.3	Project Control System Letter Confirming Sub-Contractors	Per the Specifications
01 33 00	1.10.1	Work Safe BC Status	Immediately After Award of Contract
01 33 00	1.10.2	Transcription of Insurance	Immediately After Award of Contract
01 35 13.43 01 35 43	1.5.1 1.5.2	Environmental Protection Plan (EPP)	Within Twenty-Eight (28) Calendar Days Following Contract Award
01 35 13.43 01 35 43	1.5.1.1 1.5.6.5	Wastewater Management and Disposal Plan (WWMDP)	As Part of the Environmental Protection Plan (EPP)
01 35 13.43 01 35 43	1.5.1.2 1.5.6.4	Pollution Control Plan (PCP)	As Part of the Environmental Protection Plan (EPP)
01 35 13.43 01 35 13.43 01 35 43	1.5.1.3 1.17.2 1.5.6.6	Stormwater Pollution Prevention Plan (SWPPP)	As Part of the Environmental Protection Plan (EPP)
01 35 13.43 01 35 13.43	1.5.1.4 1.18.1	Temporary Erosion and Sedimentation Control Plan (TESCP)	As Part of the Environmental Protection Plan (EPP)
01 35 13.43	1.16.5	Wastewater Treatment and Disposal Facility Permit	When required
01 74 21 02 41 16.01 31 23 33.01	1.5.1 1.6.4 1.6.2	Waste Reduction Work Plan (WRWP)	As Part of the Environmental Protection Plan (EPP)

SPEC ID	Clause	Submittal	Submittal Schedule
01 74 21	1.5.2	Materials Source Separation Program (MSSP) Plan	As Part of the Environmental Protection Plan (EPP)
01 74 21	1.5.3	Waste Audit (WA)	Upon Request
01 35 13.43 01 51 01 01 51 01	1.5.2 1.5.1 1.8.1	Site Layout Drawings	As Part of the Environmental Protection Plan (EPP)
01 35 43	1.19	Sustainable Remediation Strategies	As Part of the Environmental Protection Plan (EPP)
01 35 33	1.13.1	Notice of Project	Prior to Mobilization
01 35 33 01 35 33	1.5.3.1 1.14	Health and Safety Plan	Within Fifteen (15) Working Days Following Contract Award
01 35 33	1.5.3.1	Company Safety Manual	Prior to Mobilization
01 35 33	1.5.3.3	Copies of Reports or Directions Issued by Federal and Provincial Health and Safety Inspectors	Prior to Mobilization
01 35 33	1.5.3.5	Complete Set of Material Safety Data Sheets (MSDS), and All Other Documentation Required by Workplace Hazardous Materials Information System (WHMIS) Requirements	Prior to Mobilization
01 35 33 01 35 33	1.5.3.6 1.15	Emergency Procedures	Prior to Mobilization
01 35 33	1.5.5	Medical Surveillance for Site Personnel	Prior to Mobilization
01 45 00	1.5.1	Construction Quality Control (CQC) Plan	Within Ten (10) Working Days Following Notice of Award
01 45 00	1.5.1.1	Reporting and Document Control Plan	As part of the Construction Quality Control (CQC) Plan

SPEC ID	Clause	Submittal	Submittal Schedule
02 61 00.01 02 61 00.08	1.5 1.5	Contaminated Water Treatment Plans	Within Ten (10) Working Days Following Notice of Award
03 10 00	1.5.2	Formwork and Falsework Shop Drawings	A Minimum of Fourteen (14) Days Prior to Construction
03 20 00	1.6.1	Concrete Reinforcing Shop Drawings	A Minimum of Twenty-One (21) Days Prior to Construction
03 20 00	2.3.2	Reinforcing Steel Quality Control Mill Test Report	Upon Request
03 20 00	3.4.5	Deviation from Reinforcing Placement	A Minimum of Fourteen (14) Days Prior to Construction
03 30 00 03 30 00 03 37 13 03 30 00 03 30 00 03 01 31 03 01 31 03 01 31 03 01 32 03 01 32 03 01 32	1.7 3.6 1.8 1.8.4 3.6 1.6 1.8 1.10 1.6 1.7 1.9	Concrete Submittals	Per the Specifications
03 30 00	3.15.2.8	Comprehensive Concrete Quality Control Report	Weekly

SPEC ID	Clause	Submittal	Submittal Schedule
04 03 41	1.6	Stone Repair Submittals	Per the Specifications
04 05 12	1.5	Grout Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing Work
05 50 00	1.6.1	Metal Fabrication Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing Fabrication
05 50 00	1.7.1	Metal Fabrication Quality Control Mill Reports	Upon Request
05 12 33	1.5	Removable Bridge Submittals	Per the Specifications
05 56 00	1.6	Crane Rail Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing Work
05 56 00	3.1	Rail Survey	Just prior to commencing work
09 97 19	1.6.1	Coating Submittals	A Minimum of Twenty-Eight (28) Days Prior to Application
20 05 05	1.4	Mechanical Submittals	Per the Specifications
35 59 29	1.8	Mooring Devices Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing Fabrication
35 59 29	1.9	Mooring Devices Certification	Per the Specifications
26 05 00 26 05 00 26 05 00 26 05 00	1.4 2.2.2 3.7.1.3 3.7.5.1	Electrical Submittals	Per the Specifications
26 05 20 26 05 21 26 05 27	1.5 1.5 1.5	Product Data and Shop Drawings	A Minimum of Twenty-Eight (28) Days Prior to the work.

SPEC ID	Clause	Submittal	Submittal Schedule
26 05 31	1.5	Splitters, Junction Boxes, Pullboxes and Cabinets Product Data and Shop Drawings	Per the Specifications
26 28 21	1.4	Time current curves	Per the Specifications
26 29 23.01 27 05 15 28 31 00	1.4 1.6 1.8	Product Data and Shop Drawings	Per the Specifications
26 05 43.01	1.4	Cables in Trenches and Ducts Product Data	Per the Specifications
31 23 33.01	1.6.1	Soil Management Plan	A Minimum of Twenty-Eight (28) Days Prior to Commencing Upland Bulk Excavation Work
31 24 15 31 24 15 31 24 15 31 24 15 31 24 15	2.1.2 2.1.4 2.2.3 2.2.5 3.3.1	General Fill Source and Quality Control Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing the Placement of General Fill Material
31 68 00	1.6.1	Temporary Anchors	Minimum Fourteen (14) days prior to rock excavation
31 68 00	1.6.2	Permanent Anchors	Minimum Twenty-Eight (28) days prior to relevant concrete work
32 11 16.01 32 11 16.01	2.1.3 2.1.5	Granular Sub-Base Source and Quality Control Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing the Placement of Granular Sub-Base
32 11 23	2.1.3 2.1.5	Aggregate Base Courses Source and Quality Control Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing the Placement of Granular Base

SPEC ID	Clause	Submittal	Submittal Schedule
32 12 13.16	1.6	Asphalt Tack Coat Samples	A Minimum of Fourteen (14) Days Prior to Commencing Work
32 12 13.16	1.6.4	Asphalt Tack Coat Test Data and Certification	Upon Request
32 12 13.23	1.6	Asphalt Prime Coat Samples	A Minimum of Fourteen (14) Days Prior to Commencing Work
32 12 13.23	1.6.4	Asphalt Prime Coat Test Data and Certification	Upon Request
32 12 16 32 12 16	1.6 3.1.2.9	Asphalt Paving Submittals	A Minimum of Twenty-Eight (28) Days Prior to Commencing Work
22 05 00 22 05 01 22 15 00	Part 6 Part 9 1.B	Plumbing Submittals	Per the Specifications
22 10 10	2.2	Plumbing Pumps Product Data	Per the Specifications
22 13 18	1.6.1	Drainage Waste Test Data and Material Certification	A Minimum of Twenty-Eight (28) Days Prior to Commencing Work
22 13 18	1.7.1	Drainage Waste Piping Shop Drawings	Per the Specifications
22 15 00	1.E.7	Compressed Air System Quality Assurance Program	Within Twenty-One (21) Days of Notice of Award
22 15 00	1.F.1	Compressed Air System Trade Qualifications	Within twenty-one (21) days of Notice of Award
33 05 13 33 05 13	1.6 2.1.9	Manholes and Catchbasins Material Certification	A Minimum of Twenty-Eight (28) Days Prior to Commencing Work

SPEC ID	Clause	Submittal	Submittal Schedule
33 11 16	1.7	Water Utility Distribution Pipe Material Certification	A Minimum of Twenty-Eight (28) Days Prior to Commencing Work
33 11 16	1.6	Water Utility Distribution Piping Shop Drawings and Product Data	A Minimum of Twenty-Eight (28) Days Prior to Commencing Work
33 41 00	1.7	Storm Utility Drainage Pipe Material Certification	A Minimum of Fourteen (14) Days Prior to Commencing Work
33 41 00	1.8	Storm Utility Drainage Pipe Shop Drawings and Details	A Minimum of Twenty-Eight (28) Days Prior to Commencing the Construction of Any Permanent Stormwater Drainage Facilities
33 65 73	1.6	Duct Bank Details and Shop Drawings	A Minimum of Twenty-Eight (28) Days Prior to Commencing the Construction of Any Concrete Duct Banks

Table 2 – Progress Submittals

SPEC ID	Clause	Submittal	Submittal Schedule
01 31 19	1.7.1.3	Notice of Progress Meetings	A Minimum of Two (2) Working Days in Advance
01 31 19	1.7.2.1	Progress Meetings Minutes	Within Three (3) Working Days of Meeting
01 32 16.06 01 32 16.06	1.8.5 1.17.6	Construction Detail Schedule Updates	At or Just Before Each Weekly Construction Progress Meeting
01 32 16.06	1.17.12	Report on Construction Detail Schedule	Monthly
01 32 16.06	1.17.8	2-Week Look Ahead Schedule	At One (1) Week Intervals
01 32 16.06	1.16.4	Written Submission for Contract Extension	When Required
01 32 16.06	1.17.5	Work Breakdown Structure (WBS) Update and Reissue	When Required
01 32 16.06	1.12.2	Monthly Cash-Flow Estimate	Monthly
01 33 00	1.9.1	Photographic Documentation	Monthly
01 11 55	1.5.4	Daily Construction Report	Daily
01 11 55	1.5.36	Weekly Construction Report	Weekly
01 11 55	1.12.2	Notice of After Hours Work	Minimum of 48 hours
01 11 55	1.7.3	Proposed Public Notifications and Communication Materials	For Approval prior to Issuance or Use
01 11 55	1.7.7	Log of Public/Media Communications Sent and Received by Contractor	Monthly
01 11 55	1.21.4	Location of Various Services and Equipment: Field Drawings or Shop Drawings	When Required

SPEC ID	Clause	Submittal	Submittal Schedule
01 11 55 01 11 55	1.25.2.2.5 1.25.2.2.6	Works Coordination: Coordination Drawings, Shop Drawings, Product Data	After Coordination Meeting
03 30 00	3.15.2.5	Delivery Slips	Per the Specifications
03 30 00	3.15.2.8	Quality Control Report	Weekly
22 13 18	1.8.2	Notice of Planned/Accidental Sanitary Piping Interruptions	Fourteen (14) Days Prior to Planned Interruption/Immediately After Accidental Interruption
26 05 00 26 05 00	1.4.6 3.7.5.1	Electrical Quality Control Field Report	Within 3 Days of Field Review
26 05 43.01	3.4.6	Installation of Cables Quality Control Test Results	Per the Specifications
27 05 15	3.1.2	Fibre Optic System OTDR Test Results	Prior to proceeding with use
28 31 00	1.9.1	Fire Detection and Alarm Inspection Reports	Per the Specifications
31 23 33.01	2.1.3	Backfilling Quality Control Test Reports	Prior to Placement of Subject Material in the Work

SPEC ID	Clause	Submittal	Submittal Schedule
33 11 16	1.8.3	Notice of Planned/Accidental Water Supply Interruptions	Fourteen (14) Days Prior to Planned Interruption/Immediately After Accidental Interruption
33 11 16 33 41 00	2.8.2 2.3.4	Notice of Proposed Material Source	A Minimum of Twenty-Eight (28) Days Prior to Material Placement
33 11 16	3.8.2	Notice of Hydrostatic and Leakage Testing	A Minimum of Twenty-Four (24) Hours Before Testing
22 05 00 22 05 01	Part 10.1.1 6.1	Plumbing Quality Control Field Report	Per the Specifications
22 11 00	4.3.3	System Flush Sample	Per the Specifications
33 11 16	2.8.4	Water Utility Distribution Piping Bedding Compaction Quality Control Tests	For Review and Approval Prior to Placement of Subject Material in the Work
33 11 16	3.12.4	Field Megohmmeter Test Reports	Per the Specifications
01 35 13.43	1.17.5	Wastewater Treatment and Disposal Test Results	When required
33 41 00	2.3.6	Storm Utility Distribution Piping Bedding Compaction Quality Control Tests	For Review and Approval Prior to Placement of Subject Material in the Work
33 65 73	2.1.4	Duct Bank Bedding Compaction Quality Control Tests	For Review and Approval Prior to Placement of Subject Material in the Work
01 35 33	1.5.3.4	Copies of Incident and Accident Reports	When required

SPEC ID	Clause	Submittal	Submittal Schedule
01 45 00	1.5.2	Inspection and Laboratory Test Reports	Within Two (2) Days of Receipt
01 45 00	1.11.2	Submit Samples or Materials Required for Testing	Per the Specifications

Table 3 – Post-Construction Submittals

SPEC ID	Clause	Submittal	Submittal Schedule
26 29 23.01	1.5	Digital Metering Closeout Submittals	Per the Specifications
28 31 00	1.7	Fire Detection and Alarm Closeout Submittals	Per the Specifications
01 11 55 01 78 00 01 78 00 33 11 16 22 05 00	1.31.2 1.8.3 1.11 1.9 5.5	Record Drawings	Two (2) Weeks Before Substantial Performance
04 03 41	1.7	Stone Repair Closeout Submittals	Per the Specifications
01 78 00	1.11.4.1	Pre-Construction Survey	Per the Specifications
01 78 00	1.11.4.2	Post- Construction Surveys	Per the Specifications
01 78 00 01 78 00 01 78 00	1.12 1.14.5 1.15.5	Receipt of Delivered Products	Per the Specifications
01 78 00	1.14.4	Inventory Listing of Spare Parts	Per the Specifications
01 78 00	1.15.4	Inventory Listing of Maintenance Materials	Per the Specifications
01 78 00	1.16.4	Inventory Listing of Special Tools	Per the Specifications
01 78 00	1.18.1	Certificate of Completion	Per the Specifications

SPEC ID	Clause	Submittal	Submittal Schedule
01 91 13	1.9.1.1	Cx Procedures	Submit and Obtain Written Approval at Least Four (4) Weeks Prior to Start of Cx
01 78 00 33 11 16 33 41 00 26 05 00 26 29 23.01 28 31 00 22 05 00 22 13 18	1.8.3 3.13 3.10 3.7.5.2 1.5.2 1.9 5.3.2 4.5.1	Operations and Maintenance Manuals	Per the Specifications
05 12 33	3.4	Removable Bridge Submittals	Per the Specifications
01 91 13	1.7.2.4	Start-Up Documentation	Prior to Start of Cx
31 68 00	1.6.3	Installation and testing reports	Per the Specifications

1.6 SHOP DRAWINGS AND PRODUCT DATA

.1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.

.2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of British Columbia.

.3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.4 Allow 7 days for Departmental Representative's review of each submission.

.5 Adjustments made on shop drawings by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in shop drawings as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.7 Accompany submissions with transmittal letter, in [duplicate], containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each shop drawing, product data and sample.

.5 Other pertinent data.

.8 Submissions include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.5 Details of appropriate portions of Work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions, including identified field dimensions, and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.9 After Departmental Representative's review, distribute copies.

.10 Submit one electronic copy of shop drawings for each requirement requested in specification Sections and as Departmental Representative may reasonably request.

.11 Submit one electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.12 Submit one electronic copy of test reports for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within [3] years of date of contract award for project.

.13 Submit one electronic copy of certificates for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit one electronic copy of manufacturer’s instructions for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit one electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.16 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.17 Submit one electronic copy of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.18 Delete information not applicable to project.

.19 Supplement standard information to provide details applicable to project.

.20 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, [transparency] [copies] will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.21 The review of shop drawings by Public Works and Government Services Canada (PWGSC) is for sole purpose of ascertaining conformance with general concept.

.1 This review shall not mean that PWGSC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.

.2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.7 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

.2 Deliver samples prepaid to Departmental Representative's site office.

.3 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.6 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

.7 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.8 MOCK-UPS

.1 Erect mock-ups in accordance with [01 45 00 - Quality Control].

1.9 PHOTOGRAPHIC DOCUMENTATION

.1 Submit electronic copies of colour digital photography in jpg format, standard resolution monthly with progress statement to Departmental Representative.

.2 Project identification: name and number of project and date of exposure indicated.

.3 Number of viewpoints: 2 locations.

.1 Viewpoints and their location as determined by Departmental Representative.

.4 Frequency of photographic documentation: monthly.

.1 Upon completion of: excavation, and other work as directed by Departmental Representative.

1.10 CERTIFICATES AND TRANSCRIPTS

.1 Immediately after award of Contract, submit Work Safe BC status.

.2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes special procedures that are applicable for work performed at contaminated sites, such as the Contractor's Work Site. The soils at Esquimalt Graving Dock are known potentially to contain contaminants. Contractor shall be responsible for adhering to these special procedures while completing all work under this Contract. Refer to Appendix C for the project specific Soil Classification Report.

.2 Other Sections of the Specification, the EMP, the EGD Environmental Best Management Practices (EBMPs), and the EGD Environmental Policy throughout the work and Project Permits may also contain specific requirements for environmental protection. These documents are to be reviewed and complied with by Contractor. Those specific requirements are in addition to the requirements in this section. In the event of a perceived difference or discrepancy between the EMP, EBMP's, Contract Specifications, and the provisions of any applicable legislation, regulations, or municipal bylaws, the more stringent provisions resulting in the higher degree of environmental protection and safety, and the lower discharge of contaminants, will prevail. The control of environmental pollution requires consideration of noise levels, air, water, and land.

.3 Contractor shall review and understand, and abide by, the EGD Environmental Best Management Practices (EBMPs) and the EGD Environmental Policy during completion of the work. The EGD EBMPs and Environmental Policy are included as reference documents to these Specifications.

.4 All work shall comply with applicable local, Municipal, Provincial and Federal Acts, Laws and Regulations. In the case of conflict or discrepancy, the most stringent shall apply.

.5 Contractor shall comply with the conditions of all permits issued for completion of this project.

.6 Contractor is responsible for environmental protection during all construction activities at all locations where it performs work. Work locations include, but are not limited to, the Contractor's Work Site. This Section primarily addresses work conducted at the Contractor's Work Site, but Contractor is responsible for complying with federal, provincial, or municipal and local legislation environmental laws, regulations, and permits at all locations that are used.

.7 Contractor is responsible for its actions if they result in contamination of areas within the Contractor's Work Site or within the EGD, EGD Waterlot, or areas outside the EGD Waterlot. Contingency action to clean up uncontaminated areas

that are contaminated as a result of Contractor operations will be the responsibility of Contractor at Contractor's own cost.

1.2 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 01 33 00 (Submittal Procedures)

.3 Section 01 35 43 (Environmental Procedures and Sustainability)

.4 Section 01 74 11 (Cleaning)

.5 Section 02 55 10 (Dust Control)

.6 Section 02 61 00.01 (Contaminated Sites Water Treatment – Onsite)

.7 Section 02 61 00.08 (Contaminated Sites Water Treatment – Offsite).

.8 Section 31 23 33.01 (Excavating, Trenching, and Backfilling)

1.3 MEASUREMENT AND PAYMENT

.1 No separate payment will be made for Special Procedures for Contaminated Sites.

1.4 DEFINITIONS

.1 Refer to Section 01 11 55 (General Instructions) for definitions.

1.5 SUBMITTALS

.1 Submit, within twenty-eight (28) calendar days following Contract award, an Environmental Protection Plan (EPP) for Departmental Representative review and acceptance; see Section 01 35 43 (Environmental Procedures and Sustainability) and further requirements elsewhere in this Section of the Specification for required submittal information. The EPP shall meet the requirements outlined in the Environmental Management Plan (EMP), refer to Appendix C.

.1 Wastewater Management and Disposal Plan (WWMDP). Submit a WWMDP as a section of the EPP.

.2 Pollution Control Plan (PCP). Submit a PCP as a section of the EPP.

.3 Stormwater Pollution Prevention Plan (SWPPP). Submit a SWPPP as a section of the EPP.

.4 Temporary Erosion and Sedimentation Control Plan (TESCP). Submit a TESCP as a section of the EPP.

.2 Site Layouts: Prior to mobilization to Contractor's Work Site, and as part of the EPP; submit site layout drawings for the Contractor's Work Site, showing existing conditions and facilities, construction temporary facilities, and temporary controls provided by Contractor including the following:

.1 Equipment and Personnel decontamination areas.

.2 Means of ingress, egress, and temporary traffic control facilities.

.3 Equipment and materials staging areas.

.4 Exclusion zones, and other zones specified in Contractor's site-specific Health and Safety Plan.

.5 Grading, including contours, required to construct temporary facilities.

.6 Wastewater collection and storage areas or facilities as necessary.

.7 Wastewater Treatment and Disposal Facilities as necessary.

.3 Provide documentation that disposal facilities have the required authorization to accept the class of material encountered at the site and provide documentation that the disposal facility is willing to accept the class of material encountered at the site.

1.6 SEQUENCING AND SCHEDULING

.1 Do not commence work involving contact with potentially contaminated or hazardous materials until all environmental controls (including, but not limited to decontamination facilities) are operational and accepted by the Departmental Representative.

1.7 WASTEWATER MANAGEMENT AND DISPOSAL

.1 Refer to Section 02 61 00.01 (Contaminated Sites Water Treatment – Onsite) and Section 02 61 00.08 (Contaminated Sites Water Treatment – Offsite).

1.8 VEHICULAR ACCESS

.1 Maintenance and use at Contractor's Work Site:

.1 Prevent contamination of access roads. Immediately scrape up debris or material on access roads that is suspected to be contaminated as determined by Departmental Representative; transport and place into designated area accepted by Departmental Representative. Clean access roads at least once per shift.

1.9 DUST AND PARTICULATE CONTROL

.1 Complete dust control activities according to means and methods presented in Section 02 55 10 (Dust Control).

1.10 POLLUTION CONTROL

.1 Describe Contractor's approach, equipment, and methods to control pollution during construction activities in a PCP as part of the EPP.

.2 Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious toxic substances and pollutants produced by construction operations.

.3 Be prepared to intercept, clean up, and dispose of spills or releases that may occur whether on land or water. Maintain materials and equipment required for cleanup of spills or releases readily accessible on site.

.4 Promptly report spills and releases potentially causing damage to environment, as specified by the EMP and EBMP. Contractor shall review and understand, and abide by, the EGD EBMPs and EMP for spill response during completion of the work.

.5 Contractor shall make available the Material Safety Data Sheets (MSDS) at the Contractor's Work Site for the list of known pollutants that are being used at the Contractor's Work Site as part of the work. Contact manufacturer of pollutant if known and ascertain hazards involved, precautions required, and measures used in cleanup or mitigating action.

.6 Take immediate action using the necessary resources to contain and mitigate effects on environment and persons from spill or release. In addition, comply with EGD Spill Contingency Plan for work at the Contractor's Work Site.

.7 Provide spill response materials including containers, adsorbent, shovels, and personal protective equipment (PPE). Make spill response materials available at all times in which hazardous materials or wastes are being handled or transported.

1.11 TRANSPORTATION OF CONTAMINATED MATERIALS FROM CONTRACTOR'S WORK SITE

.1 Contractor shall assume responsibility and include all costs for excavation, testing (as necessary), transport and disposal of all excavated soils as part of the project. For bidding purposes, all excavated soil shall be considered to be classified as per the project specific Soil Classification Report contained in Appendix C. The Contractor shall be responsible for all testing of soils as necessary for health and safety, transport, disposal, and compliance with Laws and Regulations. In-situ testing or test-pitting prior to excavation will be permitted.

1.12 PROGRESS CLEANING

.1 Maintain cleanliness of work and surrounding the Contractor's Work Site to comply with federal, provincial, and local fire and safety laws, ordinances, codes, and regulations. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the Contractor's Work Site.

.2 Coordinate cleaning operations with disposal operations to prevent accumulation of dust, dirt, debris, rubbish, and waste materials.

1.13 FINAL DECONTAMINATION

.1 Perform final decontamination of construction facilities, equipment, and materials which may have come in contact with potentially contaminated materials prior to removal from the Contractor's Work Site.

.2 Perform decontamination as specified to satisfaction of Departmental Representative. Departmental Representative will inform Contractor to perform additional decontamination if required at Contractor's own cost.

1.14 REMOVAL AND DISPOSAL

.1 Remove surplus materials and temporary facilities from the Contractor's Work Site.

.2 Dispose of non-contaminated waste materials, litter, debris, and rubbish off site.

.3 Do not burn or bury rubbish and waste materials at the Contractor's Work Site.

.4 Do not dispose of volatile or hazardous wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.

.5 Do not discharge wastes into streams or waterways.

.6 Dispose of following materials at appropriate permitted Disposal Facility, Hazardous Waste Management Facility, or Wastewater Treatment and Disposal Facility identified by Contractor and in accordance with the content of these Specifications:

.1 Debris including excess construction material.

.2 Non-contaminated litter and rubbish.

.3 Disposable PPE worn during final cleaning.

.4 Wastewater removed from wastewater storage tank.

.5 Wastewater generated from final decontamination operations including wastewater storage tank cleaning.

.7 Minimize generation of Hazardous Waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

1.15 RECORD KEEPING

.1 Maintain bills of ladings and waste manifests for minimum of 365 days (one year) from date of shipment or longer period required by applicable law or regulation. These documents should also be provided to Departmental Representative.

1.16 ENVIRONMENTAL MANAGEMENT PLAN

.1 An EMP has been prepared for this Contract and is provided in an Appendix to the Specification. Specific clauses related to Contractor completion of activities associated with this project are cited in this Section of the Specification. Contractor shall also be responsible for reviewing and understanding the EMP,

and conducting all construction activities in accordance with the requirements of the EMP, Project Permits, and the Specification. Contractor shall use the EMP as a reference during development of the EPP.

1.17 WASTEWATER TREATMENT AND DISPOSAL

.1 Describe Contractor's approach, equipment, and methods to install, maintain, and operate the Wastewater Treatment and Disposal Facility in the WWMDP as part of the EPP.

.2 Design and Operating Criteria: Design water filtering plant capable of filtering waste water generated from upland dewatering, sanitary wastewater, and equipment decontamination activities to meet discharge requirements of authority having jurisdiction; including permits.

.1 Ensure that discharges from the Contractor's Work Site meet the water quality performance objectives of the EMP and Project Permits.

.2 Design water filtering operations capable of receiving liquid/solid mixtures and not causing delay to operations.

.3 Piping: Suitable material type, of sufficient diameter and structural thickness for purpose intended; satisfactorily tested for leaks with potable water in presence of Departmental Representative before handling wastewater.

.4 Installation: Provide labour, materials, and equipment and do work required for setup and construction of water filtering plant.

.5 Initial Testing (if applicable): Performance of Wastewater Treatment and Disposal Facility provided by Contractor may be inspected by Departmental Representative. Contractor shall submit treatment test results to Departmental Representative and other permitting authorities as applicable for review and the Contractor shall submit the facility's permit to treat and dispose or discharge treated wastewater. The Contractor may use a new Wastewater Treatment and Disposal Facility that is constructed for project purposes or an existing permitted Wastewater Treatment and Disposal Facility.

.6 Operation:

.1 On basis of analytical results reviewed by Departmental Representative, make system modifications required for effluent to satisfy effluent criteria, or continue with normal dewatering operations.

.2 Operate Wastewater Treatment and Disposal Facility by experienced, qualified personnel in accordance with manufacturer's instructions and procedures submitted by Contractor and reviewed by Departmental Representative.

.7 Decommissioning/dismantling:

.1 Decontaminate and remove salvageable components of water filtering plant including water filtering system, pumps, piping, and electrical equipment.

.2 Dispose of non-salvageable equipment and materials at the permitted Disposal Facility.

1.18 UPLAND WATER CONTROL AT CONTRACTOR'S WORK SITE

.1 This section applies to over-land water control (i.e. stormwater and surface water control, precipitation and run-off) for management of construction water at the Contractor's Work Site.

.2 Contractor shall prepare and submit a SWPPP and submit to Departmental Representative as part of the EPP. The SWPPP shall describe the following:

.1 Protect the Contractor's Work Site from puddling or running water. Grade areas to drain. Provide water barriers as necessary to protect the areas from soil erosion.

.2 Prevent surface water runoff from leaving work areas.

.3 Do not discharge decontaminated water, or surface water runoff, or groundwater that may have come in contact with potentially contaminated material, off site or to municipal sewers.

.4 Direct surface waters that have not contacted potentially contaminated materials and does not contain entrained solids to existing surface drainage systems.

.5 Control surface drainage including ensuring that gutters are kept open, water is not directed across or over pavements or sidewalks except through accepted pipes or properly constructed troughs, and runoff from un-stabilized areas is intercepted and diverted to suitable outlet.

.6 Dispose of water in manner not injurious to public health or safety, to the environment, or to any part of work completed or under construction.

.7 Provide, operate, and maintain necessary equipment appropriately sized to keep excavations, staging pads, and other work areas free from water.

.8 Contain water from decontamination facilities. Transfer potentially contaminated decontamination waters to wastewater storage tanks separate from wastewater from personnel hygiene/decontamination facility.

.9 Have on hand sufficient pumping equipment, machinery, and tankage in good working condition for ordinary emergencies, including power outage, and competent workers for operation of pumping equipment.

.10 Contain and collect wastewaters and transfer such collected wastewaters to Contractor-supplied drums, wastewater storage tanks, or Contractor's Work Site treatment facility.

1.19 TEMPORARY EROSION AND SEDIMENT CONTROL AT THE CONTRACTOR'S WORK SITE

.1 Contractor shall prepare and submit a TESCP to the Departmental Representative as part of the EPP. The TESCP shall address potential erosion and sediment control measures if required for construction activities at the Contractor's Work Site, and discuss the following as applicable:

.1 Plan to execute construction by methods to control surface drainage from cuts and fills, borrow and waste disposal areas, stockpiles, staging areas, and other work areas. Prevent erosion and sedimentation.

.2 Minimize amount of bare soil exposed at one time. Stabilize disturbed soils as quickly as practical. Strip vegetation, regrade, or otherwise develop to minimize erosion. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems, and water courses, and repair damage caused by soil erosion and sedimentation as directed by Departmental Representative.

.3 Provide and maintain temporary measures which may include, concrete blocks, hay or straw bales, geotextiles, drains, berms, terracing, riprap, temporary drainage piping, dikes, and other construction required to prevent erosion and migration of silt, mud, sediment, and other debris off site or to other areas of site where damage might result, or that might otherwise be required by laws and regulations. Make sediment control measures available during construction.

.4 Hay or Straw Bale: Wire-bound or string-tied; securely anchored by at least two (2) stakes or rebars driven through bale 300 mm to 450 mm into ground; chinked (filled by wedging) with hay or straw to prevent water from escaping between bales; and entrenched minimum of 100 mm into ground.

.5 Geotextile: Uniform in texture and appearance, having no defects, flaws, or tears that would affect its physical properties; and containing sufficient ultraviolet ray inhibitor and stabilizers to provide minimum 2-year service life from outdoor exposure.

.6 Net Backing: Industrial polypropylene mesh joined to geotextile at both top and bottom with double stitching of heavy-duty cord, with minimum width of 750 mm.

.7 Plan construction procedures to avoid damage to work or equipment encroachment onto water bodies or drainage ditch banks. In event of damage, promptly take action to mitigate effects. Restore affected bank or water body to existing condition.

.8 Installation:

.1 Construct temporary erosion control items as indicated. Actual alignment and/or location of various items as directed by Departmental Representative.

.2 Check erosion and sediment control measures daily after each rainfall.

.3 Whenever sedimentation is caused by stripping vegetation, regrading, or other development, remove it from adjoining surfaces, drainage systems, and watercourses, and repair damage as quickly as possible.

.4 Prior to or during construction, Departmental Representative may require installation or construction of improvements to prevent or correct temporary conditions on site. Temporary improvements must remain in place and in operation as necessary or until otherwise directed by Departmental Representative.

.5 Repair or replace damaged bales, end runs, and undercutting beneath bales.

.6 Unless otherwise directed by Departmental Representative, remove temporary erosion and sediment control devices upon completion of work. Spread accumulated sediments to form a suitable surface for seeding or dispose of, and shape area to permit natural drainage to satisfaction of Departmental Representative. Materials once removed become property of Contractor.

.9 Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

.10 Do not disturb existing embankments or embankment protection.

.11 Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

.12 If soil and debris from site accumulate in low areas, storm sewers, roadways, gutters, ditches, or other areas where, in Departmental Representative's determination, it is undesirable, remove accumulation and restore area to original condition.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOTIFICATION OF NON-COMPLIANCE

.1 Departmental Representative will notify Contractor, in writing, of observed noncompliance with federal, provincial, or municipal and local environmental laws or regulations, permits, and other elements of Contractor's EPP. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the Contractor's Work Site.

.2 Any regulatory fees or penalties that result from non-compliance with these regulations shall be the sole responsibility of Contractor to pay.

.3 Notwithstanding this notification process, Contractor shall be responsible for conducting all construction activities in a manner compliant with these regulations.

.4 Contractor shall inform Departmental Representative of proposed corrective action after receipt of such notice, and take such action for approval by Departmental Representative.

.5 Departmental Representative will issue a stop work order until satisfactory corrective action has been taken.

.6 No time extensions shall be granted or equitable adjustments allowed to Contractor for such suspensions.

3.2 IMPLEMENTATION

.1 At the Pre-Construction Meeting, Departmental Representative and Contractor shall discuss Contractor’s operations to develop mutual understandings relative to the administration of the environmental protection program.

.2 Supervision:

.1 During the work, all activities, including those of subcontractors, shall be supervised by Contractor to assure compliance with the intent and details of the EPP.

.2 Contractor shall discuss environmental compliance at daily tailgate meetings and Weekly Progress Meeting for itself and its subcontractors to assure that all personnel working at the Contractor's Work Site are familiar with the environmental protection provisions.

.3 All equipment and materials for environmental protection shall be inspected every week, at a minimum, to ensure that they are in proper order, being applied correctly, and have not deteriorated.

.4 Contractor shall provide to Departmental Representative a written inspection report as part of the weekly construction report documenting the condition of the equipment and materials.

3.3 PROTECTION OF FISH AND WILDLIFE

.1 All work shall be performed and all steps taken to prevent interference or disturbance to fish and wildlife.

.2 Water flows or habitat outside the Contractor's Work Site that are critical to fish or wildlife shall not be altered or disturbed.

3.4 DUST CONTROL

.1 Dust control shall be performed as the work proceeds, whenever a dust nuisance or hazard occurs.

3.5 MAINTENANCE OF POLLUTION CONTROL FACILITIES

.1 Contractor shall maintain all constructed facilities and portable pollution control devices for the duration of the Contract or for that length of time construction activities create the particular pollutant.

3.6 TRAINING OF CONTRACTOR PERSONNEL

.1 Contractor personnel shall be trained in environmental protection and pollution control as required by applicable federal, provincial, and local requirements. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the Contractor's Work Site.

.2 Contractor shall conduct environmental protection/pollution control meetings for all Contractor personnel.

.3 The training and meeting agenda shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and maintenance of facilities and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control. Anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants, shall also be discussed.

END OF SECTION

1 GENERAL

PWGSC Update on Asbestos Use
Effective April 1, 2016, all Public Works and Government Services of Canada (PWGSC) contracts for new construction and major rehabilitation will prohibit use of asbestos-containing materials.

COVID-19
All contractors shall follow Canadian Construction Association COVID-19 - Standardized Protocols for All Canadian Construction Sites, Provincial Regulations, and EGD site specific COVID-19 Procedures.

1.1 REFERENCES

.1 Government of Canada.

.1 Canada Labour Code - Part II (as amended)

.2 Canada Occupational Health and Safety Regulations (as amended)

.2 National Building Code of Canada (NBC): (as amended)

.1 Part 8, Safety Measures at Construction and Demolition Sites.

.3 The Canadian Electrical Code (as amended)

.4 Canadian Standards Association (CSA) as amended:

.1 CSA Z797-2018 Code of Practice for Access Scaffold.

.2 CSA S269.1-2016 Falsework for Construction Purposes.

.3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures.

.4 CSA Z1006-10 Management of Work in Confined Spaces.

.5 CSA Z462-18 Workplace Electrical Safety Standard

.5 National Fire Code of Canada 2015 (as amended)

.1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required.

.6 American National Standards Institute (ANSI): (as amended)

.1 ANSI/ASSP A10.3-2013, Operations – Safety Requirements for Powder-Actuated Fastening Systems.

.7 Province of British Columbia:

.1 Workers Compensation Act Part 3-Occupational Health and Safety. (as amended)

.2 Occupational Health and Safety Regulation (as amended)

.8 NMS Section 00 10 10 Specification Index (Appendix A thru Appendix F)

.9 Esquimalt Graving Dock (EGD) Contractors Safety Booklet (as amended)

1.2 RELATED SECTIONS

.1 Refer to the current NMS sections as indicated in Section 001010 Specification Index, including Appendices.

1.3 WORKERS' COMPENSATION BOARD COVERAGE

.1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.

.2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 COMPLIANCE WITH REGULATIONS

.1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.

.2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.5 SUBMITTALS

.1 Submit to Departmental Representative submittals listed for review in accordance with Section 01 33 30.

.2 Work affected by submittal shall not proceed until review is complete.

.3 Submit the following:

.1 Organizations Health and Safety Plan.

.2 Site Specific Safety Plan or Health and Safety Plan (SSSP or HASP)

.3 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.

.4 Copies of incident and accident reports.

.5 Complete set of Material Safety Data Sheets (SDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS 2015) requirements.

.6 Emergency Response Plan and Emergency Evacuation Plan and Procedures.

.4 The Departmental Representative will review the Contractor's Site Specific Safety Plan or Health and Safety Plan (SSSP/HASP) and emergency response procedures, and provide comments to the Contractor within 5 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.

.5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental Representative.

.6 Submission of the Site Specific Safety Plan or Health and Safety Plan, and any revised version, to the Departmental Representative is for information and reference purposes only. It shall not:

.1 Be construed to imply approval by the Departmental Representative.

.2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.

.3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.6 RESPONSIBILITY

.1 Assume responsibility as the Prime Contractor for work under this contract.

.2 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they

may be affected by conduct of Work.

.3 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable Federal, Provincial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

.4 All contractor workers shall attend an EGD Safety Orientation prior to ant work starting.

.5 The contractor is responsible for reviewing the Esquimalt Graving Dock (EGD) Contractors Safety Handbook and ensuring that the Site Specific Safety Plan and/or Health and Safety Plan are harmonized with the EGD Contractors Safety Handbook.

1.7 HEALTH AND SAFETY COORDINATOR

.1 The contractor must assign a competent and qualified Health and Safety Coordinator who shall:

.1 Be responsible for completing all health and safety training, and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.

.2 Be responsible for implementing, daily enforcing, and monitoring the Site Specific Safety Plan (SSSP) or Health and Safety Plan (HASP)

.3 Be on site during execution of work.

.4 Have minimum two (2) years' site-related working experience

.5 Have working knowledge of the applicable occupational safety and health regulations.

1.8 GENERAL CONDITIONS

.1 Provide safety barricades and lights around work site as required to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.

.2 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.

.1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.

.2 Secure site at night time or provide security guard as deemed necessary to protect site against entry.

1.9 PROJECT/SITE CONDITIONS

.1 Work at site will involve contact with:

.1 PWGSC and other Federal employees,

.2 EGD (federal) operational staff,

.3 Ship repair and other contractors,

.4 Work over and under water, Protection Against Drowning, Refer to COHS Section A Part X11-Safety Materials, Equipment, Devices and Clothing – Section 12.11 inclusive.

.5 Overhead cranes,

.6 Work at heights, **(2.4m on Federal Property)**

.7 Unpredictable weather conditions,

.8 Threat of tsunami and earthquake,

.9 Confined space and restricted access space,

.10 Work in accordance with Section 01 35 13.43 - Special Procedures for Contaminated Sites.

.11 Conditions identified in PWGSC Preliminary Hazard Assessment, see Appendix A.

1.10 UTILITY CLEARANCES

.1 The Contractor is solely responsible for all utility detection and clearances prior to starting the work.

.2 The Contractor will not rely solely upon the Reference Drawings or other information provided for Utility locations.

1.11 REGULATORY REQUIREMENTS

.1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.

.2 In event of conflict between any provision of (.1) above, the authorities having the most stringent provision will apply. Should a dispute arise in determining the most

stringent requirement, the Departmental Representative will advise on the course of action to be followed.

1.12 WORK PERMITS

.1 Obtain specialty permit(s) related to project before start of work.

1.13 FILING OF NOTICE

.1 The General Contractor shall file Notice of Project with Provincial authorities prior to commencement of work. (All PWGSC construction projects require a Notice of Work)

.2 Provide copies of all notices to the Departmental Representative.

1.14 SITE SPECIFIC HEALTH AND SAFETY PLAN

.1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and all project work sites. Identify any known and potential health risks and safety hazards.

.2 Develop, implement, and enforce a Site Specific Safety Plan (SSSP) or Health and Safety Plan (HASP) based on hazard assessment, including, but not limited to, the following:

.1 Primary requirements:

.1 Contractor's safety policy.

.2 Identification of applicable compliance obligations.

.3 Definition of responsibilities for project safety/organization chart for project.

.4 General safety rules for project.

.5 Job-specific safe work, procedures.

.6 Inspection policy and procedures.

.7 Incident reporting and investigation policy and procedures.

.8 Occupational Health and Safety Committee/Representative procedures.

.9 Occupational Health and Safety meetings.

.10 Occupational Health and Safety communications and record keeping procedures.

.11 COVID 19 Protocols and Procedures (National, Provincial and EGD Site Specific)

.12 EGD Contractors Safety Handbook

.2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.

.3 List hazardous materials to be brought on site as required by work. WHMIS 2015 SDS required for all products.

.4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.

.5 Identify personal protective equipment (PPE) to be used by workers.

.6 Identify personnel and alternates responsible for site safety and health.

.7 Identify personnel training requirements and training plan, including site orientation for new workers.

.3 Develop the site specific safety plan or health and/or safety plan in collaboration with all subcontractors. Ensure that work/activities of subcontractors are included in the hazard assessment and are reflected in the plan.

.4 Revise and update Site Specific Safety Plan (SSSP) and/or Health and Safety Plan (HASP) as required, and re-submit to the Departmental Representative.

.5 Departmental Representative's review: the review of Site Specific Safety Plan and/or Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Site Specific Safety Plan and/or Health and Safety Plan of responsibility for meeting all requirements of construction and Contract documents and legislated requirements.

1.15 EMERGENCY PROCEDURES

.1 List standard operating procedures and measures to be taken in emergency situations. Include an emergency response and emergency evacuation plan and emergency contacts (i.e. names/telephone numbers) of:

.1 Designated personnel from own company.

.2 Regulatory agencies applicable to work and as per legislated regulations.

.3 Local emergency resources.

.4 Departmental Representative and Other PWGSC staff as required. (reference: EGD Contractors Safety Handbook)

.5 A route map with written directions to the nearest hospital or medical clinic.

.2 Include the following provisions in the emergency procedures:

.1 Notify workers and the first-aid attendant, of the nature and location of the emergency.

.2 Evacuate all workers safely.

.3 Check and confirm the safe evacuation of all workers.

.4 Notify the fire department or other emergency responders.

.5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.

.6 Notify Departmental Representative and PWGSC site staff.

.3 Provide written rescue/evacuation procedures as required for, but not limited to:

.1 Work at high angles.

.2 Work in confined spaces or where there is a risk of entrapment.

.3 Work with hazardous substances.

.4 Underground work.

.5 Work on, over, under and adjacent to water.

.6 Workplaces where there are persons who require physical assistance to be moved.

.4 Design and mark emergency exit routes to provide quick and unimpeded exit.

.5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

.6 Contractors must not rely solely upon 911 for emergency rescue in a confined space, working at heights, etc.

.7 At least once each year, emergency drills, must be held to ensure awareness and effectiveness of emergency exit routes and procedures, and a record of the drills must be kept

1.16 HAZARDOUS PRODUCTS

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS 2015) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.

.2 Where use of hazardous and toxic products cannot be avoided:

.1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable SDS and WHMIS 2015 documents as per Section 01 33 30.

.2 In conjunction with Departmental Representative schedule to carry out work during "off hours" when tenants have left the building.

.3 Provide adequate means of ventilation in accordance with Section 00 01 10.

.4 The contractor shall ensure that the product is applied as per manufacturers recommendations.

.5 The contractor shall ensure that only pre-approved products are bought onto the site.

1.17 OFF SITE CONTINGENCY and EMERGENCY RESPONSE PLAN

.1 Prior to commencing Work involving handling of hazardous materials, develop off site Contingency and Emergency Response Plan.

2. Plan must provide immediate response to serious site occurrence such as explosion, fire, or migration of significant quantities of toxic or hazardous material from Site.

3. Notification of fire departments [4.17 – Worksafe BC Regulations Part 4 Buildings, Structures, Equipment, and Site Conditions]

(1) An employer having at a workplace hazardous products covered by WHMIS, explosives, pesticides, radioactive material, consumer products or hazardous wastes in quantities which may endanger firefighters, must ensure the local fire department is notified of the nature and location of the hazardous materials or substances and methods to be used in their safe handling.

(2) Subsection (1) does not apply to a workplace

(a) where materials are kept on site for less than 15 days if the employer ensures an alternative effective means for notification of fire departments is in place in the event of fire or other emergency, or

(b) which is not within the service area of a fire department. [Amended by B.C. Reg. 30/2015, effective August 4, 2015.]

1.18. PERSONAL PROTECTIVE CLOTHING and EQUIPMENT

.1 Work shall be performed in compliance with Part 8 - Personal Protective Clothing and Equipment, and Part 5 – Chemical Agents and Biological Agents, (as applicable) Worksafe BC OHS Regulations (as amended)

1.19 ASBESTOS HAZARD

.1 Carry out any activities involving asbestos shall be in accordance with current applicable Federal and Provincial Regulations.

.2 Removal and handling of asbestos shall be in accordance with current applicable Provincial / Federal Regulations (as amended)

1.20 PCB REMOVALS

.1 Mercury-containing fluorescent tubes and ballasts which contain polychlorinated biphenyls (PCBs) are classified as hazardous waste.

.2 Remove, handle, transport and dispose of as indicated in Section 000110 specification index.

1.21 REMOVAL OF LEAD-CONTAINING PAINT

.1 All paint containing TCLP lead concentrations above 5 ppm are classified as hazardous.

.2 Carry out demolition and/or remediation activities involving lead-containing paints in accordance with current applicable Provincial / Territorial Regulations.

.3 Work with lead-containing paint shall be completed as per Provincial and Federal regulations.

.4 Dry Scraping/Sanding of any materials containing lead is strictly prohibited.

.5 The use of Methylene Chloride based paint removal products is strictly prohibited.

1.22 SILICA

.1 Carry out work in accordance with Worksafe BC regulations.

1.23 ELECTRICAL SAFETY REQUIREMENTS (Reference: Worksafe BC OHS Regulation Part 19 – Electrical Safety)

.1 Comply with authorities and ensure that, when installing new facilities or modifying existing facilities, all electrical personnel are completely familiar with existing and new electrical circuits and equipment and their operation.

.1 Before undertaking any work, coordinate arc flash protection, required energizing and de-energizing of new and existing circuits with Departmental Representative.

.2 Maintain electrical safety procedures and take necessary precautions to ensure safety of all personnel working under this Contract, as well as safety of other personnel on site.

.3 Develop, implement and enforce a communication plan with Departmental representative and EGD maintenance staff for all electrical work and lockout procedures.

1.24 ELECTRICAL LOCKOUT

.1 Develop, implement and enforce use of established procedures to provide electrical lockout and to ensure the health and safety of workers for every event where work must be done on any electrical circuit or facility.

.2 Prepare the lockout procedures in writing, listing step-by-step processes to be followed by workers, including how to prepare and issue the request/authorization form. Have procedures available for review upon request by the Departmental Representative.

.3 Keep the documents and lockout tags at the site and list in a log book for the full duration of the Contract. Upon request, make such data available for viewing by Departmental Representative or by any authorized safety representative.

4. Comply with EGD Lockout Policy and Procedures (as amended)

1.25 OVERLOADING

.1 Ensure no part of work is subjected to a load which will endanger its safety or will cause permanent deformation.

1.26 FALSEWORK

.1 Design and construct falsework in accordance with CSA S269.1-1975 (R2003) (as amended)

1.27 SCAFFOLDING

.1 Design, construct and maintain scaffolding in a rigid, secure and safe manner, in accordance with CSA Z797-2009 (as amended) and B.C. Occupational Health and Safety Regulations. (as amended)

1.28 CONFINED SPACES

.1 Carry out work in compliance with current Worksafe BC Part 9 Confined Spaces and CSA Z1006-10 Management of Work in Confined Space.

1.29 RESTRICTED ACCESS

.1 Contractor shall perform a hazard assessment and develop an appropriate restricted access entry and emergency rescue plan in accordance with Worksafe BC regulations.

1.30 CONFINED SPACE AND RESTRICTED SPACE OUTSIDE OF DEFINED WORK SITE

.1 Carry out work in confined spaces in compliance with Worksafe BC Part 9 Confined Spaces and CSA Z1006-10 Management of Work in Confined Space. Coordinate all confined space entry work with PWGSC Departmental Representative through the contractor’s confined space entry permit system.

.2 Contractor shall perform a hazard assessment and develop an appropriate restricted access entry and emergency rescue plan in accordance with Worksafe BC regulations. Coordinate all restricted access space entry work with the Departmental Representative prior to entry.

.3 The Contractor is required to provide a reasonable amount of time to the Departmental Representative for making arrangements for entry and/or access to Confined Space or Restricted Access spaces located outside the designated work site.

1.31 POWDER-ACTUATED DEVICES

.1 Use powder-actuated devices in accordance with ANSI A10.3 (as amended) only after receipt of written permission from the Departmental Representative.

1.32 FIRE SAFETY AND HOT WORK

.1 Obtain Departmental Representative's authorization before any welding, cutting or any other hot work operations can be carried out on site.

.2 Hot work includes cutting/melting with use of torch, flame heating roofing kettles, or other open flame devices and grinding with equipment which produces sparks.

.3 Coordinate all hot work with Departmental Representative through the contractors' hot work permit system. Hot Work permits are a mandatory requirement for any hot work activities.

1.33 FIRE SAFETY REQUIREMENTS

.1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada. (as amended)

.3 Portable gas and diesel fuel tanks are not permitted on most federal work sites. Approval from the Departmental Representative is required prior to any gas or diesel tank being brought onto the work site.

1.34 FIRE PROTECTION AND ALARM SYSTEM

.1 Fire protection and alarm systems shall not be:

.1 Obstructed.

.2 Shut off.

.3 Left inactive at the end of a working day or shift.

.2 Do not use fire hydrants, standpipes and hose systems for purposes other than firefighting.

.3 Be responsible/liable for costs incurred from the fire department, the building owner and the tenants, resulting from false alarms.

1.35 UNFORESEEN HAZARDS

.1 Should any unforeseen or peculiar safety-related factor, hazard or condition become evident during performance of the work, immediately stop work and immediately advise the Departmental Representative verbally and in writing.

1.36 BLASTING OPERATIONS

.1 All blasting operations shall be in accordance with Worksafe BC OHS Regulation Part 21 – Blasting Operations.

1.37 POSTED DOCUMENTS

.1 Post legible versions of the following documents on site:

.1 Site Specific Safety Plan (SSSP) or Health and Safety Plan (HASP)

.2 Sequence of work.

.3 Emergency procedures.

.4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.

.5 Notice of Project.

.6 Floor plans or site plans. Must be posted in a non-inmate access area and locked up when not being used.

.7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.

.8 Workplace Hazardous Materials Information System (WHMIS 2015) documents.

.9 Material Safety Data Sheets (SDS).

.10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.

.11 All Hazardous Material and Substance Reports including Lab Analysis

.2 Post all Safety Data Sheets (SDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.

.3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

1.38 MEETINGS

.1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

1.39 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by the Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.

.3 The Departmental Representative may issue a "stop work order" if noncompliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/subcontractors will be responsible for any costs arising from such a "stop work order".

2 PRODUCTS

.1 Not used.

3 EXECUTION

.1 Not used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes environmental procedures that are required for the Contract. Contractor shall be responsible for adhering to these special procedures while completing all work under this Contract.

.2 Contractor shall review, understand and abide by the EGD Environmental Best Management Practices (EBMPs), the EMP, and the EGD Environmental Policy throughout the work. The EGD EBMPs and Environmental Policy are included as reference documents to the Specification.

.3 Environmental degradation arising from construction activities shall be prevented, abated, controlled, and minimized by complying with all applicable federal, provincial, and local laws and regulations concerning environmental pollution control and abatement, as well as the specific requirements in the Project Permits. Contractor shall comply with all permit conditions. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the EGD Work Site.

.4 Contractor is responsible for environmental protection during all construction activities at all locations it performs work. Work locations include, but are not limited to, the EGD Work Site, and during transport over water and land-based transportation of excavated material. This section primarily addresses work conducted at the EGD Work Site, but Contractor is responsible for complying with environmental protection regulations at all locations that are used.

1.2 MEASUREMENT AND PAYMENT

.1 No separate payment will be made for work associated with environmental procedures and sustainability. Activities associated with environmental procedures and sustainability shall be considered incidental to the work.

1.3 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 01 33 00 (Submittal Procedures)

1.4 DEFINITIONS

.1 Refer to Section 01 11 55 (General Instructions) for all definitions related to the Contract.

1.5 SUBMITTALS

.1 Submittals shall be in accordance with Section 01 33 00 (Submittal Procedures).

.2 Contractor shall submit an Environmental Protection Plan (EPP) for review and acceptance by Departmental Representative within twenty-eight (28) calendar days following Contract award. The EPP shall present the procedures by which Contractor shall establish and maintain quality control for environmental protection of all items of the work, and the means and methods that Contractor will use to comply with the Specification, and all required Project Permit conditions. This plan shall address all construction activities. The EPP shall present a comprehensive overview of known or potential environmental issues.

.3 Address topics at a level of detail commensurate with environmental issues and required construction tasks.

.4 Address all topics that the Specification requires Contractor to discuss in the EPP.

.5 See Section 01 35 13.43 (Special Procedures for Contaminated Sites) for additional information and requirements to be included in the EPP.

.6 At a minimum, the EPP shall contain the following information:

.1 Organization chart and names of persons responsible for EPP compliance.

.2 Names and qualifications of persons responsible for manifesting waste to be removed from site.

.3 Upland Work: See Section 01 35 13.43 (Special Procedures for Contaminated Sites) for upland work submittal requirements as part of the EPP.

.4 Pollution Control Plan:

.1 Submit a Pollution Control Plan as a section of the EPP.

.2 Procedures, response actions, and reports to be used in the event of an unforeseen spill of regulated substance. Spill response procedures shall be completed in accordance with the EGD Spill Contingency Plan.

.3 In-water refueling of marine equipment within the EGD Work Site and within Esquimalt Harbour will not be allowed. Contractor to submit to the Departmental Representative for approval, plans for refuelling of marine equipment, and BMP's for refuelling of marine equipment.

.4 The name of the individual who will be responsible for implementing and supervising the spill containment and cleanup.

.5 Training requirements for Contractor's personnel and methods of accomplishing the training.

.6 Non-hazardous and hazardous solid waste disposal plan, identifying methods and locations for solid waste disposal including structure demolition debris and other debris generated during demolition and excavating activities.

.7 Identification of potentially hazardous substances to be used on the job site; identifies intended actions to prevent introduction of such materials into air, water, or ground; and details provisions for compliance with federal, provincial, and municipal laws and regulations for storage and handling of these materials. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the EGD Work Site.

.5 Wastewater Management and Disposal Plan (WWMDP)

.1 Submit a WWMDP as a section of the EPP.

.2 Identify methods and procedures for management and/or discharge of waste waters that are generated from infiltration, precipitation, ground water, and other construction activities, such as cleanup water, decontamination water, personnel and equipment decontamination facilities, and water used in flushing of lines.

.3 See Section 01 35 13.43 (Special Procedures for Contaminated Sites) for additional requirements regarding wastewater management and disposal.

.6 Stormwater Pollution Prevention Plan (SWPPP):

.1 Submit a SWPPP as a section of the EPP.

.2 See Section 01 35 13.43 (Special Procedures for Contaminated Sites) for additional requirements regarding the SWPPP.

1.6 ENVIRONMENTAL RESPONSIBILITY

.1 Contractor shall demonstrate in the performance of the work that it is environmentally responsible by complying with environmental legislation, regulations, and authorizations; following all Departmental Representative instructions and policies, practices, and procedures established by Departmental Representative with respect to the environment that are communicated by Departmental Representative to Contractor from time to time; being observant for, and immediately notifying Departmental Representative of, any environmental problems that develop at the EGD Work Site; and taking all reasonable and necessary measures in the performance of the work to avoid causing negative impacts to the environment. Where negative impacts occur, Contractor shall immediately advise Departmental Representative and shall be solely liable to undertake all reasonable and necessary measures to minimize the effect of such negative impacts and restoring the site to pre-impact conditions.

.2 Maintain key pollution control systems in working condition throughout the project and undertake all works such that there are no unauthorized discharges of liquids or solids to the EGD water systems, marine environment, or of gas to the atmosphere.

.3 Maintain a neat work area free of unnecessary debris, tools, equipment, or materials; dispose of sewage, refuse, and chemical wastes in compliance with the EGD EBMPs, the EMP, and applicable federal, provincial, and municipal or local legislation, regulations, or laws; and remove all tools, equipment, supplies, and wastes from the site upon completion of the work.

.4 Maintain all equipment and machinery in good working order and free of leaks or excess oil, grease, and debris. Ensure that appropriately equipped spill kits are available on all equipment at the EGD Work Site and ensure that workers and supervisory staff are knowledgeable with the provisions of the EPP and are adequately trained to implement the measures contained therein.

1.7 FIRES

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

1.8 DISPOSAL OF NON-SEDIMENT WASTE

.1 Do not bury rubbish and waste materials on the EGD Work Site.

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

.3 Do not discharge wastes into streams or waterways.

.4 Contractor is responsible for storing, separating, handling, transporting, and disposing of all waste materials in accordance with provincial, federal, and local and municipal regulations and requirements, and at appropriate Disposal Facilities or transfer stations.

.5 Disposal/recycling of other waste generated during the project shall be done in compliance with federal, provincial, and municipal, or local legislation, regulations, and laws, as applicable and the facilities used will need to be reviewed by Departmental Representative.

1.9 VEHICULAR ACCESS AND PARKING

.1 Maintenance and use:

.1 Prevent contamination of access roads. Immediately scrape up debris or material on access roads that is suspected to be contaminated from Contractor activities as determined by Departmental Representative; transport and place into a designated area approved by Departmental Representative. Clean access roads at least once per shift.

.2 Departmental Representative, at Departmental Representative's sole discretion, may collect soil samples for chemical analyses from traveling surfaces of constructed and existing access routes prior to, during, and upon completion of the work. Excavate and dispose of soil contaminated by Contractor's activities at Contractor's own cost.

.2 Vehicles/equipment shall be in good working order and not be leaking any fuel or fluids.

.3 Traffic management measures (such as 'flag person') shall be implemented if required at site access points to direct traffic.

1.10 UPLAND DRAINAGE

.1 Comply with the Temporary Erosion and Sedimentation Control (TESC) Plan, as prepared for and provided in the EPP and described in Section 01 35 13.43 (Special Procedures for Contaminated Sites), for work to be completed at the EGD Work Site. Implement monitoring and reporting requirements to ensure that control measures are in compliance with the TESC Plan and federal, provincial, and municipal laws and regulations. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the EGD Work Site.

1.11 SURFACE WATER QUALITY

.1 Materials and equipment shall be regularly inspected, maintained, operated, and stored in a manner that prevents deleterious substances (e.g. petroleum products, silt, etc.) from entering the watercourse.

1.12 WORK ADJACENT TO WATERWAYS

.1 Applies to work to be performed at the EGD Work Site:

.1 Do not use waterway beds for borrow material.

.2 Do not dump excavated fill, waste material, or debris in waterways.

.3 Special care shall be exercised while working near water's edge including implementation of site-specific erosion and sediment control measures.

1.13 POLLUTION CONTROL

.1 See Section 01 35 13.43 (Special Procedures for Contaminated Sites) for requirements regarding pollution control.

1.14 SPILL OR RELEASE OF DILETERIOUS SUBSTANCES

.1 Contractor shall immediately contain and assess the spill, provide appropriate notifications, and take the necessary steps to prevent further discharge. Contractor is responsible for immediate cleanup of the spill and restoration of the area to the satisfaction of Departmental Representative and other regulatory agencies, where involved.

.2 Contractor shall follow the procedures for spill reporting as outlined in its Pollution Control Plan included in the EPP.

.3 All workers shall be fully aware of the spill prevention and response procedures including notification of Departmental Representative.

.4 Report all spills in accordance with the British Columbia Spill Reporting Regulations, EBMPs, the EMP, EGD Spill Contingency Plan, Fisheries Act.

.5 Departmental Representative shall be immediately informed of all spills that occur at the EGD Work Site.

.6 Further information on dangerous goods emergency cleanup and precautions including a list of companies performing this work can be obtained from the Transport Canada 24-hour number (613) 996-6666 collect.

.7 Spill kits shall be kept at the EGD Work Site at all times.

.8 Contractor shall take due care to ensure no deleterious materials, including sediment-laden runoff, leave the EGD Work Site or enter any surface water or stormwater at or near the EGD Work Site.

.9 If Contractor is planning to discharge any deleterious materials, including water discharge (effluent) or sediment-laden runoff (including concrete, runoff coming in contact with uncured concrete, and any other sediment-laden runoff), leaving the EGD Work Site, Contractor is responsible for ensuring that appropriate permits are in place and that the discharge meets the permit requirements.

.10 Equipment fuelling, or lubricating shall occur at the EGD Work Site in accordance with EBMPs and the EMP.

.11 The use of any paints, corrosion protective coatings, wood preservatives, or any other potentially deleterious substances that may be applied to surfaces that will have contact with the marine environment, shall be in accordance with EBMPs, the EMP, environmental protection measures outlined in the EPP, as well as applicable legislation, guidance documents or industry standards pertaining to the activity. The application of paints, corrosion protective coatings, wood preservatives or any other potentially deleterious substance should occur away from water wherever possible to ensure no accidental release of deleterious chemicals by runoff or overspray.

.12 Any equipment remaining on site overnight shall have appropriately placed drip pans or other spill/leak containment measures.

.13 Measurements for the containment of potentially harmful toxic substances due to the rinse, cleaning water, or solvents for glues, wood preservatives, and other potentially harmful or toxic substances shall be identified and implemented by Contractor to prevent leakage, loss, or discharge into the storm drain system or into the marine environment.

.14 Prevent discharges containing asphalt, grout, concrete, or other waste materials from reaching storm drains or the marine environment. This includes, but is not limited to the following:

.1 Minimizing the washing of sand or gravel from new asphalt, debris from drilling or cutting, or other materials into storm drains and the marine environment by sweeping.

.2 Application of fog seals, tack coats, or other coatings, if required, during periods when rainfall is unlikely to occur during application.

.3 Cleaning equipment off site.

.4 Protection of drainage structures with filter fences if required.

.15 During the purging of tanks and associated lines, procedures must prevent the release of any fuels to the surface, surface water, catch basins, or soils within or surrounding the EGD Work Site.

1.15 NOISE AND LIGHT CONTROL

.1 Contractor shall comply with EBMPs regarding noise control while conducting activities at the EGD Work Site and identify measures for noise control in the EPP.

.2 Although municipal bylaws are not applicable to federal sites, the EGD Environmental Policy states that the EGD will "*meet or exceed applicable federal, provincial and municipal legislation and regulations...related to [their] identified environmental aspects*"; therefore, Contractor is to adhere to Township of Esquimalt and City of Colwood noise bylaws at the EGD Work Site boundary and respect an 85 dBA limit for the construction zone. Contractor shall undertake noisier activities during daytime hours whenever possible and may be required to modify activities/schedules based on noise monitoring and resident feedback. Site-specific noise legislation for the project are provided in the table below.

Table 01 35 43-1

Legislation	**Application to the Project**
Township of Esquimalt "Noise Control Bylaw, 2007, No. 2677"	The Bylaw permits Noise Source Zones denoted "Activity" (applicable to the EGD) the following equivalent sound level limits in Noise Receiver Zones denoted "Quiet" (applicable to the residential areas immediately adjacent to the EGD): 60 dBA (decibels, A-weighted) during the day (from 7:00 a.m. to 10:00 p.m. on a week day or Saturday and from 10:00 a.m. to 10:00 p.m. on a Sunday or holiday). 55 dBA during night time hours.
City of Colwood Bylaw No. 38	The Bylaw to Regulate Noise within the City of Colwood prohibits the disturbance of the quiet, peace, rest, enjoyment, comfort or convenience of the neighbourhood

	or of persons in the vicinity, and stipulates the following construction hours: 07:00 to 19:00 h Monday to Saturday 08:00 to 17:00 h on Sundays and statutory holidays

.3 All construction equipment shall be operated with exhaust systems in good repair to minimize noise.

.4 Ensure that noise control devices (i.e. mufflers and silencers) on construction equipment are properly maintained.

.5 Contractor shall implement use of lighting shrouds for work to be completed during night-time hours to minimize lighting disruptions to local residents.

1.16 NOTIFICATION

.1 Departmental Representative will notify Contractor, in writing, of observed noncompliance with federal, provincial, or municipal environmental laws or regulations, permits, and other elements of Contractor's EPP. Notwithstanding this notification process, Contractor shall be responsible for conducting all construction activities in a manner compliant with these regulations. Although provincial laws and municipal by-laws generally do not apply on federal lands, Contractor will respect provincial laws and municipal bylaws and rules at the EGD Work Site.

.2 Contractor shall inform Departmental Representative of proposed corrective action after receipt of such notice, and take such action for approval by Departmental Representative.

.3 Departmental Representative will issue a stop work order until satisfactory corrective action has been taken.

.4 No time extensions shall be granted, or equitable adjustments allowed to Contractor for such suspensions.

1.17 MIGRATORY BIRDS/WILDLFE HABITAT

.1 Ensure that all works are in compliance with the Migratory Birds Convention Act. If Contractor, in the course of its work, identifies nesting birds within the EGD Work Site, notify Departmental Representative immediately.

.2 Restrict vehicle movements to construction areas and access roads and avoid harassment of animals.

1.18 HISTORICAL/ARCHAEOLOGICAL CONTROL

.1 Give immediate notice to the Departmental Representative if evidence of archaeological finda are encountered during construction and await written instructions before proceeding with work in the vicinity of any such finds.

.2 Relics, antiquities and items of historical or scientific interest shall remain the property of the Crown. Protect such articles and request directives from the Departmental Representative.

1.19 SUSTAINABLE REMEDIATION

.1 A sustainable remediation section shall be submitted by Contractor as a subsection of the EPP. The sustainable remediation section shall describe the sustainable remediation strategies and/or technologies used during completion of this work. It shall include a description of all of the sustainable remediation elements incorporated into Contractor's approach, whether required by the Contract documents or independently proposed by Contractor, including, but not limited to, energy use reduction controls and tracking measures; transportation minimization and sustainable transportation evaluation; emission reduction controls and policies; recycling, reuse, and waste minimization; use of local materials, facilities, and work force; and/or justification for any proposed approach that does not meet the minimum sustainable remediation requirements and/or preferences included in the Contract documents.

.2 The sustainable remediation section of the EPP will be reviewed by Departmental Representative as part of the pre-construction submittal requirements of the Specification. Final acceptance of the EPP by Departmental Representative will constitute acceptance of the sustainable remediation requirements.

.3 Contractor must include the following as a part of its sustainable remediation section within the EPP:

.1 Management of energy and air emissions.

.2 Water management approach.

.3 Waste management plan including material consumption, waste generation, waste reduction, and disposal procedures. This shall consider both Contractor and project-generated waste.

.4 Consideration of ecological impacts (including on-site traffic pattern and speed control management).

.5 Post-work documentation.

.4 Energy and Air Emissions Management:

.1 Contractor shall provide documentation that supports good vessel and engine / equipment maintenance and properly train operators to run equipment efficiently.

.2 Contractor shall provide a list of equipment to be used, including expected fuel usage and hours of operation, as well as a list of fuels and hydraulic oils that will be used in equipment.

.3 Fuel and hydraulic oil requirements include, but are not limited to, the following:

.1 Ensure hydraulic machinery, if required, uses environmentally-sensitive hydraulic fluids that are non-toxic to aquatic life and that are readily or inherently biodegradable.

.4 All personal vehicles should be turned off when not in use or when the driver leaves the unit for any length of time, except:

.1 In the event of the use of a power tailgate when the electrical system alone would not support its operation; such as in cold weather or low electrical supply conditions.

.2 In extreme winter weather situations where a vehicle not idling would create an operational safety problem (e.g., severe fogging or icing of windshield).

.5 Car share and carpool programs are strongly encouraged.

.6 Contractor shall minimize idling to control air pollution due to exhaust emissions and reduce fuel usage.

.1 When the equipment is forced to remain motionless due to traffic conditions or mechanical difficulties outside of the operator's control.

.2 When it is necessary to ensure the safe operation of the machine or to verify that the machine is in good working order or complies with other conditions specified by the machine manufacturer's manual or other technical document prescribed for that machine.

.3 When testing, servicing, repairing, or for diagnostic purposes, including regeneration of a diesel particulate filter.

.4 When necessary to serve the purpose of the machine in the course of its operation, including during the operation of a crane, cement mixer, cherry picker, boom lift, or similar machine.

.5 In the performance of emergency work or for public safety purposes; or in accordance with an approved written anti-idling procedure.

.6 Idling limits will be enforced by Departmental Representative.

.7 Turning off diesel combustion engines on construction equipment not in active use, and on trucks that are idling while waiting to load or unload material for five (5) minutes or more.

.8 Contractor shall place diesel equipment away from the general public and sensitive receptors.

.9 Contractor shall use, to the extent practicable, machines with automatic idle-shutdown devices and auxiliary power systems that meet California Air Resources Board (CARB) equipment specifications to power cab heating and air conditioning when equipment is unengaged.

.10 Contractor shall retrofit machinery and heavy equipment for diesel-engine emission control and exhaust treatment technologies such as particulate filters and oxidation catalysts.

.11 Contractor shall use cleaner engines, cleaner or alternative fuels, and cleaner diesel control technology on diesel-powered equipment with engines greater than 50 horsepower whether the equipment is owned or rented.

.12 Contractor will be encouraged to use cleaner engines, cleaner or alternative fuels, and cleaner diesel control technology on vessels and vehicles.

.13 Contractor shall limit EGD Work Site vehicle speeds to posted EGD facility speed limits.

.14 Contractor shall use rail, when feasible and cost effective, for the transportation of materials to minimize greenhouse gas emissions.

.5 Water Management:

.1 Contractor shall minimize fresh water and potable water consumption and maximize use of non-potable water and water reuse during daily operations and treatment processes.

.2 Contractor shall explore the utilization of rumble grates with a closed-loop greywater washing system (or an advanced, self-contained wheel washing system) to minimize vehicle tracking of sediment and soil across non-work areas or off site.

.6 Material Consumption and Waste Generation and Disposal Management:

.1 Contractor shall maximize diverting the total project waste, in order of preference by: 1) weight; and 2) volume, whichever is most feasible to measure, by seeking opportunities to reduce, reuse, and/or recycle demolition materials that are not considered contaminated or hazardous substances. Contractor shall dispose of uncontaminated recyclable or salvable demolition materials by a combination of salvage, reuse, or recycling at a Disposal Facility, approved by Departmental Representative. Other innovative approaches to achieve the minimum diversion rate are encouraged and should be specified and described in the sustainable remediation section of the EPP.

.2 Waste material management hierarchy can be viewed as: reuse on-site, recycle on-site, reuse off-site, and recycle off-site.

.3 Minimum diversion rate may be achieved by recovering and recycling the following materials, components, and fixtures:

.1 Concrete and concrete blocks.

.2 Ferrous metal.

.3 Non-ferrous metals: Copper, aluminum, etc.

.4 Untreated lumber.

.5 Plywood and particle board.

.6 Paper and cardboard.

.7 Non-contaminated soil and topsoil.

.7 Ecological Impacts Management:

.1 Contractor shall clean all equipment prior to each arrival at the EGD Work Site to ensure that no invasive vegetative species are present on the equipment during the performance of the work.

.2 Contractor shall establish minimally-intrusive and well-designed traffic patterns for on-site activities and plans to minimize on-site impacts and reduce off-site traffic congestion.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes Contractor requirements for quality control, including coordination with material suppliers, testing agencies, and other entities that may be employed by PWGSC or Departmental Representative during completion of the work. The intent of this Section is to require Contractor to establish a necessary level of quality control that will:

.1 Provide sufficient information to assure both Contractor and Departmental Representative that the Specification requirements are and have been met.

.2 Contractor shall establish, provide, and maintain a Construction Quality Control (CQC) Plan as specified herein, detailing the methods and procedures that will be taken to assure that all materials and completed construction elements conform to the Drawings, the Specification, and other requirements. Although guidelines are established, and certain minimum requirements are specified herein and elsewhere in the Specification, it is the responsibility of Contractor to ensure that construction and construction quality control are accomplished in accordance with the stated purpose and in accordance with the Specification as described herein.

.3 Contractor shall be prepared to discuss and present, at the Pre-Construction Meeting, its understanding of the quality control requirements. Contractor shall not begin any construction until the CQC Plan has been reviewed and accepted by Departmental Representative.

1.2 MEASUREMENT AND PAYMENT

.1 Quality control is considered incidental to the work and will not be measured separately. No separate payment will be made under this Section.

1.3 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 01 35 13.43 (Special Procedures for Contaminated Sites)

.3 Section 01 35 43 (Environmental Procedures and Sustainability)

1.4 DEFINITIONS

.1 NOT USED

1.5 SUBMITTALS

.1 Within ten (10) working days following Notice of Award, submit the CQC Plan for review and acceptance by Departmental Representative. Contractor’s CQC Plan shall include:

.1 Reporting and Document Control Plan describing procedures for communicating progress testing, and other data with Departmental Representative.

.2 Personnel, procedures, methods, instructions, records, and forms to be used to control the work and verify that the work conforms to the Contract documents.

.3 Description of the CQC organization, including an organization chart showing the various CQC team members, along with their designated responsibilities and lines of authority. At a minimum, identify the Project Manager, Site Supervisor(s), CQC Supervisor, Surveyor, or Engineer, and Health and Safety Coordinator.

.4 Acknowledgement that the CQC staff will conduct inspections for all aspects of the work specified, and shall report to the CQC Supervisor, or someone of higher authority in Contractor's organization.

.5 The name, qualifications, duties, responsibilities, and authorities of each person assigned a primary CQC function.

.6 Testing methods, schedules, and procedures used to report CQC information to Departmental Representative, including samples of the various reporting forms.

.2 Submit four (4) copies of all inspection and laboratory test reports to Departmental Representative within two (2) days following completion of inspection or receipt of analytical data from a testing laboratory.

.3 Provide copies to subcontractor of work being inspected or tested.

1.6 REFERENCES

.1 NOT USED

1.7 QUALITY CONTROL ORGANIZATION

.1 CQC Supervisor: As part of the CQC Plan, Contractor shall identify an individual within its organization, located at the EGD Work Site, who shall be responsible for overall management of the CQC as part of the Contract, and have the authority to act in all CQC matters for the Contractor.

.2 Personnel: A staff shall be maintained under the direction of the CQC Supervisor to perform all CQC activities. The actual number of staff during any specific work period may vary to cover shift needs, and rates of performance. The personnel of this staff shall be fully qualified by experience and technical training to perform their assigned responsibilities and shall be directly hired for the work by Contractor.

1.8 INSPECTION

.1 Contractor will allow Departmental Representative access to the work. If part of the work is in preparation at locations other than the EGD Work Site, Contractor shall allow access to such work whenever and wherever it is in progress.

.2 Give timely notice requesting inspection if work is designated for special tests, inspections, or reviews by Departmental Representative instructions, or law of the EGD Work Site.

.3 If Contractor covers, or permits to be covered, work that has been designated for special tests, inspections, or reviews before such is made, uncover such work, have inspections or tests satisfactorily completed, and make good such work.

1.9 INDEPENDANT INSPECTION AGENCIES

.1 Independent inspection/testing agencies will be engaged by the Contractor for purpose of inspecting or testing portions of work.

.2 Employment of inspection/testing agencies does not relax responsibility to perform work in accordance with Contract documents.

.3 If defects are revealed during inspection or testing, additional inspection or testing will be required to ascertain full degree of defect. Correct defect and irregularities as advised by Departmental Representative at no cost to PWGSC. Contractor shall pay costs for re-testing and re-inspection as necessary.

1.10 ACCESS TO WORK

.1 Allow inspection / testing firms access to EGD Work Site.

.2 Contractor shall make accessible to Departmental Representative all construction equipment that is employed for completion of the work.

.3 Contractor shall cooperate to provide reasonable facilities for such access.

1.11 PROCEDURES

.1 Notify appropriate entity and Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples or materials required for testing, as requested in the Specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in work.

.3 Provide labour and facilities to obtain and handle samples and materials at the EGD Work Site. Provide sufficient space to store samples as necessary.

.4 Complete required materials testing as described in the Specifications for which the work applies. Results of laboratory testing shall be reviewed by Departmental Representative to determine compliance with the requirements of the work.

1.12 REJECTED WORK

.1 Remove defective work, whether result of poor workmanship, use of defective products, or damage, and whether incorporated in work or not, which has been rejected by Departmental Representative as failing to conform to Contract documents. Replace or re-execute in accordance with Contract documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If, in the opinion of Departmental Representative, it is not expedient to correct defective work or work not performed in accordance with the Contract documents, PWGSC will deduct from the Tender Price the difference in value between work performed and that called for by Contract documents, the amount of which will be determined by Departmental Representative.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers mobilization and demobilization for the work.

.2 Mobilization shall include the following activities:

- .1 Establishment of necessary site offices;
- .2 Site preparation for working and lay down areas, including site perimeter fencing;
- .3 Workshops and other temporary facilities (as covered by Section 01 51 01 Temporary Facilities), including utility connections;
- .4 Set up of site survey control monuments;
- .5 Development and implementation of all environmental protection measures;
- .6 Moving all major equipment required for the work to the EGD Work Site;
- .7 Making ready for work; and,
- .8 The cost of maintaining bonds and insurance as required.

.3 Demobilization shall include the following activities:

- .1 All things necessary to remove all construction equipment, plant and excess materials from the EGD Work Site;
- .2 Dismantling and removal of all temporary facilities; and,
- .3 Clean up of the EGD Work Site to a condition satisfactory to Departmental Representative at completion of the work.

.4 Items which are not to be included in mobilization / demobilization are any portion of the work covered by a specific Tender item or other incidental work which is specified as being included in a Tender item.

1.2 RELATED SECTIONS

.1 Section 01 51 01 (Temporary Facilities)

1.3 MEASUREMENT AND PAYMENT

.1 Mobilization and demobilization will not be measured for payment.

.2 Mobilization will be paid for at the Lump Sum price tendered for MOBILIZATION. Payment shall include for all costs in connection with mobilization as described in Clause 1.1.2 of this Section. The Lump Sum tendered for Mobilization shall be paid on completion of all applicable items listed in Clause 1.1.2 to the satisfaction of Departmental Representative.

.3 Supply and set up of plant and equipment not specifically noted in Clause 1.1.2 of this Section shall be deemed to be incidental to the work and shall not be covered by the Lump Sum tendered for Mobilization.

.4 Demobilization will be paid for at the Lump Sum price tendered for DEMOBILIZATION. Payment shall include for all costs in connection with demobilization as described in Clause 1.1.3 of this Section. The Lump Sum tendered for Demobilization shall be paid on completion of all applicable items listed in Clause 1.1.3 to the satisfaction of Departmental Representative.

1.4 DEFINITIONS

.1 NOT USED

1.5 SUBMITTALS

.1 NOT USED

1.6 REFERENCES

.1 NOT USED

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section presents requirements for the establishment of temporary facilities as part of the Work including Contractor access to the EGD Facility and Contractor's Work Site, locations for material delivery, Contractor's Lay-Down Area, requirements for office space, and availability of site services.

.2 Contractor's Work Site is delineated on the drawings and will be made available for the duration of the Contract. All materials delivery, on-site staging, storage, and placement of temporary facilities must take place within these boundaries.

.1 The Contractor's Work Site is limited and constricted. The Contractor shall determine distribution of required facilities, storage, staging, etc within the Contractor's Work Site. Access for Contractor's Staff, Consultant Team and the Departmental Representative will be maintained for the duration of the Contract.

.3 Install, maintain, and operate all temporary facilities and controls as required for safe and proper completion of the Work for the duration of the Contract.

.4 The Contractor' Work Site will be made available to Contractor at the time of Notice of Award. **This is contingent upon Contractor's submittal, and Departmental Representative's acceptance, of pre-construction submittals.**

1.2 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. Include all costs for temporary facilities in the tendered price for MOBILIZATION, as described in Section 01 50 00 (Mobilization and Demobilization).

1.3 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 01 35 13.43 (Special Procedures for Contaminated Sites)

.3 Section 01 50 00 (Mobilization and Demobilization)

.4 Section 01 74 11 (Cleaning)

1.4 DEFINITIONS

.1 Refer to Section 01 11 55 (General Instructions) for all definitions associated with this Contract.

1.5 SUBMITTALS

.1 Contractor shall submit layout drawings for the Contractor's Work Site to Departmental Representative in accordance with schedule requirements presented in Section 01 35 13.43 (Special Procedures for Contaminated Sites) as part of the Environmental Protection Plan.

1.6 REFERENCES

.1 NOT USED

1.7 ACCESS AND DELIVERY

.1 The Esquimalt Graving Dock Facility shall be assumed to be fully operational for the duration of the Contract.

.2 The Contractor's primary access to the EGD Facility will be via the Main Entrance off Admirals Road.

.1 The designated entry and exit of Contractor's vehicles to the Contractor's Work Site will be via the EGD Main Entrance on Admirals Road, along the north Main Entrance Roadway, and along the north side of the dry dock to the east end apron. Access to the south side of the dry dock outside the work site will be only by special permission from the Departmental Representative, as shown on the Drawings.

.1 Repair damage resulting from Contractor's use.

.2 Access to the floor of the dry dock will be within the Contractor's designated work site area via the two staircases located at the northeast and southeast corners of the dry dock.

.3 Vehicular movement in and out of the EGD Facility will pass through check points and be monitored by EGD security. All Contractor's and subcontractor's staff must carry current photo identification or a valid EGD Contractor Access Pass. All Contractor's and subcontractor's staff that do not have a valid EGD Contractor Access Pass are subject to a sign-in process as administered by EGD Facility security.

.1 No parking is allowed outside of the Contractor's Work Area. Unauthorized vehicles will be towed at the Contractor's expense.

.4 Individual safety and security requirements are in place:

.1 All persons will be subject to security check prior to entering the EGD Facility and must obtain security clearance.

.1 All un-cleared personnel require escort at all times while at the EGD Facility.

.2 All persons performing work must complete EGD Safety Orientation prior to performance of any work at the EGD Facility.

.5 For all land access, Contractor is required to use only the designated entrance to the EGD Facility as shown on the Drawings and as described herein.

.6 Delivery of materials may take place via land. For land based deliveries, the following shall apply:

.1 For infrequent delivery by single-unit vehicles (i.e. Vehicles without a hitched trailer unit), no additional restrictions shall apply;

.2 Deliveries exceeding a frequency of four per hour, or any deliveries by multi-unit vehicles (i.e. Vehicles with a trailer) will be considered limited access. Limited access additional restrictions are as follows:

.1 Contractor must provide written request a minimum 48 hours of delivery requirement, and provide 24 hour advanced written confirmation of any planned limited access deliveries.

.2 Limited access deliveries may be subject to 24 hour delay from requested time of delivery subject to other operations taking place within the EGD Facility. This delay, if applicable, will be confirmed by the Departmental Representative at the time of the Contractor's 48 hour advance request, except in the case of Emergency Dockings as described in Section 00 11 55 of the specifications.

.3 A looped route for arrival, delivery, and exit may be available to limited access vehicles via the South Jetty Access road and South Dry Dock roadway. The availability of this route will be dependent on other operations within the EGD Facility and must be coordinated with the Departmental Representative at the time of the written 48 hour advance request for access.

.1 Access along the South Jetty Access Road will be restricted as follows:

.1 Cannot impede access for emergency vehicles

.2 Cannot impact ongoing tenant operations or ongoing ship repair activities

.3 Cannot impact other contracts or contractors

.4 Cannot impact crane services

.5 Requires written permission form the Departmental Representative.

.7 Provide and maintain access roads, sidewalk crossing ramps, and construction runways as may be required for access to the work. All roadways and walkways outside of the Project Site and Work Area shall be kept clear of materials and equipment at all times.

.8 No vehicles shall be parked or left unattended beyond the limits of the Project Site and Work Area.

.9 No materials shall be stored outside of the Contractor's Work Site.

.10 Provide and maintain competent flag operators, traffic signals, barricades and flares, lights, or lanterns as may be required to perform work and to protect other users of the EGD Facility.

1.8 CONTRACROR'S LAY-DOWN AREA AND DEPARTMENTAL REPRESENTATIVE'S OFFICE SPACE

.1 The Contractor's Work Site and Lay-Down Area is shown on the Drawings. The Contractor shall place temporary fencing where shown in accordance with requirements provided in Section 01 35 33 (Health and Safety Requirements). The location of the temporary fencing shall not exceed the Contractor's Work Site. The Contractor shall submit layout drawings for the Contractor's Work Site prior to mobilization, clearly showing location of the temporary fencing, for review by the Departmental Representative. Temporary fencing shall not be installed prior to acceptance of layout by

the Departmental Representative. Provide means of access to the Departmental Representative for emergency use.

.2 Provide space nearby to the Contractor's Office Area for the Office of the Departmental Representative's consultant team. The consultant team's temporary office will be provided and maintained by the Contractor for the duration of the Contract. The Office of the Departmental Representative's consultant team shall include the following, all provided by the Contractor:

.1 240 sq ft of office space for exclusive use of Departmental Representative's consultant team and other personnel as determined by the Departmental Representative. Office space may be one or more buildings containing a minimum of 2 separate offices and one meeting room. The offices shall be equipped with internet access, and a printer capable of connectivity with each office space shall be provided. Power, water, heating and maintenance of the buildings are Contractor's responsibility.

1.9 POWER

.1 Electrical power and lighting may be available at the EGD Facility. Ship repair activities take priority over the work included in this Contract. If available, electrical power may be used for construction purposes at no extra cost to the Contract.

.2 Conveyance from existing power sources to desired location of use is the responsibility of the Contractor, and shall not be placed in a way that could interfere with other operations within the EGD Facility. To access available power, Contractor must take out an electrical permit, use a licensed electrical contractor to make connections, and provide CSA approved equipment, panel(s), cable, etc.

.3 Contractor to submit written request to the Departmental Representative for use of site services minimum 48 hours in advance of requirement for use.

.4 Availability of site services is at the sole discretion of the Departmental Representative and at no time does the unavailability of site services result in delay by the Crown.

1.10 COMPRESSED AIR

.1 Compressed air service may be available at the EGD Facility. Ship repair activities take priority over the work included in this Contract. If available, compressed air may be used for construction purposes at no extra cost to the Contract. Conveyance from existing connection points to desired location of use is the responsibility of the Contractor, and shall not be placed in a way that could interfere with other operations within the EGD Facility. Conveyance equipment shall include isolation shut-offs.

.2 Contractor to submit written request to the Departmental Representative for use of site services minimum 48 hours in advance of requirement for use.

.3 Availability of site services is at the sole discretion of the Departmental Representative and at no time does the unavailability of site services result in delay by the Crown.

1.11 WATER SUPPLY

.1 Non-potable water supply may be available at the EGD Facility. Ship repair activities take priority over the work included in this Contract. If available, water may be used for

construction purposes at no cost to the Contract. Conveyance from existing connection points to desired location of use is the responsibility of the Contractor, and shall not be placed in a way that could interfere with other operations within the EGD Facility. Conveyance equipment shall include isolation shut-offs.

.2 Contractor to submit written request to the Departmental Representative for use of site services minimum 48 hours in advance of requirement for use.

.3 Availability of site services is at the sole discretion of the Departmental Representative and at no time does the unavailability of site services result in delay by the Crown.

1.12 CRANE SERVICES

.1 Crane services may be available at the EGD Facility. Ship repair activities take priority over the work included in this Contract. If available, contractor will follow established procedures for requisition of crane services. Contractor will supply all equipment below the hook necessary for safe lifting of load, including certified rigger(s).

.2 Contractor to submit written request to the Departmental Representative for use of site services minimum 48 hours in advance of requirement for use.

.3 Availability of site services is at the sole discretion of the Departmental Representative and at no time does the unavailability of site services result in delay by the Crown.

1.13 SANITARY FACILITIES

.1 Contractor is responsible for providing its own washroom facilities for the duration of the Contract. Contractor’s washrooms shall be located within the Project Site and Work Area.

1.14 SCAFFOLDING

.1 Construct and maintain scaffolding in a rigid, secure, and safe manner.

.2 Erect scaffolding independent of walls. Remove promptly when no longer required.

1.15 REMOVAL OF TEMOPRARY FACILITIES

.1 Remove temporary facilities from the Contractor's Work Site when directed by Departmental Representative.

.2 Clean and repair damage caused by installation or use of temporary facilities.

1.16 CLEAN-UP

.1 Conduct all project clean-up activities in accordance with Section 01 74 11 (Cleaning).

.2 Remove construction debris, waste materials, and packaging material from the Contractor's Work Site daily.

.3 Clean dirt or mud tracked onto paved or surfaced roadways.

.4 Store materials resulting from work activities that are salvageable.

1.17 SIGNS AND NOTICES

.1 Signs and notices for safety and instruction shall be in both official languages or graphic symbols conforming to CAN/CSA-Z321.

.2 Maintain signs and notices in good condition for duration of project, and dispose of off-site on completion of project or when directed by Departmental Representative.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 PRODUCTS, MATERIALS AND EQUIPMENT

.1 Use new products, materials and equipment unless otherwise specified. The term "products" is referred to throughout the Specification.

.2 Use products of one manufacturer for material and equipment of the same type or classification unless otherwise specified.

.3 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.

.4 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.

.5 Provide metal fastenings and accessories in the same texture, colour and finish as base metal in which they occur.

- .1 Prevent electrolytic action between dissimilar metals.
- .2 Use non-corrosive fasteners, anchors and spacers for securing exterior work.

.6 Fastenings which cause spalling or cracking are not acceptable.

.7 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.8 Use heavy hexagon heads, semi-finished unless otherwise specified.

.9 Bolts may not project more than one (1) diameter beyond nuts.

.10 Types of washers as follows:

- .1 Plain type washers: Use on equipment and sheet metal.
- .2 Soft gasket lock type washers: Use where vibrations occur.
- .3 Resilient washers: Use with stainless steel.

.11 Deliver, store, and maintain packaged material and equipment with manufacturer's seals and labels intact.

.12 Prevent damage, adulteration, and soiling of products during delivery, handling, and storage. Immediately remove rejected products from site.

.13 Store products in accordance with suppliers' instructions.

.14 Touch up damaged factory finished surfaces to Departmental Representative's satisfaction:

- .1 Use primer or enamel to match original.
- .2 Do not paint over nameplates.

1.2 QUALITY OF PRODUCTS

.1 Products, materials and equipment (referred to as products) incorporated into work shall be new, not damaged or defective, and of the best quality (compatible with the specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of the products provided.

.2 Defective products will be rejected regardless of previous inspections.

.1 Inspection does not relieve responsibility, but is precaution against oversight or error.

.2 Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Retain purchase orders, invoices and other documents to prove that all products utilized in this Contract meet the requirements of the specifications. Produce documents when requested by Departmental Representative.

.4 Should any dispute arise as to quality or fitness of products, the decision rests strictly with Departmental Representative based upon the requirements of the Contract documents.

.5 Unless otherwise indicated in the Specification, maintain uniformity of manufacture for any particular or like item throughout the project.

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

1.3 AVAILABILITY OF PRODUCTS

.1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply lead times for any items.

.2 If delays in supply of products are foreseeable, notify Departmental Representative of such in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of the work.

.3 In event of failure to notify Departmental Representative at the start of work and should it subsequently appear that the work may be delayed for such reason, Departmental Representative reserves the right to substitute more readily available products of similar character, at no increase in either the Contract price or the Contract time.

1.4 MANUFACTURERS INSTRUCTIONS

.1 Unless otherwise indicated in the specifications, install or erect products in accordance with the manufacturer’s instructions.

.1 Do not rely on labels or enclosures provided with products.

.2 Obtain written instructions directly from the manufacturer.

.2 Notify Departmental Representative in writing of conflicts between the Specification and the manufacturer's instructions so that Departmental Representative may establish the course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in either the Contract price or the Contract time.

1.5 CONTRACTOR'S OPTIONS FOR SELECTION OF PRODUCTS FOR TENDERING

.1 Products specified by "Prescriptive" specifications: select any product meeting or exceeding the Specification.

.2 Products specified under "Acceptable Products" (used for complex mechanical or electrical systems, for example): Select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specification and indicated Products.

.3 Products specified by performance and referenced standard: Select any product meeting or exceeding the referenced standard.

.4 Products specified as "Approved Products" to meet particular design requirements or to match existing materials: Use only the specified Approved Product. Alternative products may be considered provided full technical data is received in writing by Departmental Representative in accordance with "Special Instructions to Tenderers".

.5 When products are specified by a referenced standard or by Performance specifications, upon request of Departmental Representative obtain from manufacturer an independent laboratory report showing that the product meets or exceeds the specified requirements.

1.6 SUBSTITUTION AFTER CONTRACT AWARD

.1 No substitutions are permitted without prior written acceptance of Departmental Representative.

.2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.

.3 Proposals will be considered by Departmental Representative if:

.1 Products selected by Tenderer from those specified are not available;

.2 Delivery date of products selected from those specified would unduly delay completion of Contract, or

.3 Alternative product to that specified, which is brought to the attention of considered by Departmental Representative, and which is considered by

Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.

.4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.

.5 Amounts of all credits arising from approval of the substitutions will be determined by Departmental Representative, and the Contract price will be reduced accordingly.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section provides general requirements for maintaining project cleanliness during completion of the work and requirements for final cleaning prior to project closeout and demobilization from the EGD Work Site.

1.2 MEASUREMENT AND PAYMENT

.1 Cleaning is considered incidental to the work and will not be measured separately. No measurement or payment will be made under this Section.

1.3 RELATED SECTIONS

.1 NOT USED

1.4 DEFINITIONS

.1 NOT USED

1.5 SUBMITTALS

.1 NOT USED

1.6 REFERENCES

.1 NOT USED

1.7 PROJECT CLEANLINESS

.1 Maintain work in tidy condition, free from accumulation of waste products and debris, including that caused by the EGD facility or other Contractors.

.2 Remove waste materials from EGD Work Site at daily regularly scheduled times or dispose of as directed by Departmental Representative. Do not burn waste materials.

.3 Make arrangements with, and obtain permits from, authorities having jurisdiction for disposal of waste and debris.

.4 Provide containers at the EGD Work Site for collection of waste materials and debris.

.5 Dispose of waste materials and debris off site in accordance with these Specifications.

.6 Clean interior areas prior to finishing work, and maintain areas free of dust and other contaminants during finishing operations.

.7 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.8 Schedule cleaning operations so that resulting dust, debris, and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems, nearby structures and equipment, and adjacent water bodies.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 FILLING & EMPTYING TUNNEL

.1 Following the completion of the section 3 refurbishment works, the filling and emptying tunnel shall be thoroughly cleaned to remove all dust, dirt, debris and contaminants.

.2 This will require confined space entry and is considered part of the work.

.3 Standing water and/or water infiltration in the tunnel shall be removed during the cleaning process.

.4 Once the tunnel cleaning process is complete and approved by the Departmental Representative, the tunnel lids shall be protected (sealed) to prevent contamination. Seals shall remain in place until project completion.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section describes waste management and disposal procedures for structures demolition work.

1.2 MEASUREMENT AND PAYMENT

.1 No separate payment will be made for work associated with waste management and disposal. Activities associated with waste management and disposal shall be considered incidental to the work.

1.3 RELATED SECTIONS

.1 Section 01 11 55 (General Instructions)

.2 Section 02 41 16.01 (Structure Demolition)

1.4 DEFINITIONS

.1 Refer to Section 01 11 55 (General Instructions) for all definitions related to this Contract.

1.5 SUBMITTALS

.1 Prepare a Waste Reduction Work Plan (WRWP), to be submitted as part of the EPP, and that includes a written report describing opportunities for reduction, re-use, or recycling of materials.

.2 Prepare a Materials Source Separation Program (MSSP) Plan, to be submitted as part of the EPP, and which consists of a series of ongoing activities to separate re-usable and recyclable waste material into material categories from other types of waste at the point of generation.

.3 Upon request by Departmental Representative, prepare and submit a Waste Audit (WA), which relates to projected waste generation and involves controlled separation of waste

1.6 MATERIALS SOURCE SEPERATION

.1 Before project start-up, prepare Materials Source Separation Program. Provide separate containers for re-usable and/or recyclable materials of the following:

.1 Metals.

.2 Wood.

.3 Plastics

.4 Other materials as indicated in technical sections.

.2 Implement Materials Source Separation Program for waste generated on project in compliance with approved methods and as accepted by Departmental Representative.

.3 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.4 Locate separated materials in areas which minimize material damage.

1.7 DIVERSION OF MATERIAL

.1 Create a list of materials to be separated from the general waste stream and stockpiled in separate containers, to the acceptance of Departmental Representative and consistent with fire regulations.

.1 Mark containers.

.2 Provide instruction on disposal practices.

1.8 STORAGE, HANDLING AND APPLICATION

.1 Do work in compliance with Waste Reduction Work Plan.

.2 Handle waste materials not re-used, salvaged, or recycled in accordance with appropriate regulations and codes.

.3 Materials in separated condition: Collect, handle, store on site, and transport off-site to an approved and authorized recycling facility.

.4 Materials must be immediately separated into required categories for re-use or recycling.

.5 Unless specified otherwise, materials for removal become Contractor’s property.

.6 On-site sale of salvaged / recyclable material is not permitted.

.7 Provide Departmental Representative with receipts indicating quantity and type of materials delivered to landfill.

.8 Provide Departmental Representative with receipts indicating quantity and type of materials sent for recycling.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section provides project closeout requirements for post-construction submittals that Contractor is required to submit to Departmental Representative following completion of the work.

.2 This Section also presents process and requirements for inspection and declaration that the work has been completed as required by the Contract documents. Upon formal review and acceptance of the work by Departmental Representative, the work will be determined to be complete and Contractor shall then demobilize from the EGD Work Site.

1.2 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. Include all costs for closeout submittals in the tendered price for POST-CONSTRUCTION SUBMITTALS, as described in Section 01 33 00 (Submittal Procedures).

1.3 RELATED SECTIONS

.1 Section 01 50 00 (Mobilization and Demobilization)

.2 Section 01 11 55 (General Instructions)

1.4 DEFINITIONS

.1 NOT USED

1.5 SUBMITTALS

.1 NOT USED

1.6 REFERENCES

.1 NOT USED

1.7 INSPECTION AND DECLARATION

.1 Inspection by Contractor: Contractor shall conduct inspection of work, identify deficiencies and defects, and repair as required to conform to requirements of the Contract documents.

.2 Notify Departmental Representative, in writing, of satisfactory completion of Contractor inspection and that corrections have been made.

.3 Request inspection by Departmental Representative.

.4 Inspection by Departmental Representative: Departmental Representative, accompanied by Contractor, will inspect the work to identify defects or

deficiencies in the work and then compile a deficiency list describing all noted defects and deficiencies.

.5 Contractor shall correct work accordingly, as advised by Departmental Representative, at no cost to PWGSC.

.6 Final Inspection: When items noted above are completed, request Final Inspection of work by Departmental Representative, accompanied by Contractor. If work is still deemed incomplete by Departmental Representative, complete outstanding items and request re-inspection. Repeat this process until the work is complete to Departmental Representative's satisfaction.

1.8 SUBMISSION

.1 Prepare instructions and data by personnel experienced in maintenance and operation of described products.

.2 Revise content of documents as required before final submittal.

.3 Two (2) weeks before substantial performance of the work, submit to Departmental Representative four (4) final copies of all Record Drawings and other required post-construction documentation (e.g. operation and maintenance manuals).

.4 Ensure spare parts, maintenance materials and special tools provided are new, neither damaged nor defective, and of same quality and manufacture as products provided in work.

.5 If requested, furnish evidence as to type, source and quality of products provided.

.6 Defective products will be rejected, regardless of previous inspections. Replace products at Contractor's expense.

1.9 FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: Vinyl, hard covered, three (3) "D" ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 Cover: Identify each binder with typed or printed title "Project Record Documents"; list title of project and identify subject matter of contents.

.4 Arrange content by systems under section numbers and sequence of table of contents.

.5 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.6 Text: Manufacturer's printed data, or typewritten data.

.7 Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.10 CONTENTS, EACH VOLUME

.1 Table of contents – provide the following:

.1 Title of project.

.2 Date of submission.

.3 Names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

.4 Schedule of products and systems, indexed to content of volume.

.2 For each product or system, list the names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product data: Mark each sheet to clearly identify products and component parts, and data applicable to installation. Delete inapplicable information.

.4 Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

1.11 RECORD DOCUMENTS (FOR "AS BUILT" PURPOSES)

.1 Contract Drawings and shop drawings: Legibly mark each item to record actual construction, including:

.1 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.2 Field changes of dimension and detail.

.3 Changes made by change orders.

.4 Details not on original Contract drawings.

.5 References to related shop drawings and modifications.

.2 Contract Specifications: Legibly mark each item to record actual construction, including;

.1 Manufacturer, trade name, and catalogue number of each “Product / Material” actually installed, particularly optional items and substitute items.

.2 Changes made by change orders.

.3 Record of “as-built” Information:

.1 Record changes in red ink. Refer also to Section 01 11 55 (General Instructions) for preparation of record documents.

.2 Before final inspection at completion of the project, using the hardcopy set of Contract Drawings, Specification and shop drawings that have been marked-up by Contractor with “as-built” information throughout the project, neatly transfer all annotations to the second set of Contract

Drawings, Specifications and shop drawings (as preparation for the record documents).

.4 Submit "Record" information for all elements of the work as required by the Specification. Record information shall include, but not be limited to, the following:

.1 Pre-Construction Survey for the entire EGD Work Site.

.2 Post- Construction Surveys for completion of work elements. Surveys shall be those used for the basis of measurement and payment of the work.

.3 Any additional "Record" information provided as part of Daily and Weekly Construction Reports.

.4 Record Drawings as described elsewhere in this Section.

.5 Submit the record documents (the complete record of "as-built" information) for review and approval of Departmental Representative. If corrections are required, make such corrections to Departmental Representative's satisfaction, and re-submit for review and approval of Departmental Representative.

.6 Contractor is required to submit AutoCAD versions of all record drawings.

1.12 EQUIPMENT AND SYSTEMS

.1 Operating procedures – include the following:

.1 Start-up, break-in, and routine normal operating instructions and sequences.

.2 Regulation, control, stopping, shutdown, and emergency instructions.

.3 Summer, winter, and any special operating instructions.

.2 Maintenance requirements – list routine procedures.

.3 Provide servicing and lubrication schedule, and list of lubricants required.

.4 Include manufacturer's printed operation and maintenance instructions.

.5 Include sequence of operation by controls manufacturer.

.6 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.7 Provide installed control diagrams by controls manufacturer.

.8 Provide Contractor's coordination drawings with installed colour coded piping diagrams.

.9 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

.10 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.11 Additional requirements: as specified in individual specification Sections.

1.13 MANUFACTURERS DOCUMENTATION REPORTS

.1 When specified in individual Sections of the Specification, require manufacturer to provide authorized representative to demonstrate operation of equipment and system, instruct Departmental Representative's indicated facility's personnel, and provide detailed written report that demonstration and instructions have been completed.

.2 Departmental Representative will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.

1.14 SPARE PARTS

.1 Provide spare parts in quantities specified in individual Sections of the Specification.

.2 Provide items of same manufacture and quality as items in work.

.3 Deliver to on-site location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in maintenance manual.

.5 Obtain receipt for delivered products and submit to Departmental Representative.

1.15 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials in quantities specified in individual Sections of the Specification.

.2 Provide items of same manufacture and quality as items in work.

.3 Deliver to on-site location as directed; place and store.

.4 Receive and catalogue all items. Submit inventory listing to Departmental Representative. Include approved listings in maintenance manual.

.5 Obtain receipt for delivered products and submit to Departmental Representative.

1.16 SPECIAL TOOLS

.1 Provide special tools in quantities specified in individual Sections of the Specification.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to location as directed; place and store.

.4 4 Receive and catalogue all items:

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in maintenance manual.

1.17 WARRANTIES, BONDS, TEST REPORTS, INSPECTION REPORTS

.1 Separate each document with index tab sheets keyed to table of contents listing.

.2 List subcontractor, supplier and manufacturer with name, address, and telephone number of responsible principal.

.3 Obtain warranties, bonds, test results, inspection reports executed in duplicate by subcontractors, suppliers, manufacturers, and inspection agencies within ten (10) days after completion of the applicable item of work.

.4 Except for items put into use with Departmental Representative's permission, leave date of beginning of time of warranty until the date of substantial performance is determined.

.5 Verify that documents are in proper form, contain full information, and are notarized.

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittal.

1.18 COMPLETION

.1 Submit a written certificate that the following actions have been performed:

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

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

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

.4 Certificates required by the PWGSC Fire Protection Engineering Services and utility companies have been submitted.

.5 Operation of systems has been demonstrated to the EGD personnel indicated by Departmental Representative.

.6 Work is complete and ready for final inspection.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers general requirements relating to commissioning of project's components and systems, specifying general requirements for Performance Verification (PV) of components, equipment, sub-systems, systems, and integrated systems.

1.2 MEASUREMENT AND PAYMENT

.1 Payment for commissioning shall be at the Lump Sum price tendered for COMMISSIONING, which shall cover the work activities listed in this Section. Payment shall include for all costs in connection with commissioning.

1.3 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

1.4 ACRONYMS

.1 AFD - Alternate Forms of Delivery, service provider.

.2 BMM - Building Management Manual.

.3 Cx - Commissioning.

.4 EMCS - Energy Monitoring and Control Systems.

.5 O&M - Operation and Maintenance.

.6 PI - Product Information.

.7 PV - Performance Verification.

.8 TAB - Testing, Adjusting and Balancing.

1.5 GENERAL

.1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's PV responsibilities have been completed and approved. Objectives:

.1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.

.2 Effectively train O&M staff.

.3 Contractor to assist in Cx process, operating equipment and systems, troubleshooting and making adjustments as required.

1.6 NON-CONFORMANCE WITH PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the non-functional system, including related systems as deemed required by Departmental Representative to ensure effective performance.

.2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor.

1.7 PRE Cx REVIEW

.1 During Construction: Co-ordinate provision, location and installation of provisions for Cx.

.2 Before start of Cx:

.1 Ensure installation of related components, equipment, sub-systems, systems is complete.

.2 Fully understand Cx requirements and procedures.

.3 Understand completely design criteria and intent and special features.

.4 Submit complete start-up documentation to Departmental Representative.

.5 Ensure systems have been cleaned thoroughly.

.6 Ensure “As-Built” system schematics are available.

.3 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.8 CONFLICTS

.1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.

.2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.9 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 (Submittal Procedures).

.1 Submit proposed Cx procedures to Departmental Representative and obtain written approval at least four (4) weeks prior to start of Cx.

.2 Documentation to be provided for all electrical and mechanical systems.

1.10 COMMISSIONING DOCUMENTATION

.1 Departmental Representative to review and approve Cx documentation.

.2 Provide completed and approved Cx documentation to Departmental Representative.

1.11 COMMISSIONING SCHEDULE

.1 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:

.1 Approval of Cx reports.

.2 Verification of reported results.

.3 Repairs, re-testing, re-commissioning, re-verification.

.4 Training.

1.12 STARTING AND TESTING

.1 Contractor assumes liabilities and costs for inspections, including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.13 MANUFACTURERS INVOLVEMENT

.1 Obtain manufacturer's installation, start -up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative.

.1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.

.2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.

1.14 PROCEDURES

.1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.

.2 Conduct start-up and testing in following distinct phases:

.1 Included in delivery and installation:

.1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.

.2 Visual inspection of quality of installation.

.2 Start-up: follow accepted start-up procedures.

.3 Operational testing: document equipment performance.

.4 System PV: include repetition of tests after correcting deficiencies.

1.15 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

.1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.

.2 Operate and maintain systems for length of time required for commissioning to be completed.

.3 After completion of commissioning, operate and maintain systems until substantial completion.

1.16 TEST RESULTS

.1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.

.2 Provide manpower and materials, assume costs for re-commissioning.

1.17 START OF COMMISSIONING

.1 Notify Departmental Representative at least fourteen (14) days prior to start of Cx.

.2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.18 COMMISSIONING PERFORMANCE VERIFICATION

.1 Carry out Cx under actual operating conditions, over entire operating range, in all modes.

.2 Cx procedures to be repeatable and reported results are to be verifiable.

.3 Follow equipment manufacturer’s operating instructions.

1.19 WITNESSING COMMISSIONING

.1 Departmental Representative to witness activities and verify results.

1.20 DEFICIENCIES, FAULTS, DEFECTS

.1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.

.2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed only with written approval from Departmental Representative.

1.21 COMPLETION OF COMMISSIONING

.1 Upon completion of Cx, leave systems in normal operating mode.

.2 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.22 MAINTENANCE, MATERIALS, SPARE PARTS AND SPECIAL TOOLS

.1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.23 OCCUPANCY

.1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

END OF SECTION

1. Part 1 – General

1.1 DESCRIPTION

.1 This Section covers methods and procedures for demolishing, disposal off-site, salvaging, storing, recycling and removing existing items at the work site (including electrical, mechanical and water services) designated to be removed, disposed off-site, relocated or reinstated, in whole or in part, as described on the Drawings.

.2 This Section also covers items to be salvaged during the course of the work, as described on the Drawings, and then handed over to Departmental Representative for unspecified future uses.

This Section also covers items to be salvaged during the course of the work, as described on the Drawings, and then reused in the Works, including granite coping blocks from the east end dock wall that is to be demolished.

.3 Temporary rail safety stops, located near the east end of the crane rails but outside the work site, will be installed by others prior to the start of this Contract.

.4 For requirements pertaining to localized demolition and/or surface preparation of existing concrete structures in readiness for new concrete work, refer to relevant Sections of the Specification and to the Drawings.

.6 For demolition of in-situ mass concrete and in-situ reinforced concrete structures, refer to Section 02 41 16.01 (Structure Demolition).

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 02 41 13.14 (Asphalt Paving Removal)

.3 Section 02 41 16.01 (Structure Demolition)

.4 Section 02 55 10 (Dust Control)

.5 Section 31 23 33.01 (Excavating, Trenching and Backfilling)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Selective site demolition items will not be measured individually. Payment for work in this Section will be made at the Lump Sum price tendered for SELECTIVE SITE DEMOLITION. Payment shall be full compensation for all work in connection with selective site demolition (including electrical, mechanical and water services) as described in this Section and on the Drawings.

.2 Demolition of concrete structures will be measured to Section 02 41 16.01 (Structure Demolition), and payment shall include all costs in connection with demolition of concrete structures as specified in that Section.

.3 Removal of existing asphalt paving will be measured to Section 02 41 13.14 (Asphalt Paving Removal), and payment shall include all costs in connection with asphalt paving removal as specified in that Section.

1.4 REFERENCES

.1 CAN/CSA-S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

.2 Occupational Health and Safety Regulations, WorkSafeBC.

.3 National Building Code of Canada (NBCC 2015), Part 8 - Safety Measures at Construction and Demolition Sites.

1.5 DEFINITIONS - NOT USED

1.6 SUBMITTALS – NOT USED

2. PART 2 – PRODUCTS – NOT USED

3. Part 3 – Execution

3.1 PREPARATION AND PROTECTION

.1 Inspect site with Departmental Representative to verify extent and location of items designated for removal, disposal, recycling, salvage and items to remain or to be re-used in the Work.

.2 Protect existing items designated to remain and items designated for salvage or re-use. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative.

.3 Cut existing surfaces as required to accommodate new work.

.4 Remove items so shown or specified.

.5 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.

.6 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material, colour, finish and texture.

.7 Making good is defined as matching construction and finishing materials and the adjacent surfaces such that there is no visible difference between existing and new surfaces when viewed from 1.5 metres in ambient light, and includes painting the whole surface to the next change in plane.

.8 Protect and preserve intact the existing tide marker boards at the east end of the south wall of the dry dock.

.9 Protect in accordance with Section 31 23 33.01 (Excavating, Trenching and Backfilling).

.10 Locate and protect electrical and mechanical services. Preserve active services traversing site in operating condition. Notify and obtain approval of Departmental Representative before starting demolition.

.11 Disconnect and cap designated sewer drains, water lines and electrical duct banks. Remove standpipes, manholes and vaults as shown on the Drawings, and securely plug to form watertight seal. Seal end of underground ducts to prevent water ingress into duct bank system.

.12 Schedule demolition and change over of mechanical and electrical services as indicated in:

.1 Section 22 15 00 (General Service Compressed Air Systems)

.2 Section 33 11 16 (Water Utility Distribution Piping)

.3 Section 33 34 00 (Sanitary Sewer Force Main)

.4 Section 26 05 00 (Common Work Results for Electrical)

.13 Ensure site demolition work is performed in accordance with applicable Provincial and environmental regulations.

.14 Perform site demolition work in accordance with the Occupational Health and Safety Regulations of WorkSafe BC.

.15 Manage hazardous materials in accordance with applicable Provincial and Federal environmental regulations.

.16 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.

.17 Do not dispose of waste or volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.

.18 Ensure proper disposal procedures are maintained throughout the project.

.19 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers or onto adjacent properties.

.20 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with applicable Provincial and Federal environmental regulations.

.21 Do not disturb or damage items designated to remain in place.

3.2 REMOVAL AND STORAGE

.1 Remove and store materials designated to be salvaged or re-used, in manner to prevent damage, at Contractor's storage location. Advise Departmental Representative in writing of designated storage location.

.2 Store and protect in accordance with requirements for maximum preservation of material.

.3 Handle salvaged materials as new materials.

.4 Label stored materials, indicating material type and quantity.

.5 Label the location of storage areas for salvaged material and provide barriers and security devices. Designate appropriate security resources and other measures to prevent vandalism, damage and theft.

.6 Locate stored materials convenient for use in new construction to eliminate double handling wherever possible.

.7 Stockpile materials designated for off-site disposal in location(s) which facilitate removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

.8 Remove stockpiled material, as directed by Departmental Representative, when it interferes with construction activities.

3.3 DEMOLITION, SALVAGE AND DISPOSAL

.1 Remove materials that cannot be salvaged for re-use or recycling, and dispose of in accordance with applicable codes at licensed facilities.

.2 Dismantle items containing materials for salvage and stockpile salvaged materials at Contractor's storage location.

.3 Separate waste materials for re-use and recycling.

.4 Handle and dispose of hazardous materials in accordance with applicable Provincial and Federal environmental regulations.

.5 Remove asphalt pavement in accordance with Section 02 41 13.14 (Asphalt Paving Removal).

.6 Demolish and dispose off-site any reinforced or unreinforced concrete designated for removal in accordance with Section 02 41 16.01 (Structure Demolition).

.7 Excavate at least 300 mm below pipe invert, when removing pipes under existing or future pavement area.

.8 Backfill in areas as indicated and in accordance with Section 31 23 33.01 (Excavating, Trenching and Backfilling).

.9 Remove and dispose off-site all existing electrical, mechanical and water services designated to be removed and disposed off-site, in whole or in part, as described on the Drawings.

3.4 CLEANING

.1 Remove debris, trim surfaces and leave work site clean, upon completion of Work.

.2 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.5 PROTECTION

.1 Repair damage to adjacent materials or property caused by selective site demolition.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the breakup and removal of existing asphalt pavement at the east end of the dock apron roadway.

1.2 RELATED SECTIONS

.1 Section 01 74 21 (Waste Management and Disposal)

.2 Section 02 41 16.01 (Structure Demolition)

.3 Section 02 55 10 (Dust Control)

1.3 MEASUREMENT AND PAYMENT

.1 Removal of existing asphalt pavement will be measured in cubic metres of asphalt material actually removed, regardless of depth or thickness removed or number of operations required.

.2 Payment for removal of existing asphalt shall be at the unit price tendered for ASPHALT PAVING REMOVAL. Payment shall include all costs in connection with breakup, sorting, removing, hauling, stockpiling and disposal of existing asphalt pavement to the limits shown on the Drawings.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Contractor is responsible for the disposal of asphalt materials.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 NOT USED

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 PREPARATION

.1 Prior to beginning removal operation, inspect and verify with Departmental Representative areas, depths and lines of asphalt pavement to be removed.

.2 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.

3.2 PROTECTION

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

3.3 REMOVAL

.1 Remove existing asphalt pavement to lines and grades as shown on the Drawings, except as otherwise established by Departmental Representative in the field.

.2 Use equipment and methods of removal and hauling which do not damage or disturb underlying pavement or granular materials that are to remain in place.

.3 Prevent contamination with base course aggregates, soil or other materials when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving.

.4 Provide for suppression of dust generated by removal process in accordance with Section 02 55 10 (Dust Control).

3.4 STOCKPILING MATERIAL

.1 Dispose of removed asphalt pavement by stockpiling in locations designated by Departmental Representative.

.2 Removed asphalt pavement which is to be recycled in hot mix asphalt concrete under this Contract may be stockpiled at designated asphalt plant site.

3.5 SWEEPING

.1 Sweep remaining asphalt pavement surfaces clean of debris resulting from removal operations using rotary power brooms and hand brooms as required.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the demolition of existing mass concrete and reinforced concrete structures and the disposal of debris arising from such demolition. Existing concrete structures to be demolished include: dry dock walls and service tunnel, concrete slab apron, capstan anchor block, crane beams, crane stops, pavement slabs (concrete base under asphalt paving), manholes, vaults and duct banks.

.2 Demolition and disposal of existing portions of Section 3 Dock walls and floors associated with the repair and refurbishment of the Section 3 dock walls and floors is covered under Section 03 01 31 (Dock Floor Concrete Topping) and Section 03 01 32 (Dock Walls Concrete Repair).

.3 Demolition and disposal of asphalt pavement is covered under Section 02 41 13.14 (Asphalt Paving Removal).

.4 Demolition and disposal of existing timber, steel, attachments and utilities is covered under Section 02 41 13 (Selective Site Demolition).

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 35 13.43 (Special Procedures for Contaminated Sites)

.3 Section 01 35 33 (Health and Safety Requirements)

.4 Section 01 35 43 (Environmental Procedures and Sustainability)

.5 Section 01 74 21 (Waste Management and Disposal)

.6 Section 02 41 13.14 (Asphalt Paving Removal)

.7 Section 02 55 10 (Dust Control)

1.3 MEASUREMENT AND PAYMENT

.1 Measurement for demolition of existing concrete structures will be calculated from vertical cross-sections developed from field surveys of existing concrete surface (before demolition), and the concrete/rock interface or concrete/soil interface behind existing concrete structures (after demolition), to minimum lines of excavation shown on the Drawings or directed by the Departmental Representative. Deductions shall be made in the measured volume for tunnels/openings/voids within the concrete structure. Cross-sections shall be produced at spacings no greater than 5.0 m intervals along the excavated surface. The field surveys shall be performed in the same manner as specified in Section

31 23 16.26 (Rock Excavation). Structure demolition will be measured in cubic metres of concrete demolished for unreinforced and reinforced concrete structures, computed from the aforementioned cross-sections.

.2 The demolition and disposal of miscellaneous reinforcing bars, formwork ties, tie-rods, anchor bolts, and jointing/caulking materials within the existing concrete structures will not be paid for separately, but shall be included in the unit price of the work covered by this Section.

.3 Demolition of concrete structures, as described in this Section, and regardless of the method of demolition, will be paid for at the unit price tendered for STRUCTURE DEMOLITION. Payment shall include for all costs in connection with demolition, controlled breakup, blasting where permitted, sorting, transport and disposal of the concrete structures, as specified and as shown on the Drawings.

.4 The removal, temporary storage and handover to Departmental Representative of granite coping blocks from the east end dock wall that is to be demolished, as described on the Drawings, is not to be considered as structure demolition and instead will be covered under Section 02 41 13 (Selective Site Demolition).

1.4 REFERENCES

.1 Canadian Standards Association (CSA):

.1 CAN/CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.

.2 CAN/CSA-A23.1, Concrete Materials and Methods of Concrete Construction.

.2 National Building Code of Canada (NBCC), Part 8 - Safety Measures at Construction and Demolition Sites.

.3 WorkSafeBC, Occupational Health & Safety Regulations.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 At least twenty-eight (28) days prior to commencing concrete structure demolition work, and in accordance with Section 01 33 00 (Submittal Procedures) submit for review by Departmental Representative design, drawings and supporting data prepared by qualified professional engineer registered or licensed in the Province of British Columbia, Canada showing proposed method and sequencing of work, access falsework, temporary support, shoring and underpinning, and product data for concrete structure demolition. Refer also to the requirements of Section 31 23 33.01 (Excavating, Trenching and Backfilling).

.2 At least twenty-eight (28) days prior to start of structure demolition work, submit detailed Waste Reduction Work Plan in accordance with Section 01 74 21 (Waste Management and Disposal) and indicate:

.1 Descriptions of types and anticipated quantities of materials to be salvaged, re-used, recycled and land-filled.

.2 Schedule of concrete demolition.

.3 Number and location of dumpsters.

.4 Anticipated frequency of tippage.

.5 Names and addresses of hauliers, waste facilities and waste receiving organizations.

1.7 SITE CONDITIONS

.1 Review environmental site information and take precautions to protect environment.

.2 Contractor shall inspect the work site to thoroughly familiarize himself with site conditions before starting structure demolition work.

.3 Should material resembling spray or trowel-applied asbestos, or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify Departmental Representative immediately. Do not proceed until written instructions have been received from Departmental Representative.

.4 Notify Departmental Representative before disrupting Esquimalt Graving Dock access or services.

Part 2 Products

2.1 EQUIPMENT

.1 Leave equipment and machinery running only while in use, except where extreme temperatures prohibit shutting down.

.2 Demonstrate that tools and machinery are being used in manner which allows for salvage of materials in best condition possible.

Part 3 Execution

3.1 PREPARATION AND PROTECTION

.1 Do work in accordance with Section 01 35 33 (Health and Safety Requirements).

.2 Protection:

.1 Support affected structures and prevent movement, settlement, or damage to adjacent structures, utilities and portions of structures to remain in place. Provide bracing, shoring and underpinning as required.

.2 If safety of structure being disassembled or demolished (or adjacent structures and services) appears to be endangered, take preventative measures, cease operations and immediately notify Departmental Representative.

.3 Prevent debris from blocking surface drainage system, mechanical and electrical systems.

.4 Keep noise, dust, and inconvenience to occupants to a minimum and in accordance with Section 02 55 10 (Dust Control).

.5 Protect dry dock cranes, caisson gates, electrical systems, services and equipment.

.6 Install and maintain temporary structural safety barricades and work site procedures throughout the demolition work, in accordance with WorkSafeBC requirements.

.7 Provide temporary dust screens, covers, railings, supports and other protection as required.

.3 Locate and protect utility lines. Do not disrupt active or energized utilities designated to remain undisturbed.

.4 Disconnect electrical, fibre optic, telephone and communication service lines entering areas designated for demolition as shown on the Drawings.

.5 Post warning signs on electrical lines and equipment which must remain energized to serve other dock equipment and services during period of demolition.

.6 Disconnect, cap and re-route designated mechanical services, as shown on the Drawings.

.7 Employ structural demolition methods that minimize or eliminate deposition of cementitious material, concrete debris or concrete dust into the marine environment.

3.2 DEMOLITION, SALVAGE AND DISPOSAL

.1 Demolish and remove existing concrete structures, and portions of existing structures as shown on the Drawings, to permit new construction.

.2 Prevent debris, dust, and any sediment laden waters from entering any drainage system, water course or marine environment in line with EGD Environmental Best Management Practices (EBMPs), specifically EBMP #17 and EBMP #18.

.3 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.

.4 Do not dispose of waste or volatile materials including but not limited to, mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers.

.5 Sort materials into appropriate piles for re-use and/or recycling.

3.3 DISASSEMBLY, AND DEMOLITION PROCEDURES

.1 Demolish and remove portions of existing dry dock structure and attachments, as shown on the Drawings, to extend the dry dock and to permit new construction.

.2 If the Contractor elects to use controlled blasting to assist in demolition of concrete structures, then the relevant provisions and requirements of Section 31 23 16.26 (Rock Excavation) will apply to execution of the work, including the definitions described in that Section, and the stipulated submittals in that Section.

.3 Throughout course of disassembly and demolition pay close attention to connections and material assemblies. Employ workmanship procedures which minimize damage to materials and equipment.

.4 Ensure workers and subcontractors are trained to carry out work in accordance with appropriate demolition techniques.

.5 Project supervisor with previous demolition experience must be present on site throughout demolition work.

.6 Carry out demolition in accordance with CAN/CSA S350 and other applicable safety standards.

.7 Workers must utilize adequate fall protection as required by WorkSafeBC.

.8 Remove and store materials to be salvaged, in manner to prevent damage.

.9 Store and protect in accordance with requirements for maximum preservation of material.

.10 Handle salvaged materials as new materials.

.11 Where existing materials are to be re-used in the work, use special care in removal, handling, storage and re-installation to assure proper function in completed work.

.12 Trim faces and edges of partially demolished structural elements to tolerances shown on the Drawings.

.13 Waste Management and Disposal:

.1 Separate waste materials for reuse and/or recycling, in accordance with Section 01 74 21 (Waste Management and Disposal).

.2 Dispose of removed materials, to appropriate recycling or re-use facilities except where specified otherwise, in accordance with authority having jurisdiction.

.3 Dispose of creosoted or treated timber components in accordance with Provincial regulations.

3.4 STOCKPILING

.1 Stockpiling of excavated soils is not permitted on-site

.2 Label stockpiles, indicating material type and quantity.

.3 Designate appropriate security resources/measures to prevent vandalism, damage and theft.

.4 For salvaged attachments and utilities that are to be re-used in the work, locate stockpiled materials convenient for use in new construction. Eliminate double-handling wherever possible.

.5 Stockpile materials shall be contained and filtered to limit particle transfer into the marine environment.

3.5 REMOVAL FROM SITE AND DISPOSAL

.1 Remove materials that cannot be salvaged for re-use or recycling, and dispose of in accordance with applicable codes at licensed facilities.

.2 Transport material designated for alternate disposal by approved haulers to receiving organizations listed in Waste Reduction Work Plan and in accordance with regulations. Do not deviate from haulers and receiving organizations listed in Waste Reduction Work Plan without prior written authorization from Departmental Representative.

.3 Dispose of materials not designated for alternate disposal in accordance with regulations. Disposal facilities must be listed in Waste Reduction Work Plan. Do not deviate from disposal facilities listed in Waste Reduction Work Plan without prior written authorization from Departmental Representative.

3.6 CLEANING AND RESTORATION

.1 Keep site clean and organized throughout demolition procedure.

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

.3 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife or marine environment.

.4 Repair damage to adjacent structures and utilities caused by disassembly or demolition of structures in the work, as directed by Departmental Representative.

.5 Upon completion of project, reinstate adjacent dock apron, wall and floor areas affected by Work to condition which existed prior to beginning of Work, and match the condition of adjacent, undisturbed areas.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section specifies requirements for dust control for the duration of the project.

1.2 RELATED SECTIONS

.1 Section 02 41 13.14 (Asphalt Paving Removal)

.2 Section 02 41 16.01 (Structure Demolition)

.3 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.4 Section 31 24 15 (General Fill)

1.3 MEASUREMENT AND PAYMENT

.1 Supply and application of water for dust control is considered incidental to the work and will not be measured separately.

.2 Supply, installation, relocation as necessary, and final removal of dust screens for dust control is considered incidental to the work and will not be measured separately.

.3 No measurement or payment will be made under this Section.

1.4 DEFINITIONS

.1 NOT USED

1.5 SUBMITTALS

.1 NOT USED

1.6 REFERENCES

.1 NOT USED

Part 2 Products

2.1 MATERIALS

.1 Water: to Departmental Representative’s approval.

.2 Dust Screens: to Departmental Representative’s approval.

Part 3 Execution

3.1 APPLICATION

.1 Ensure that dust arising from all Contractor operations, such as barge or truck transportation, material stockpiling and demolition work, is controlled by water application and use of dust screens. Stockpiling of excavated soils is not permitted on-site.

.2 Ensure that dust blown from the Work does not affect adjacent facilities.

.3 Apply water as required for dust control, and when directed by Departmental Representative. Dust control methods shall be chosen such that a minimal amount of water required.

.4 Apply water with distributors equipped with spray system to ensure uniform application and with means of shut off.

.5 Runoff from water used for dust control shall not enter the storm drains.

.6 Provide temporary dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of work, and public.

.7 Maintain, relocate as necessary, and remove dust screens at completion of those portions of the work that may generate airborne dust.

.8 Secure and cover material in open trucks hauling excavated material, and re-use the covers.

.9 If Contractor’s dust and particulate control is not sufficient for controlling dusts and particulates into atmosphere, stop work. Discuss, with Departmental Representative, procedures to resolve the problem. Make necessary changes to operations prior to resuming excavation, handling, processing, or other work that may cause release of dusts or particulates.

.10 Take extra precautions, when necessary, to ensure that dust control measures are adequate during hot and dry weather, if there are strong winds.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the treatment of Contaminated or Potentially Contaminated Water collected from excavations.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

1.3 MEASUREMENT AND PAYMENT

.1 The Contractor shall treat Contaminated or Potentially Contaminated Water collected from the excavation onsite or offsite. Contaminated or Potentially Contaminated water system provisions will be paid in accordance with lump sum price for **Contaminated Sites Water Treatment - System Provisions**, which will include the design, obtaining all necessary permits, mobilization, demobilization, supply and erection of all onsite ancillary tanks, storage containers, loading facilities, equipment and piping to dewater, collect, store, sample, and provide for treatment and discharge of Contaminated or Potentially Contaminated Water that may collect in the excavation during the work.

.2 Contaminated Water Treatment operations will be paid in accordance with the lump sum price established for **Contaminated Sites Water Treatment - Operation** to process Contaminated or Potentially Contaminated Water in accordance with required permit and associated regulations and requirements. Includes all labour and fees for operation of water treatment system to dewater, collect, store, and sample Contaminated or Potentially Contaminated Water. Includes operation of Onsite Contaminated Water Treatment Plant to treat contaminants in water to below permit and regulation requirements and discharge in accordance with applicable permit and regulations or Transport and Treatment at Offsite Contaminated Water Treatment Facility. Includes analytical testing to demonstrate compliance with Contract, permit and applicable regulations

1.4 DEFINITIONS

.1 See Section 01 11 55 General Requirements

1.5 SUBMITTALS

.1 Onsite water treatment submittals shall include:

.1 Contaminated Water Treatment Provision Plan: within 10 Working Days after Contract award and prior to mobilization to Site, Submit methods, means, and sequences for Contaminated Water Treatment Plant Provision for compliance with: applicable permits, certificates, approvals, or any

other form of authorizations; other federal, provincial, or municipal requirements; and in accordance with the Contract. Includes onsite infrastructure, proposed collection and treatment methods and proposed discharge location and quality. Must be signed by Contractor's Qualified Professional.

.2 Provide copies of all correspondence with Discharge Approval authority, including:

.1 Copy of Discharge Approval including: approval from authority having jurisdiction, discharge criteria and rate, and sampling requirements (including substances and other parameters, and frequency).

.2 Copy of test results forwarded to Discharge Approval authority.

.3 Copy of changes to Discharge Approval, including orders to cease discharge.

.4 Onsite Contaminated Water Treatment Plant Testing:

.1 Within 5 Working Days of conducting initial operations testing, and prior to operating or discharge, Submit results of initial operations test.

.2 Within 5 Working Days of sampling Submit sampling results of operational (recurrent) testing.

.2 Offsite water treatment submittals shall include:

.1 Contaminated Water Treatment Provision Plan: within 10 Working Days after Contract award and prior to mobilization to Site, Submit methods, means, and sequences for Contaminated Water Treatment Plant Provision for compliance with: applicable permits, certificates, approvals, or any other form of authorizations; other federal, provincial, or municipal requirements; and in accordance with the Contract. Includes onsite infrastructure.

.2 Offsite Contaminated Water Treatment Facility Plan: at least 10 days prior to transporting material to a Treatment Facility, Submit documentation describing Treatment Facility. Include for each Treatment Facility:

.1 Copy of permit, certificate, approval, license, or other required form of authorization issued by a Facility Authority for the Treatment of relevant Contaminated Water.

.2 Letter from Contractor's Qualified Professional that the Treatment Facility is appropriate for the nature, type, concentration, and quantity of Contaminated Water to be Treated in accordance with any authorization and complies with appropriate government requirements of a general nature (eg BC Landfill Criteria).

.3 Letter from Treatment Facility that they can accept within the schedule in Contract the nature, type, concentration, and quantity of Contaminated Water to be Treated at the Facility, signed by an authorized representative of the Facility.

.3 Certificate of Treatment: within 30 Working Days of treatment at Offsite Contaminated Water Treatment Facility, Submit documentation verifying that materials have been treated by Contractor. Include:

.1 Issued by the Treatment Facility.

.2 On company letterhead.

.3 Name and location of facility where the material is being treated.

.4 Date and weight for each shipment received and total weight received at the offsite facility.

.5 Date and weight for each treatment event and total weight treated at the offsite facility.

.6 Treatment methodology.

.7 Laboratory certificates demonstrating Treatment objectives were met.

.8 Disposition of treated material.

.9 Signed by identified authorized treatment company representative.

.3 Make all submittals in accordance with Section 01 33 00 (Submittal Procedures).

Part 2 Products

2.1 NOT USED

Part 3 Execution

3.1 Execution for onsite water treatment:

.1 Contaminated Water Transport Pressure distributor to be:

.1 Initiate appropriate measures and procedures to reduce the volume of water entering the excavation and prevent uncontaminated water from being contaminated. Prevent the discharge of Contaminated or Potentially Contaminated Water.

.2 Assume ownership of and be responsible for Contaminated and Potentially Contaminated Water.

.2 Contaminated Water Treatment Onsite

.1 Design and Discharge Requirements:

.1 Design and Operating Criteria: design Contaminated Water Treatment Plant capable of treating quality and quantity of Contaminated Water generated from dewatering excavations and

Work areas to facilitate Work and meet Discharge Approval requirements; capable of treating contaminants which may require removing oil, suspended solids, particulates, dissolved metals, petroleum and asbestos fibers, and filter water through 5-micron particulate filter (or as required by permit and applicable regulations) prior to discharge.

.2 Discharge to environment only in compliance with the Discharge Approval and requirements by the Discharge Approval authority. Discharge to environment only as determined in accordance to permit and regulatory requirements by Contractor's Qualified Professional and as accepted by Departmental Representative.

.2 Initial Testing: determine performance of Contaminated Water Treatment Plant provided by Contractor as follows prior to commencing excavation:

.1 Test run with potable water to ensure operation, no leaks are occurring, and no contaminants are introduced into treated water.

.2 Performance verification (contaminant removal) with Contaminated Water test batch to ensure treatment is effective. Treat, store, test, and assess samples by Contractor's Qualified Professional.

.3 Provide access for independent collection of treated stored water samples by the Departmental Representative.

.3 Operational Testing:

.1 Operate Contaminated Water Treatment Plant using experienced, qualified personnel and in accordance with manufacturer's instructions and procedures as Submittals by Contractor.

.2 Collect, analyze, and assess samples as required by Contractor's Qualified Professional, and at a minimum of every 72 hours of operation.

.3 Provide access for independent collection of samples by the Departmental Representative.

.4 On basis of analytical results by Contractor or Departmental Representative obtained from samples collected at the discharge point, cease discharge and make Plant modifications required for effluent to satisfy effluent criteria as directed by the Departmental Representative or Discharge Approval authority. Perform Initial Testing after Plant modifications.

.4 Decommissioning/Dismantling:

.1 Decontaminate and remove salvageable components of Contaminated Water Treatment Plant including treatment system, pumps, piping, and electrical equipment.

.2 Dispose of non-salvageable equipment and materials at Disposal Facility accepted by the Departmental Representative.

Decontaminate salvageable equipment as required prior to demobilization from Site.

3.2 Execution for offsite water treatment:

.1 Contaminated Water Transport

.1 Assume ownership of, and be responsible for Contaminated Water and Potentially Contaminated Water once it accumulates in excavation or in the Works including during remove, handling, storage and offsite transportation.

.2 Contaminated Water Treatment Offsite

.1 Assume ownership of, and be responsible for, Contaminated Water treated offsite.

.2 Contaminated Water Treatment - Offsite: treat at Treatment Facility provided by Contractor and accepted by the Departmental Representative.

.3 Offsite Treatment Facility must:

.1 Be an existing offsite facility located in Canada or the United States.

.2 Be designed, constructed and operated for the handling or processing of Contaminated Water for the purposes of Treatment.

.3 Hold a valid and subsisting permit, certificate, approval, license, or other required form of authorization issued by a Facility Authority for the treatment of relevant Contaminated Water.

.4 Comply with requirements of acts, regulations, bylaws, and other requirements, in force or appropriately adopted as guidelines, including the BC Environmental Management Act and BC Landfill Criteria for Municipal Solid Waste, or Yukon Environment Act and Yukon Solid Waste Regulations, municipal zoning bylaws, or equivalent.

.4 Treat material as soon as practical and within 100 Working Days of leaving Site or as required by Contract unless otherwise accepted by Departmental Representative.

.5 Water sent to an offsite Treatment Facility must subsequently be discharged in compliance with a Discharge Approval.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the treatment of Contaminated or Potentially Contaminated Water collected from excavations.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

1.3 MEASUREMENT AND PAYMENT

.1 The Contractor shall treat Contaminated or Potentially Contaminated Water collected from the excavation onsite or offsite. The Contractor will only be paid for onsite or offsite treatment, not both. Should the Contractor select to treat Contaminated or Potentially Contaminated Water Offsite, System Provision will be paid in accordance with lump sum price for **Contaminated Sites Water Treatment Offsite – Provisions** which will include the design and permit, temporarily provide for duration of Work, and erect all onsite ancillary tanks, storage containers, equipment and piping to dewater contaminated and potentially contaminated water from the excavation, collect, store, and sample contaminated or potentially Contaminated Water. Includes provision of bulk storage tanks and loading facilities for Offsite Water Treatment Facility.

.2 Contaminated Water Treatment Offsite-Operation will be paid in accordance with the lump sum price established for **Contaminated Sites Water Treatment Offsite- Operations** to process Contaminated Water offsite. Includes operation of dewatering of Contaminated or Potentially Contaminated Water from excavation, collecting, storing, and sampling. Includes treating Non-Aqueous Phase Liquids and other associated contaminated present in recovered water. Includes Transport and Treatment at Offsite Contaminated Water Treatment Facility. Includes analytical testing to demonstrate compliance with Contract.

1.4 DEFINITIONS

.1 See Section 01 11 55 General Instructions

1.5 SUBMITTALS

.1 Contaminated Water Treatment Provision Plan: within 10 Working Days after Contract award and prior to mobilization to Site, Submit methods, means, and sequences for Contaminated Water Treatment Plant Provision for compliance with: applicable permits, certificates, approvals, or any other form of authorizations; other federal, provincial, or municipal requirements; and in accordance with the Contract. Includes onsite infrastructure.

PART 1 GENERAL

1.1 Description

Work for this section generally includes the removal and replacement of the concrete slab on the base of dock bottom in Section 3 and includes:

.1 Concrete floor partial demolition.

.2 Concrete surface preparation.

.3 Placement procedure for new bonded concrete topping.

.4 Trench drain removal and replacement

1.2 Related Documents and Specifications Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 35 33 (Health and Safety Requirements)

.3 Section 01 35 43 (Environmental Procedures and Sustainability)

.4 Section 01 74 11 (Cleaning)

.5 Section 02 41 23 (Selective Site Demolition)

.6 Section 03 01 32 (Dock Walls Concrete Repair)

.7 Section 03 10 00 (Concrete forming and Accessories)

.8 Section 03 20 00 (Concrete Reinforcing)

.9 Section 03 30 00 (Cast-in-Place Concrete)

.10 Section 03 39 00 (In-Situ Concrete Structures)

.11 Section 04 03 41 (Stone Repair)

.12 Section 05 50 00 (Metal Fabrications)

1.3 Measurement and Payment Procedures

.1 Concrete covered by this Section will be measured in cubic meters incorporated into the work, determined by the details and dimensions shown on the Drawings. Block outs, ducts, embedded pipe or other items creating voids where the volume is greater than 0.10 m^3 shall be deducted from the measurement.

.2 Concrete covered by this Section will be paid for at the relevant unit prices tendered for **DOCK FLOOR CONCRETE TOPPING**. Payment for concrete shall include all costs in connection with the concrete as specified and as shown on the Drawings, including old concrete removal and disposal, concrete surface preparation, reinforcing steel, formwork, pits and openings, falsework, accessories and temporary support structures required for the work.

.1 Concrete works for removal and filling of existing abandoned sewers shall be included in the concrete volume measurement.

.2 Concrete works for filling of existing sump pits shall be included in the concrete volume measurement.

.3 Concrete works for removal and replacement of the concrete curb at Caisson Stop #4 shall be included in the concrete volume measurement.

.3 No measurement or payment will be made for concrete placed to correct unauthorized demolition of existing concrete structures.

.4 Concrete for Grit Channels and Filling/ Emptying Tunnels will not be measured separately, but are considered part of the work. All costs in connection with the Grit Channels and Filling/ Emptying Tunnels, shall be included in the unit prices tendered for concrete.

.5 Expansion joints, contraction joints and construction joints will not be measured separately, but are considered part of the work. All costs in connection with the construction of joints, including water stop where indicated, shall be included in the unit prices tendered for concrete.

.6 Miscellaneous metal fabrications for the Grit Channels and Filling/ Emptying Tunnel Grates & Covers will be measured to Section 05 50 00 (Metal Fabrications), and payment shall include all costs in connection with supplying and installing miscellaneous metal fabrications.

.7 Trench drains covered by this section will be measured in linear meters incorporated into the work, determined by the details and dimensions shown on the Drawings except as noted otherwise. Note: The Grit Channels are not included in the trench drain measurement.

.8 Trench drains associated with this Section will be paid for at the relevant unit rates tendered for **TRENCH DRAINS – EXISTING DOCK FLOOR**. Payment for trench drains shall include all costs in connection with the provision and installation of the trench drains, as specified and as shown on the Drawings, including reinforcing steel and applicable mounting hardware. Removal and disposal of the existing trench drain is considered part of this work.

1.4 References

.1 Canadian Standards Association (CSA):

.1 CSA A23.1-19, Concrete Materials and Methods of Concrete Construction

.2 CSA A23.2-19, Test Methods and Standard Practices for Concrete

.2 CSA A3000-18, Cementitious Materials Compendium

.3 CSA-S6-14, Canadian Highway Bridge Design Code

.4 CSA-G30.18-09 (R2019), Billet-Steel Bars for Concrete Reinforcement

.5 CAN/CSA-G40.21-13, Structural Quality Steels

.2 International Concrete Repair Institute (ICRI):

.1 ICRI 210.3R-13, Guide for Using In-Situ Pull-off Tests to Evaluate Bond of Concrete Surface Materials

.2 ICRI 310.1R-08, Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Steel Corrosion

.3 ICRI 310.2R-13, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair

.4 ICRI 310.3R-14, Guide for the Preparation of Concrete Surfaces for Repair Using Hydrodemolition Methods

.5 ICRI Concrete Surface Profiles (CSP's)

.3 Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.4 American National Standards Institute/American Concrete Institute: ANSI/ACI 315, Details and Detailing of Concrete Reinforcement.

.5 American Society for Testing and Materials (ASTM):

.1 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes

.2 ASTM A955, Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcement

.3 ASTM C171, Standard Specification for Sheet Materials for Curing Concrete

.4 ASTM C494, Standard Specification for Chemical Admixtures for Concrete

.5 ASTM C1116, Standard Specification for Fiber-Reinforced Concrete

.6 ASTM C1583, Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength of Concrete Repair and Overlay

.7 ASTM D6432, Standard Guide for Using the Surface Ground Penetrating Radar Method for Subsurface Investigation

.8 ASTM E1155, Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers

.6 American Concrete Institute (ACI):

.1 ACI 302.1R-15, Guide to Concrete Floor and Slab Construction

.2 ACI 305R-10, Guide to Hot Weather Concreting

.3 ACI 306R-16, Guide to Cold Weather Concreting

.4 ACI 308.1-11, Specification for Curing Concrete

.7 European Standards (EN):

.1 EN 1433, Drainage Channels for Vehicular and Pedestrian Areas

1.5 Definitions

.1 Not used

1.6 Submittals

.1 Submittals in accordance with Section 01 33 00 (Submittal Procedures).

.2 Submit a **Quality Control Plan** in accordance with Section 03 30 00 (Cast-in-Place Concrete)

.3 Submit a **Concrete Placement Workplan**, for approval 14 days prior to construction. which shall include (but is not limited to) the following:

.1 Pour sequence, staging areas, concrete pumping equipment and procedures, formwork, pre-pour checklists, manpower requirements, subcontractors' roles and responsibilities, concrete testing, bonding agent application, concrete consolidation, concrete finishing, saw cutting, flatness testing and curing procedures.

.4 Meeting minutes for a **Concrete Pre-Pour Meeting** which shall be held a minimum of 14 days prior to the 'Mock-Up' concrete placements.

.1 Attendees shall include representatives from the: General Contractor, Concrete Contractor, Concrete Finishing Contractor, Concrete Pumping Contractor, Concrete Ready-Mix Supplier, Contractor's Concrete Testing Agency, PSPC Representative, Consultant, Materials Consultant.

.2 The agenda at a minimum shall include: Staging, mix design, concrete delivery, concrete testing, concrete bonding agent, concrete placement and consolidation, finishing, saw cutting, curing, concrete testing and floor flatness testing.

.5 Submit Cementitious grout bonding agent data sheet 14 days prior to construction.

.6 Reinforcing Steel Shop Drawings per Section 03 02 00 (Concrete Reinforcing):

.7 Submit Survey data 14 days prior to construction, showing:

.1 Trench drain locations (and elevations)

.2 Filling and emptying tunnel grate locations (and elevations)

.3 Granite block locations (and elevations)

.8 Submit Trench Drain information 28 days prior to construction, including:

.1 Shop drawings

.2 Technical Data

.3 Sample Section of drain assembly

.9 Submit Miscellaneous Metals Shop Drawings 28 days prior to construction, including:

.1 Filling/Emptying Tunnel Grate and lid

.2 Grit Channels

.10 Submit Product information for dowel anchoring adhesive 14 days prior to construction.

1.7 Concrete Mix Design Trials

.1 In conformance with Section 03 30 00 (Cast-in-Place Concrete)

1.8 Quality Control

.1 Concrete Surface Preparation

.1 The prepared surface of the existing concrete slab shall be reviewed by the Departmental Representative following demolition and surface preparation.

.2 The bond surface tensile capacity of the existing concrete surface shall be tested per ICRI 210.3R-13 and CSA A23.2-6B at least every 500 m^2 of the prepared floor surface. A test shall consist of a minimum of three (3), 100 mm diameter samples. The test shall be completed by adhering steel plates of sufficient thickness (stiffness) to the prepared surface and applying a tensile load. Minimum average bond surface tensile capacity: **0.9 MPa**.

.2 Reinforcing Dowel – Anchor Testing

.1 Proof load testing of drilled reinforcing steel dowels shall be completed at intervals selected by the Departmental Representative, but not less than 4 tests shall be completed.

.2 A test shall consist of a minimum of three (3) steel reinforcing bars selected at random during installation.

.3 Proof load shall be 60 kN.

.4 A test will be considered satisfactory if all samples sustain the proof load without permanent deformation and/or distress.

.5 Test failure will result in further testing and or rejection of the adhesive product or installation process.

.3 Concrete Quality Control Testing to be completed in conformance with Section 03 30 00, except as noted:

.1 Full time concrete monitoring shall be provided and shall include testing of concrete slump, temperature, density and air content for every concrete batch.

.4 Bond Testing of the concrete topping shall be completed in conformance with CSA A23.2-6B for every 1000 m^2 of floor surface. A test shall consist of a minimum of three (3), 100 mm diameter samples. Minimum average bond strength: **0.9 MPa**.

.5 Flatness Testing shall be completed for every concrete topping placement in conformance with ASTM E1155.

1.9 Quality Assurance

.1 In conformance with Section 03 30 00 (Cast-in-Place Concrete)

1.10 Mock-Up

.1 The contractor shall prepare two (2) mock-ups of the bonded concrete topping work. Both mock-up locations shall be within Section 3 of dock bottom, designated by the Departmental Representative. The size of the first mock-up shall be at least 9144 mm by 5700 mm and will be located between two rows of existing granite blocks. The second mock-up shall be at least 9144 mm by 9295 mm and will be located between dock wall and the nearest row of granite blocks. The mock-ups shall be used to evaluate the:

- .1 Removal of existing concrete slab.
- .2 Installation of reinforcing steel.
- .3 Installation of new trench drain, as required.
- .4 Concrete surface preparation.
- .5 Installation of the new concrete topping, including bonding agent. Installation of concrete control joints.
- .6 Concrete Finishing. Once accepted, the mock-up shall be the acceptable standard for slab finish.
- .7 If deemed acceptable by the Departmental Representative, the mock-up may form part of the finished work.

.2 Quality Control testing shall be provided by the Contractor and shall include anchor testing, concrete testing, bond testing and flatness testing.

2. PART 2 – PRODUCTS

2.1 Materials

.1 Provide stainless steel deformed reinforcing bars in conformance with Section 03 20 00 (Concrete Reinforcing).

.2 Provide metal fabrications in conformance with Section 05 50 00 (Metal Fabrications).

.3 Adhesive for drilled rebar shall be in conformation with Section 03 30 00 (Cast-in-Place Concrete).

.4 Provide concrete in conformance with Section 03 30 00 (Cast-in-Place Concrete). Concrete shall be **Type E**.

.5 Bonding Agent - shall consist of a slurry of Type GU cement and water mixed to thick flowable consistency. The maximum water/cementing materials ratio of the slurry shall be 0.5. Refer to CSA A23.1-19, Section 7.9.4.2 a).

- .1 The bonding agent shall be a pre-manufactured and prebagged product and shall be submitted for review by the Departmental Representative.
- .2 Latex or epoxy bonding agents are not permitted.

.6 Joint material for sawcut joints shall be polyurea material with the following properties:

- .1 Shore A Hardness (ASTM D2240): 84 to 88

.2 Adhesion to Concrete (ASTM D4541) @ 7 Days: 1.7 MPa

.2 UV stable

.7 Cementitious grout for joints to be Portland cement based and shrinkage compensated with a minimum 28-day compressive strength of 60 MPa.

2.2 Trench Drain

.1 The trench drain assembly system shall be a premanufactured segmented drain system cast into the concrete topping. The body of the drain shall be polymer concrete featuring stainless steel rails and removable ductile iron grate. The drain body and grates shall be from the same supplier.

.2 Load Rating: EN 1433 Load Class E

.3 Polymer concrete body:

.1 Minimum concrete compressive strength: 95 MPa

.2 Acid and alkali resistant

.3 Nominal interior clear opening: 200 mm

.4 Pre-cast units shall be manufactured with a continuous 0.5% invert slope.

.5 The invert of the body shall be square or feature a partial radius.

.6 Stainless steel edge rail shall be integrally cast into the drain body by the manufacturer. Minimum edge rail steel thickness: 2.5 mm

.7 The drain body shall feature anchoring keys on the outside wall to enhance embedment into the concrete topping.

.8 The drain body shall feature male to female interlocking end profiles.

.9 An installation device, provided by the manufacturer, shall facilitate height and joint alignment during installation. The installation device shall be attached to the new concrete topping reinforcing steel.

.4 The grates shall be ductile iron with slotted openings.

.1 The grates shall be designed and manufactured to fit with the intended drain body.

.2 The grates shall <u>not</u> be equipped with a hold-down clip and/or a locking mechanism.

2.3 Miscellaneous Materials

.1 Evaporation reducer shall be a spray-applied monomolecular film that reduces the rate of surface moisture evaporation under hot, dry and/or windy conditions. Product shall be used to minimize plastic shrinkage cracking and must not affect the cement hydration process.

.2 Absorptive cover shall be burlap cloth made from washed jute weighing approximately 335 g/m2. When used, absorptive cover shall be covered with

specified moisture-retaining cover. Absorptive cover shall be pre-soaked for a minimum period of 24 hours.

.3 Moisture-retaining cover shall be one of the following, complying with ASTM C171:

.1 Waterproof paper

.2 Polyethylene film

.3 Polyethylene-coated burlap

.4 Single or multi-use curing blanket.

3. PART 3 – EXECUTION

3.1 General

.1 This part includes concrete removal, surface preparation, mixing, placement, consolidation, finishing and curing concrete in accordance with the requirements of CSA A23.1-19.

.2 All work is to be performed in accordance with the requirements of Section 01 35 33 (Health and safety Requirements).

3.2 Survey – Existing Conditions

.1 The Contractor shall conduct a profile survey to establish screed elevations and volume control. This is only required where the concrete slopes towards drains. Between the granite blocks, the top elevation of the granite shall be used as screed elevation.

3.3 Concrete Removal

.1 The existing concrete shall be removed to a minimum depth of 200 mm from the surface by suitable means (suitable means may include, but is not limited to: hydro-milling, milling, scarifying). Removal of sound concrete will be required to reach minimum repair depths shown on drawings. Existing concrete strength and condition will vary. Compressive strength of existing concrete is expected to be between 35MPa and 65MPa, however higher compressive strengths may be encountered. Equipment and procedures are to be capable of removing the existing concrete and reach the depth specified on the drawings.

.1 The Contractor shall be responsible for completing Ground Penetration Radar (GPR) concrete scanning prior to demolition to locate any existing embedded reinforcing steel or other elements which may hinder the concrete removal process.

.2 Floor areas with known reinforcing steel have been identified on the Demolition Drawing, however additional reinforcing or other embedded steel items may be encountered in the slab. Contractor to assume full responsibility for identifying embedded steel objects.

.2 If old floor repairs with a depth of more than 200 mm are exposed, localized removal depth shall be increased to extend 10 mm below the depth of the old repair.

.3 Additional concrete removal is required to facilitate the installation of the new trench drains.

.4 The Contractor shall provide full containment and disposal of removed concrete and debris in accordance with the requirements of Section 01 35 43 Environmental Procedures.

3.4 Surface Preparation

.1 Following removal of the existing overburden concrete, the concrete bond surface shall be prepared to accept the new concrete topping.

.2 The concrete bond surface shall be prepared by suitable means, including but not limited to wet-grit blasting or hydrodemolition, to remove all bruised, loose, and deteriorated concrete.

.3 The method of surface preparation shall have sufficient energy to remove 13 mm of the sound concrete material. Pressure washing is not considered adequate for surface preparation.

.4 If hydrodemolition is used for surface preparation, all slurry shall be contained, collected and disposed of in accordance with applicable regulations.

.5 Prepared concrete surfaces shall have a rough, dust-free and open texture meeting ICRI Concrete Surface Profile (CSP) 8 to 10.

.6 Prior to placing new concrete, the prepared surface shall be thoroughly pressure washed (3000 to 5000 psi) and flushed to remove all dust and other contamination. The surface shall be protected from collection of dirt and/or debris.

.7 The prepared concrete bond surface shall be saturated for at least 24 hours prior to placing new concrete topping. Remove any standing water from concrete surface. Existing concrete surfaces shall be in a Saturated Surface Dry (SSD) condition when placing new concrete topping.

3.5 Trench Drain Installation

.1 The trench drains are to be installed level and are the lowest point of floor elevation. The elevation of the trench drain shall be determined based on the elevation of the row of keel granite block adjacent to the drain. Vary the slope of the concrete slab between the keel granite blocks and the trench drain (as identified on the drawings) to provide a level trench drain installation.

.2 Follow trench drain Manufacturer’s written installation recommendations.

.3 Trench drain shall be sufficiently secured with manufacturer supplied installation devices to prevent movement during concrete placement.

.1 The installation devices may be attached to concrete topping reinforcing steel. Otherwise, additional dowels shall be installed as required.

.4 Prior to concrete placement, complete an elevation survey of trench drain to ensure correct position and elevation of trench. The elevation of the top of the trench drains shall be constant and parallel with the keel granite blocks.

.5 Prior to placing new concrete, the bond surface of the trench drain shall be thoroughly pressure washed (3000 to 5000 psi) and flushed to remove all dust, laitance, grease, oil and other contamination.

.6 Protect the trench drain finished surfaces from concrete splash and/or contamination.

3.6 Concrete Reinforcement

.1 All reinforcing steel shall be stainless steel in conformance with Section 03 20 00 (Concrete Reinforcement).

.2 Complete reinforcing steel installation in accordance with Section 03 20 00 (Concrete Reinforcement).

.3 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA-A23.1.

.4 Slope reinforcement as required to match the concrete surface slope and to maintain the specified concrete cover.

.5 Install dowels as indicted and in accordance with CSA-A23.1.

.6 Prior to placing concrete, obtain Departmental Representative’s approval of reinforcing steel and placement.

.7 Ensure cover to reinforcement is maintained during concrete pour.

3.7 Concrete Placement

.1 Do not place concrete until the Departmental Representative has reviewed and approved the prepared concrete substrate.

.2 Deposit concrete continuously or in layers so that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of cold joints or other planes of weakness. The maximum free fall of concrete shall be 1.5 m. If a section cannot be placed continuously, provide construction joints as herein specified or as shown on the Project Drawings. Deposit concrete to avoid segregation at its final location.

.3 The Contractor shall provide finishing equipment of adequate size and design to permit the complete placement and finishing of a complete width between two rows of granite blocks.

.4 All concrete shall be thoroughly consolidated. Vibration shall be in accordance with CSA A23.1. Do not use vibrators to transport the concrete.

.5 Deposit and consolidate concrete slabs in a continuous operation until the placing of a panel or section is complete.

.1 Consolidate slab concrete during placing operations using an internal vibrator. Keep the vibrator perpendicular to the surface of the concrete at all times.

.2 Bring slab surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

.3 The evaporation rate of water from exposed surfaces of plastic concrete shall not exceed 1 kg/m2/hr. Windbreaks, foggers, and/or the application of the surface applied evaporation reducer shall be used to limit the evaporation rates as specified. The rate of evaporation chart in Annex D of CSA A23.1 shall be used to determine the evaporation rate of water.

.6 Cold-Weather: Concrete operations shall comply with provisions of ACI 306R.

.7 Hot-Weather: When hot weather conditions exist, place concrete in compliance with ACI 305R except as modified herein. Measures shall be employed to control the initial set and slump loss of concrete during hot weather placements to prevent cold joints and ensure that the maximum specified water/cementitious materials ratio is not exceeded.

.1 Concrete temperature at time of placement shall not exceed 25 °C. Appropriate measures shall be employed to maintain concrete temperature at time of placement below 25 °C.

.2 Cool placing environment by fog spray of forms, reinforcing steel, and subgrade with water just prior to concrete placement. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before placement of concrete.

.8 Concrete shall not be placed if rain is forecast or if the ambient temperature will drop below 5 degrees Celsius in the first 24 hours of curing.

.9 Bonding agent shall be applied only in sufficient quantity that can be used within 30 minutes of first mixing. Refer to CSA A23.1, Section 7.9.4.2 a).

.10 The slurry shall be applied in advance of concrete placement using a stiff broom and vigorously working the slurry into the concrete surface. The slurry shall be covered with concrete within 15 minutes of application. Do not allow the slurry bonding coat to dry. Dried or partially dried bond coat shall be removed completely and fresh bond coat re-applied.

.11 Check flatness after bull floating and before final finishing.

.12 Schedule concrete delivery so that concrete placement is continuous. Cold joints and construction joints are not permitted except where pre-determined.

3.8 Concrete Joints

.1 Construction joints (noted on the drawings as "CJ") shall match the existing joints, as identified on the Drawings.

.2 Where construction joints are required, the surface of the set concrete shall be roughened by sandblasting and thoroughly cleaned for foreign matter and laitance.

.3 Contraction joints (noted on the drawings as "SJ") shall be sawcut as soon as the concrete has hardened sufficiently to resist raveling while cutting. Depth of sawcut shall be 50 mm. Width of the sawcut shall be 6 mm.

.4 Dry-process saw cutting may be used. Dry-process saw cutting shall commence immediately following final finishing using specialized dry-process saw cutting equipment.

.5 Contraction joints shall be filled with material (cementitious grout or polymer) at a concrete age of not less than 90 days.

3.9 Concrete Finishing

.1 Final finishing shall commence after the bleed water has disappeared and when the concrete has stiffened sufficiently to prevent the working of excess mortar to the surface. No water shall be used to facilitate finishing.

.2 After consolidating, screeding, and leveling concrete slabs, do not work surface until ready for floating. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, granular texture. Do not over finish concrete. The application of cement or other fine materials during finishing operations shall not be allowed.

.3 Apply a light broom finish to the slab surface. The orientation of the broom finish shall be parallel to the direction of water drainage flow. Do not apply a steel trowel finish to the slab surface.

.4 Allowable tolerances for the finished slab topping, when tested in accordance with ASTM E1155, shall be the following:

.1 $F_F \geq 35$

.2 F_L - Does not apply.

3.10 Concrete Curing and Protection

.1 Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Protect concrete from rapid moisture loss before and during finishing operations with evaporation reducer or fog spray. Apply evaporation reducer in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

.2 Curing shall be in conformance with CSA A23.1, Type 3 and shall begin as soon as the finishing operation has been completed and the surface will not be damaged by the curing method. Curing shall be maintained for not less than ten **(10) days**.

.3 Perform curing of concrete by water submersion or by moisture-retaining cover curing as herein specified. Provide curing by one of the following methods.

.1 Keep concrete surface continuously wet by covering with water.

.2 Cover concrete surface with two layers of presoaked, absorptive cover (burlap), thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 100 mm lap over adjacent absorptive covers. Moisture retaining cover (polyethylene sheet) shall be placed over absorptive cover to prevent drying out.

.4 At the time of application, the temperature of the curing materials (water and/or absorptive cover) shall be within **10°C** of the concrete temperature. If required, the contractor shall provide means of sufficiently heating the curing materials.

.5 Protect all new dock bottom surfaces against damage during construction. Protect floor joints with plywood until joint filling is complete.

3.11 Concrete Surface Repairs

.1 After removal of forms, repair and patch any defective areas with patching mortar approved by the Consultant.

.2 In any honeycomb and rock pocket areas, saw cut area and remove material down to solid concrete. Saw cut edges shall be perpendicular to the concrete surface. Thoroughly clean out loose material, saturate repair area with water to a saturated, surface dry condition (do not allow free standing water in repair area) and brush-coat the area with a slurry coat of structural repair mortar. Place structural repair mortar before slurry coat has dried. Protect and cure repair mortar.

.3 In any areas of uneven construction joints, grind smooth high points and uneven edges.

3.12 Cleaning

.1 Following completion of work, the work area (including the filling and emptying tunnel) shall be cleaned in accordance with Section 01 74 11 (Cleaning).

END OF SECTION

1. PART 1 – GENERAL

1.1 Section Includes

Work for this section generally includes the repair of damaged concrete on the north and south walls, Section 3, and includes:

.1 Concrete removal.

.2 Removal of existing concrete reinforcement.

.3 Concrete surface preparation.

.4 Preparation of damage locations for shotcrete installation.

.5 Repair of leaking wall joints.

.6 Drainage pipe installation.

.7 Mortar repairs.

.8 Finishing and curing.

.9 Installation of new wall anchors.

1.2 Related Documents and Specification Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 35 33 (Health and Safety Requirements)

.3 Section 02 41 23 (Selective Site Demolition)

.4 Section 03 01 31 (Dock Floor Concrete Topping)

.5 Section 03 10 00 (Concrete forming and Accessories)

.6 Section 03 20 00 (Concrete Reinforcing)

.7 Section 03 30 00 (Cast-in-Place Concrete)

.8 Section 03 37 13 (Shotcrete)

.9 Section 04 03 41 (Stone Repair)

.10 Section 04 05 12 (Masonry Mortar and Grouting)

.11 Section 05 50 00 (Metal Fabrications)

1.3 Measurement and Payment Procedures

.1 Work covered by this Section includes:

.1 Demolition of concrete to facilitate repairs utilizing shotcrete will be measured by unit area of concrete removed – measured in place, in square meters of concrete removed from the face of the existing wall. Area will be measured on the vertical plain of the original concrete surface.

.1 Wall returns, such as located in the pipe chase, will not be included in the measured area.

.2 Existing (old) concrete repair materials which are outside the vertical face of the wall (proud of the wall surface) are

considered part of the work and shall not be included in the area measurement.

.2 Demolition of concrete for shotcrete repairs will be paid for at the unit price tendered for **CONCRETE DEMOLITION-SHOTCRETE REPAIRS.** Payment shall include all costs associated with concrete demolition, disposal, and surface preparation.

.3 Shotcrete placed to repair specified sections of the existing dock walls will be measured by volume of concrete (shotcrete) installed - measured in place, in cubic meters of shotcrete incorporated into work. Rebound (waste) shotcrete material accumulated during the installation process is considered incidental to the repair works and will not be incorporated into the volume measurement.

.4 Shotcrete for dock wall repairs will be paid for at the unit price tendered for **SHOTCRETE REPAIRS.** Payment shall include all costs associated with shotcrete supply and installation including all reinforcing steel, formwork, falsework, accessories and temporary support structures required for the work.

.5 Mortar repairs: Shall be measured in lineal meters of specified repair types listed below. Mortar repairs covered by this Section will be paid for at the relevant unit prices tendered for the MORTAR REPAIR types noted below. Payment for mortar repairs shall include all costs in connection with the repairs, as specified and as shown on the Drawings, including concrete removal and disposal, surface preparation, all reinforcing steel, formwork, falsework, accessories (including drainage pipes for leaking joint repair) and temporary support structures required for the work.

.1 Repair Type 1C – Vertical/ Horizontal Concrete Repair at Construction Joint

.2 Repair Type 1D – Vertical/ Horizontal Concrete Repair at Construction Joint

.3 Repair Type 2C – Vertical/ Horizontal Concrete Repair at No Construction Joint

.4 Repair Type 3C – Concrete Repair at Altar

.5 Repair Type 3D – Concrete Repair at Altar

.6 Repair Type 5C – Corner Concrete Repairs

.1 Stair Tread Repairs shall be measured as Type 5C repairs.

.7 Leaking Joint Mortar Repair – Vertical/ Horizontal Concrete Repair at Construction Joints, Below Granite Altars

.6 New wall anchors under this Section shall be measured on a per unit basis and paid for at the relevant unit prices tendered for **RECESSED WALL ANCHORS** or **NON-RECESSED WALL ANCHORS**, as applicable.

.2 No measurement or payment will be made for concrete placed to correct unauthorized demolition of existing concrete structures.

.3 Expansion joints, contraction joints and construction joints will not be measured separately, but considered part of the work. All costs in connection with the construction of joints, including waterstops where indicated, shall be included in the unit prices tendered for concrete repair.

.4 Removal of existing reinforcing steel bars will not be measured, but considered incidental to the work. All costs in connection with the removal of old reinforcing shall be included in unit prices tendered for concrete.

.5 Miscellaneous metal fabrications will be measured to Section 05 50 00 (Metal Fabrications), and payment shall include all costs in connection with supplying and installing miscellaneous metal fabrications.

1.4 References

.1 Canadian Standards Association (CSA):

.1 CSA A23.1-19, Concrete Materials and Methods of Concrete Construction

.2 CSA A23.2-19, Test Methods and Standard Practices for Concrete

.3 CSA A3000-18, Cementitious Materials Compendium

.4 CSA-S6-14, Canadian Highway Bridge Design Code

.5 CSA-G30.18-09 (R2019), Billet-Steel Bars for Concrete Reinforcement

.6 CAN/CSA-G40.21-13, Structural Quality Steels

.2 International Concrete Repair Institute (ICRI):

.1 ICRI 210.3R-13, Guide for Using In-Situ Pull off Tests to Evaluate Bond of Concrete Surface Materials

.2 ICRI 310.1R-08, Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Steel Corrosion

.3 ICRI 310.2R-13, Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair

.4 ICRI 310.3R-14, Guide for the Preparation of Concrete Surfaces for Repair Using Hydrodemolition Methods

.5 ICRI Concrete Surface Profiles (CSP's)

.3 Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.4 American National Standards Institute/American Concrete Institute: ANSI/ACI 315, Details and Detailing of Concrete Reinforcement.

.5 American Society for Testing and Materials (ASTM):

.1 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes

.2 ASTM A955, Standard Specification for Deformed and Plain Stainless-Steel Bars for Concrete Reinforcement

.3 ASTM C171, Standard Specification for Sheet Materials for Curing Concrete

.4 ASTM C494, Standard Specification for Chemical Admixtures for Concrete

.5 ASTM C1116, Standard Specification for Fiber-Reinforced Concrete

.6 American Concrete Institute (ACI):

.1 ACI 305R-10, Guide to Hot Weather Concreting

.2 ACI 306R-16, Guide to Cold Weather Concreting

.3 ACI 308.1-11, Specification for Curing Concrete

.4 ACI 506R-16, Guide to Shotcrete

.5 ACI 506.2-13, Specification for Shotcrete

.6 ACI-Certified Shotcrete Nozzleman (Wet-Mix Process)

.7 ACI C660 CP-60(15)

1.5 Definitions

.1 Altar – horizontal shelves located on the north and south walls of the Esquimalt Graving Dock which feature mortared-in-place granite blocks.

1.6 Submittals for Review

.1 Submittals in accordance with Section 01 33 00 (Shop Drawings, Product Data and Samples).

1.7 Quality Control

.1 Concrete Surface Preparation

.1 The prepared surface of the existing concrete slab shall be reviewed by the Departmental Representative following concrete demolition and surface preparation.

.2 The bond surface tensile capacity of the existing concrete surface shall be tested per ICRI 210.3R-13 and CSA A23.2-6B at least every 100 m^2 of the prepared wall surface. A test shall consist of a minimum of three (3), 100 mm diameter samples. The test shall be completed by adhering steel plates of sufficient thickness (stiffness) to the prepared surface and applying a tensile load. Minimum average bond surface tensile capacity: **0.9 MPa**.

.2 Reinforcing Dowel – Anchor Testing

.1 Proof load testing of drilled reinforcing steel dowels shall be completed at intervals selected by the Departmental Representative, but not less than 4 tests shall be completed.

.2 A test shall consist of a minimum of three (3) steel reinforcing bars selected at random during installation.

.3 Proof load shall be 30 kN.

.4 A test will be considered satisfactory if all samples sustain the proof load without permanent deformation and/or distress.

.5 Test failure will result in further testing and or rejection of the adhesive product or installation process.

.3 Shotcrete Quality Control Testing

.1 Completed in conformance with Section 03 30 00 (Cast-in-Place Concrete) & Section 03 37 13 (Shotcrete), except as noted:

.2 Full time concrete monitoring shall be provided and shall include testing of concrete slump, temperature and plastic air content for every concrete batch.

.4 Repair Mortar Quality Control Testing

.1 Repair mortar compressive strength samples (50 mm cubes) shall be cast for every repair mortar type, for every day of mortar preparation.

.2 Samples shall be cast and tested in conformance with CSA A3004-C2.

.3 Compressive strength tests shall be completed at ages of 7 days and 28 days. A compressive strength test shall be the average strength result of three (3) mortar cube samples.

.5 Bond Testing of the concrete repairs shall be completed in conformance with CSA A23.2-6B for every 100 m^2 of wall repairs. A test shall consist of a minimum of three (3), 75 mm diameter samples. Minimum average bond strength: **0.9 MPa**. Contractor to make good test locations.

1.8 Quality Assurance

.1 In conformance with Section 03 30 00 (Cast-in-Place Concrete).

1.9 Mock-Up

.1 Mock-ups shall be prepared for each of the following shotcrete and mortar repair details, including:

- Type 1 (A and/or B),
- Type 1C,
- Type 2 (A and/or B),
- Type 2C,
- Type 3 (A and/or B),
- Type 3C,
- Type 3D,
- Type 4,
- Type 4T,

- Type 4B,
- Type 5 (A and/or B), and
- Type 5C
- Leaking Joint Repair

The mock-up locations shall be within Section 3 of the Esquimalt Graving Dock, in an area designated by the Departmental Representative. The size of each mock-up shall be at least 2 lineal meters for each repair type. The mock-ups shall include:

.1 Removal of existing concrete.

.2 Installation of reinforcing steel, as required.

.3 Concrete surface preparation and cleaning using the same methods that will be used for the duration of the work.

.4 Shooting of shotcrete (in conformance with Section 03 37 13)

.5 Installation of repair mortar.

.6 Finishing. Once accepted, the mock-up shall be the acceptable standard for concrete finish.

.7 If deemed acceptable by the Departmental Representative, the mock-up may form part of the finished work.

.2 Quality Control testing shall be provided by the Contractor and shall include:

.1 Tensile bond surface capacity of the existing substrate,

.2 Shotcrete testing – in conformance with Section 03 37 13 (Shotcrete)

.3 Tensile bond testing of the repair shotcrete, and

.4 Mortar testing.

.3 Submit Mock-up test results for review by Departmental Representative at least 14 days prior to commencing bulk of work.

2. PART 2 – PRODUCTS

2.1 Materials

.1 Provide stainless steel deformed reinforcing bars in conformance with Section 03 20 00 (Concrete Reinforcing).

.2 Provide metal fabrications in conformance with Section 05 50 00 (Metal Fabrications).

.3 Adhesive for drilled rebar shall be in conformance with Section 03 30 00 (Cast-in-Place Concrete).

.4 Provide shotcrete in conformance with Section 03 37 13 (Shotcrete).

.5 Non-Leaking Joints: Structural Repair Mortar, with cured properties:

1. Compressive Strength at 24 hours, minimum 18 MPa
2. Compressive Strength at 7 days, minimum 30 MPa
3. Compressive Strength at 28 days, minimum 40 MPa

4. Bond Strength CAN A23.2-6B, minimum 2.5 MPa
5. Bond Strength ASTM C882 (Slant Shear), minimum 10 MPa
6. Length Change at 28 days, maximum 0.07%
7. Submit product literature for review by Departmental Representative.

.6 Leaking Joints: Rapid Set Hydraulic Cement:

1. Working Time, +/- 1 minute
2. Hardening Time, maximum 2 minutes
3. Compressive Strength at 7 days, minimum 50 MPa
4. Submit product literature for review by Departmental Representative

2.2 Miscellaneous Materials

.1 Evaporation reducer shall be a spray-applied monomolecular film that reduces the rate of surface moisture evaporation under hot, dry and/or windy conditions. Product shall be used to minimize plastic shrinkage cracking and must not affect the cement hydration process.

.2 Absorptive cover shall be burlap cloth made from washed jute weighing approximately 335 g/m2. When used, absorptive cover shall be covered with specified moisture-retaining cover. Absorptive cover shall be pre-soaked for a minimum period of 24 hours.

.3 Moisture-retaining cover shall be one of the following, complying with ASTM C171:

.1 Waterproof paper

.2 Polyethylene film

.3 Polyethylene-coated burlap

.4 Single or multi-use curing blanket.

3. PART 3 – EXECUTION

3.1 General

.1 This part includes concrete removal, surface preparation, mixing, placement, consolidation, finishing and curing concrete in accordance with the requirements of CSA A23.1-19.

.2 Complete all works in conformance with Section 01 35 33 (Health and Safety Requirements) and the requirements of WorkSafeBC.

3.2 Concrete Removal

.1 The existing concrete at noted repair locations shall be removed until sound concrete is reached or to the minimum depths indicated on the drawings, whichever is greater. Removal of sound concrete may be required to reach minimum repair depths shown on drawings. Existing concrete strength and condition will vary. Compressive strength of existing concrete is expected to be

between 35MPa and 65MPa, however higher compressive strengths may be encountered.

.1 Concrete removal techniques, equipment and procedures are to be selected by the contractor and shall be capable of removing the existing concrete and to reach the repair depth specified on the drawings.

.2 However, the concrete removal techniques, equipment and procedures shall not cause damage to existing sound, or undamaged areas of concrete.

.2 Some repair locations require the removal of existing concrete repairs which are proud (outside the plane) of the existing wall face. This concrete removal is considered incidental to the repair works.

.3 Cut all existing reinforcing steel from repairs areas flush with the repair surface.

3.3 Surface Preparation

.1 Exposed concrete surfaces shall be prepared to accept repair shotcrete or mortar.

.2 The exposed concrete shall be prepared by suitable means, including but not limited to sandblasting or hydrodemolition to remove all bruised, loose, and deteriorated concrete.

.3 The method of surface preparation shall have sufficient energy to remove 13 mm of the sound concrete material. Pressure washing is not considered adequate for surface preparation.

.4 If hydrodemolition is used for surface preparation, all slurry shall be contained, collected and disposed of in accordance with applicable regulations.

.5 Prepared concrete surfaces shall have a rough, dust-free and open texture meting ICRI Concrete Surface Profile (CSP) 7 to 10.

.6 Immediately prior to placing new concrete, the prepared surface shall be thoroughly pressure washed (3000 to 5000 psi) and flushed to remove all dust, hydrodemolition slurry, laitance, grease, oil and other contamination.

.7 The concrete substrate shall maintain a tensile bond strength capacity of at least 0.9 MPa when tested in accordance with ICRI 210.3R-13.

3.4 Leaking Wall Joint Repairs

.1 Leaking concrete joints within repair areas shall be repaired (sealed) with a rapid setting hydraulic mortar prior to application of repair shotcrete or mortar.

.2 As described on the Drawings, additional sound concrete removal shall be completed to facilitate the installation of the rapid setting mortar.

.3 As described on the Drawings, drainage pipes shall be installed at leaking vertical construction joints.

.1 Drainage pipes shall be installed prior to the installation of shotcrete or repair mortar.

.2 Drainage pipes shall be on 1 m centre, or at a closer spacing as directed by the Departmental Representative. Pipes shall be 25 mm outside diameter Schedule 40 plastic pipe.

.3 Holes shall be drilled into the existing leaking joint to a minimum depth of 150 mm. Pipes shall extend at least 150 mm beyond the final finished face of the wall repairs.

.4 Drainage pipes shall be inclined, minimum 5%, to allow free drainage of water.

.5 The pipes shall be protected during shotcrete or mortar application to prevent entry of materials and blockage of the pipes.

.6 Following sufficient stiffening and curing of the repair shotcrete/mortar, cut the pipe flush with the face of the wall surface.

.4 All repair product installation shall be done in strict accordance with the manufacturer's written instructions, including but not limited to: surface preparation; maximum time between mixing, placement, and finishing; temperature of application; and quantity/thickness of material placed.

.5 Repair shotcrete and/or mortar application shall not proceed until it has been shown, to the satisfaction of the Departmental Representative, that the repaired leaking joints are free from ongoing water leakage.

3.5 Concrete Repairs below Altars

.1 The contractor shall provide temporary support to granite altar blocks as required throughout the repair works.

.1 Temporary support could include shoring and/or wedges installed to prevent movement or shifting of the granite blocks due to removal of existing materials and/or vibrations due to concrete chipping.

.2 When completing concrete removal and concrete surface preparation, the contractor shall exercise caution to avoid removal of excessive amounts of original granite block bedding mortar. All bedding mortar shall be replaced prior to shotcrete or repair mortar installation.

.3 When water leakage is actively occurring below altar blocks, the procedure provided in Section 3.4 shall be followed.

.1 Repair (sealing) of active water leaks may include installation of drainage pipes as directed by the Departmental Representative.

.2 Drainage pipes, when required, shall extend 150 mm into original bedding mortar.

.3 Shotcrete or repair mortar shall not be installed over actively leaking joints.

3.6 Concrete Reinforcement

.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA-A23.1.

.2 Install dowels as indicted on reviewed placing drawings and in accordance with CSA-A23.1.

.4 Prior to placing shotcrete, obtain Departmental Representative's approval of reinforcing steel and placement.

.5 Ensure cover to reinforcement is maintained during shotcrete or concrete placement.

.6 Deviation from placement, such as for construction access, to be noted and submitted to the Departmental Representative for review not less than fourteen (14) days prior to construction.

3.7 Field Bending

.1 Do not field bend reinforcement except where indicated or authorized in writing by Departmental Representative. When field bending is authorized, bend without heat, applying a slow and steady pressure.

.2 Replace bars which develop cracks or splits, or exhibit excessive surface contamination.

3.8 Shotcrete Placement

.1 Do not place shotcrete until the Consultant has reviewed and approved the prepared concrete substrate.

.2 Shotcrete shall not be applied to active water leakage points.

3.9 Mortar Placement

.1 All repair product installation shall be done in strict accordance with the manufacturer's written instructions, including but not limited to: surface preparation; maximum time between mixing, placement, and finishing; temperature of application; and quantity/thickness of material placed.

2 Take appropriate measures to prevent excess material from contaminating adjacent surfaces.

3.10 Joints

.1 Where construction joints are required, the surface of the set concrete shall be roughed to 5mm amplitude thoroughly cleaned to remove any foreign matter and laitance.

.2 Contraction joints shall be sawcut as soon as the concrete has hardened sufficiently to resist raveling while cutting. Depth of sawcut shall be 50 mm.

.3 Dry-process saw cutting may be used. Dry-process saw cutting shall commence immediately following final finishing using specialized dry-process saw cutting equipment.

3.11 Wall Tarp Anchors

.1 Remove concrete for recessed wall anchors by wet coring and chipping.

.2 Prepare the concrete surface for new repair mortar as described in 3.3 of this specification section.

.3 New eye-bolt for recessed anchors shall be installed flush with the vertical wall surface.

3.12 Finish

.1 Shotcrete - In conformance with Section 03 37 13 (Shotcrete)

.2 Repair Mortar - In conformance with Section 03 37 13 (Shotcrete)

3.13 Shotcrete Curing and Protection

.1 In conformance with Section 03 37 13 (Shotcrete)

3.14 Mortar Curing and Protection

.1 In conformance with Section 03 37 13 (Shotcrete)

3.15 Concrete Surface Repairs

.1 Repair and patch defective areas with patching mortar approved by the Departmental Representative.

.2 In honeycomb and rock pocket areas, saw cut area and remove material down to solid concrete. Saw cut edges shall be perpendicular to the concrete surface. Thoroughly clean out loose material, saturate repair area with water and allow to dry back to a saturated surface dry condition (do not allow free standing water in repair area) and brush-coat the area to be patched with a slurry coat of structural repair mortar. Place structural repair mortar before slurry coat has dried. Protect and cure repair mortar.

.3 In areas of uneven construction joints, grind smooth high points and uneven edges.

3.16 Field Welding

.1 Do not field weld reinforcement except where indicated or authorized in writing by Departmental Representative. When field welding is authorized by Departmental Representative, weld reinforcement in accordance with CSA-W186.

3.17 Handling and Storage

.1 Reinforcing steel shall be handled and stored at all times so that damage, surface contamination and loss of identification tags are avoided.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers formwork for all concrete components of the work.

1.2 RELATED SECTIONS

.1 Section 03 01 31 (Dock Floor Concrete Topping)

.2 Section 03 01 32 (Dock Walls Concrete Repairs)

.3 Section 03 20 00 (Concrete Reinforcing)

.4 Section 03 30 00 (Cast-in-Place Concrete)

.5 Section 03 39 00 (In-Situ Concrete)

1.3 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under sections for which concrete formwork, falsework and accessories are required.

1.4 REFERENCES

.1 ANSI/ACI-347, Concrete Formwork, Recommended Practice for.

.2 ASTM A760/A760M-01a, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.

.3 CAN/CSA G401-01, Corrugated Steel Pipe Products.

.4 CAN/CSA-A23.1-14, Concrete Materials and Methods of Concrete Construction.

.5 CAN3-O86-M, Engineering Design in Wood (Working Stress Design).

.6 CAN3-O86.1-M, Engineering Design in Wood (Limit States Design).

.7 CAN3-O86.1S1, Supplement No. 1 to CAN3-O86.1-M Engineering Design in Wood (Limit States Design).

.8 CAN3-O86 S1, Supplement No. 1 to CAN3-O86-M, Engineering Design in Wood (Working Stress Design).

.9 CSA O121-M, Douglas Fir Plywood.

.10 CSA-S269.1-1975 (R2003), Falsework for Construction Purposes.

.11 CSA-S269.2-M87 (R2003), Access Scaffolding for Construction Purposes.

.12 CSA-S269.3-M92 (R2003), Concrete Formwork.

.13 CSA O151-M, Canadian Softwood Plywood.

1.5 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit shop drawings for formwork and falsework a minimum of 14 days prior to construction.

.1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of BC, Canada.

.3 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.

.4 Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

.5 Indicate sequence of erection and removal of formwork/falsework as directed by Departmental Representative.

1.6 DEFINITIONS

.1 NOT USED

Part 2 Products

2.1 MATERIALS

.1 Formwork lumber:

.1 plywood and wood formwork materials to CAN3-O86.1, CAN3-O86.1S1.

.2 Falsework materials: to CSA S269.1.

.3 Form ties: removable or snap-off metal ties, fixed or adjustable length, free of tie devices leaving holes larger than 25 mm dia. in concrete surface. The portion which remains embedded in the concrete shall have a minimum cover of 50 mm after patching.

.4 Form release agent: chemically active release agents containing compounds that react with free lime present in concrete to provide water insoluble soaps, preventing concrete from sticking to forms.

.5 Form stripping agent: colourless mineral oil, free of kerosene, with viscosity between 70 and 110 s Saybolt Universal 15 to 24 mm^2/S at 40° C, flashpoint minimum 150° C, open cup.

Part 3 Execution

3.1 ERECTION

.1 Verify lines, levels and plumb walls before proceeding with formwork and ensure dimensions agree with drawings.

.2 Obtain Departmental Representative's approval for use of earth forms.

.3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.

.4 Construct falsework in accordance with CSA S269.1.

.5 Construct forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.

.6 Obtain Departmental Representative's permission before framing openings not indicated in concrete joists, beams or columns.

.7 Align form joints and make watertight. Keep form joints to minimum.

.8 Use 25 mm chamfer strips on external corners of beams, joints and columns, except where indicated otherwise on the Drawings.

.9 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.

.10 Line forms for the following surfaces:

.1 Exposed faces of dry dock walls;

.2 Internal faces of access chamber.

.11 Do not stagger joints of form lining material. Align joints to obtain uniform pattern.

.12 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.

.13 Re-use of formwork and falsework is subject to requirements of CAN/CSA-A23.1.

.14 Slip-forming methods shall not be used.

.15 Formwork and falsework shall be designed and fabricated in accordance with WorkSafeBC regulations.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply and installation of water stops in all construction joints in concrete work as noted on the project drawings. Waterstops are classified as Types 1 through 4 depending on materials, configuration and installation details.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 10 00 (Concrete Forming and Accessories)

.3 Section 03 30 00 (Cast-in-Place Concrete)

.4 Section 03 39 00 (In-Situ Concrete Structures)

1.3 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. Supply and installation of waterstops shall be measured and paid for as specified in the relevant Sections.

.2 The cost of quality control and remediation of defects shall be deemed to be incidental to the work and no separate payment will be made.

.3 The cost of Departmental Representative's quality assurance testing will be borne by Departmental Representative.

1.4 REFERENCES

.1 American Society for Testing and Materials, hereinafter referred to as ASTM:

.1 ASTM D624-00(2020): Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

.2 ASTM D638-14: Standard Test Method for Tensile Properties of Plastics

.3 ASTM D746-20: Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

.4 ASTM D792: Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

.5 ASTM D2240-15e1: Standard Test Method for Rubber Property - Durometer Hardness

1.5 SUBMITTALS

.1 At least twenty-eight (28) days before the start of installation of each type of waterstop submit, to Departmental Representative for their review, the following items in accordance with Section 01 33 00 (Submittal Procedures):

- .1 Manufacturers data and specifications for:
  - .1 Each type and shape of waterstop to be used.
  - .2 Any adhesives to be used to secure waterstops.
  - .3 Any accessory items to be used for installation of waterstops (i.e. hog rings and ties.
- .2 Samples of each of the above items to be used.
- .3 Shop drawings indicating locations and configurations of all waterstops to be installed including methods of securement and locations and details and all splices and joints to be made with indication of whether splices and joints are field or shop made.
- .4 Samples of each type of splice and joint to be used.
- .5 Quality assurance program documents including process for remediating any waterstops which are displaced or damaged during placement of concrete.

1.6 DELIVERY STORAGE AND HANDLING

.1 All product shall be stored and handled in strict accordance with the manufacturers requirements at all times.

Part 2 Products

2.1 MATERIALS

.1 Types 1,2 & 3

- .1 Material to be a flexible virgin polyvinyl chloride compound.
- .2 Material to be compatible with salt water.
- .3 Minimum tear resistance to be 52.5 N/mm in accordance with ASTM D624.
- .4 Minimum tensile strength to be 13.8 MPa in accordance with ASTM D638.
- .5 Minimum ultimate elongation to be 350% in accordance with ASTM D638.
- .6 Maximum brittle point to be -35℃ in accordance with ASTM D746.
- .7 Maximum specific gravity to be 1.4 in accordance with ASTM D792.
- .8 Minimum Shore “A” hardness to be 80 in accordance with ASTM D2240.
- .9 Minimum hydraulic head resistance to be 30m.

.10 Intersection and change of direction joints shall be shop fabricated.

.2 Type 4:

.1 Material to be a hydrophilic synthetic rubber compound capable of expansion when exposed to water.

.2 Material shall not contain sodium bentonite.

.3 Material to be compatible with salt water.

.4 Minimum free swelling capacity in salt water to be 100% in 3.5% salt water.

.5 Minimum tensile strength to be 2.5 MPa in accordance with ASTM D638.

.6 Specific gravity to be 1.2 to 1.4 in accordance with ASTM D792.

.7 Minimum Shore "A" hardness to be 25 in accordance with ASTM D2240

.8 Minimum hydraulic head resistance to be 30m.

.9 Acceptance of type 4 materials may be subject to test samples of installed waterstops.

.3 Adhesives

.1 All adhesives to be used for installations of waterstops shall be approved by the waterstop supplier for the intended application.

.4 Accessory items

.1 All accessory items to be used for installation of waterstops shall be approved by the waterstop supplier for the intended application.

2.2 Configuration

.1 Type 1 & 2 waterstops:

.1 To be flat ribbed type with center bulbs.

.2 To have overall widths of 230mm with flange thicknesses of 9mm and center bult outer diameters of 20mm.

.3 May have split flanges on one side only.

.2 Type 3 waterstops:

.1 To be flat ribbed type with center bulbs.

.2 To have overall widths of 230mm with flange thicknesses of 9mm and center bult outer diameters of 20mm.

.3 Must have solid flanges on both sides.

.3 Type 4 waterstops:

.1 To be rectangular is shape. Minor variations in shape to be approved by departmental representative.

.2 To have a minimum size of 5mm thick by 20mm wide.

Part 3 Execution

3.1 GENERAL

.1 No work shall commence until approval in writing is given by Departmental Representative for the waterstops, adhesives and accessories.

.2 No installation of waterstops shall commence until approval in writing is given by Departmental Representative for the submitted sample materials and shop drawings.

3.2 INSTALLATION

.1 Type 1 waterstops:

.1 To be installed at vertical construction joints between pours of new concrete with waterstops running vertically along the joint.

.2 To be installed using either closed forms at the construction joint with split flange waterstops or with split forms and solid flange waterstops.

.2 Type 2 waterstops:

.1 To be installed at vertical construction joints between pours of new concrete with waterstops running horizontally along the joint.

.2 To be installed using either closed forms at the construction joint with split flange waterstops or with split forms and solid flange waterstops.

.3 Type 3 waterstops:

.1 To be installed at horizontal construction joints between pours of new concrete with waterstops oriented vertically and running horizontally along the joint.

.4 Type 4 waterstops:

.1 To be installed at horizontal and vertical construction joints where new concrete is to be cast against existing concrete with waterstops running horizontally or vertically along the joint.

.5 Type 1 through 3 waterstops:

.1 To be installed in strict accordance with the manufacturer’s requirements ensuring that the waterstops are adequately secured to the reinforcement to prevent movement or displacement of the waterstop during placement of concrete.

.2 Make all splices in strict accordance with the manufacturers requirements.

.3 Ensure that the center bulb is centered on the construction joint and will not be embedded at either side of the joint.

.6 Type 4 waterstops:

.1 Ensure that the existing concrete surface is flat, clean and dry where the waterstop is to be installed.

.2 To be installed in strict accordance with the manufacturer's requirements utilizing the manufacturer's approved adhesive and any other form of securement required and approved by the manufacturer.

.3 Do not install the waterstops in standing water, on wetted surfaces or in any conditions which may result in the waterstops coming in contact with water prior to placement of concrete.

.4 Any waterstops which become wetted prior to placement of concrete must be replaced prior to placement of concrete.

.7 Type 1,2,3 & 4 waterstops:

.1 Center all waterstops on joints as near to the mid point between reinforcement mats as practical. Where only one mat of reinforcement is to be present in the joint locate the waterstop adjacent to, and inboard of, the reinforcement.

3.3 COMPLETION OF JOINT

.1 Upon completion of casting the first placement of concrete for each joint where new concrete is to be cast against new concrete:

.1 Strip forms where required.

.2 Inspect all water stops for damage or displacement, and remediate any waterstops in conformance with the approved quality assurance program.

.3 Clean unembedded or split flanges of watertops of all laitance, excess concrete, dirt, oil or other foreign matter.

.4 Glue all split flanges in accordance with the manufacturer's requirements.

.5 Secure the remaining unembedded flanges in accordance with the manufacturer's requirements.

.6 Install any required shop fabricated joints or intersections in accordance with the manufacturer's requirements.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the provision and installation of (uncoated and stainless steel) reinforcement for all concrete components of the work.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 01 31 (Dock Floor Concrete Topping)

.3 Section 03 01 32 (Dock Walls Concrete Repairs)

.4 Section 03 30 00 (Cast-in-Place Concrete)

.5 Section 03 39 00 (In-Situ Concrete Structures)

.6 Section 33 41 00 (Storm Utility Drainage Piping)

.7 Section 33 65 73 (Concrete Duct Banks and Vaults)

1.3 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. Include reinforcement costs in items of concrete work in Section 03 39 00 (In-Situ Concrete Structures) and Section 33 65 73 (Concrete Duct Banks and Vaults), as relevant to the item of concrete work.

.2 Payment for reinforcing steel (paid under the relevant concrete items per Clauses 1.3.1), whether for uncoated or stainless steel, shall include for all costs in connection with detailing, fabricating, supplying and installing reinforcing steel, including supporting materials, spacers, ties, inserts for dowels, and additional splices not shown on the Contract Drawings.

1.4 REFERENCES

.1 Canadian Standards Association (CSA):

.1 CAN/CSA-A23.1-14, Concrete Materials and Methods of Concrete Construction.

.2 CAN/CSA-S6-14, Canadian Highway Bridge Design Code.

.3 CSA-G30.3, Cold Drawn Steel Tie Wire for Concrete Reinforcement.

.4 CSA-G30.5, Welded Steel Wire Fabric for Concrete Reinforcement.

.5 CSA-G30.14, Deformed Steel Wire for Concrete Reinforcement.

.6 CSA-G30.15, Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

.7 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.

.8 CAN/CSA-G40.21, Structural Quality Steels.

.9 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

.10 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement (for Grade 75 Threadbar).

.2 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes.

.3 ASTM A955M, Standard Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement.

.3 Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.4 American National Standards Institute/American Concrete Institute: ANSI/ACI 315, Details and Detailing of Concrete Reinforcement.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Submit shop drawings, including placement of reinforcement, in accordance with Section 01 33 00 (Submittal Procedures) 21 days prior to placing concrete.

.2 Shop drawings shall consist of bar bending details, bar schedules and placing drawings. Bar schedules shall detail each type of bar and provide a total weight, computed from the theoretical mass specified in CAN/CSA-G30.18.

.3 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, types of reinforcement (uncoated or stainless), locations of reinforcement and splices, and mechanical splices if approved by Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings. Prepare reinforcement drawings in accordance with the Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.4 Detail lap lengths and bar development lengths to CAN/CSA-S6-14 (Canadian Highway Bridge Design Code), unless indicated otherwise.

Part 2 Products

2.1 MATERIALS

.1 Provide stainless steel reinforcing bars unless noted otherwise.

.2 Substitution of bar sizes, spacing and splice locations may be made only if permitted in writing by Departmental Representative.

.3 Provide materials free of loose rust, mill scale or oil coating which may reduce concrete bond.

.4 Weldable reinforcing steel: uncoated weldable low alloy steel deformed bars to CAN/CSA-G30.18.

.5 Stainless steel reinforcing: bars to ASTM A276 and ASTM A955M. Stainless steel reinforcing bars shall be of a stainless steel type specified as follows: 316 LN, Duplex 2205 or Duplex 2304, Grade 60, minimum yield strength of 420 MPa. Stainless steel reinforcing bars shall only be used at specific locations identified on the Drawings. Substitution of stainless steel reinforcing bars with epoxy coated bars, galvanized bars or bars made from proprietary materials (MMFX® or similar) will not be permitted.

.6 Plain round bars: to CAN/CSA-G40.21.

.7 Tie wires used to tie stainless steel reinforcing bars to other stainless steel reinforcing bars, to uncoated reinforcing steel bars or to shear studs, shall be stainless steel wire of a type listed as follows: 316 LN, Duplex 2205 or Duplex 2304. Tie wire shall be 1.6 mm in diameter.

.8 Deformed steel wire for concrete reinforcement: to CSA-G30.14.

.9 Welded steel wire fabric: to CSA-G30.5. Provide in flat sheets only.

.10 Welded deformed steel wire fabric: to CSA-G30.15. Provide in flat sheets only.

.11 Chairs, bolsters, bar supports, spacers: acceptable non-metallic material in accordance with CAN/CSA-A23.1. stainless steel reinforcing bars.

.12 Mechanical couplers for reinforcing bars: subject to approval of Departmental Representative.

2.2 DETAILING AND FABRICATION

.1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.l, ANSI/ACI 315, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.

.2 Reinforcement splices shall be located as detailed on the reviewed placing drawings. Obtain Departmental Representative's approval for locations of reinforcement splices other than those shown on reviewed placing drawings.

.3 Provide lap splice lengths, standard hooks and bar development lengths to CAN/CSA-S6-14 (Canadian Highway Bridge Design Code), unless indicated otherwise. All reinforcing bar embedments shall be treated as tension embedments, and all lap splices shall be treated as Class B tension lap splices to CAN/CSA-S6-14, unless indicated otherwise. The smaller bar shall govern the splice length, except for angled splices.

.4 Mechanical couplers for reinforcing bars may be used subject to approval of Departmental Representative and shall develop not less than 120 % of the minimum yield strength of the bar. Where mechanical couplers are to be used to couple stainless steel reinforcing bars, the mechanical coupler shall be stainless steel.

.5 Welding of reinforcement is not permitted without written approval of Departmental Representative. If welding is approved by Departmental Representative, weld reinforcement in accordance with CSA-W186.

.6 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

.1 All steel incorporated in the work shall be identified by heat number.

.2 Provide Departmental Representative with certified copy of mill test report for each lot of reinforcing steel (including stainless steel reinforcing bars), showing physical and chemical analysis, prior to fabrication.

.3 Upon request, inform Departmental Representative of proposed source of material to be supplied.

Part 3 Execution

3.1 FIELD BENDING

.1 Do not field bend reinforcement except where indicated or authorized in writing by Departmental Representative. When field bending is authorized, bend without heat, applying a slow and steady pressure.

.2 Do not field bend stainless steel reinforcement except where authorized in writing by Departmental Representative. Stainless steel reinforcement shall only be bent on equipment assigned solely for this purpose.

.3 Replace bars which develop cracks or splits or exhibit excessive surface contamination.

3.2 FIELD WELDING

.1 Do not field weld reinforcement except where indicated or authorized in writing by Departmental Representative. When field welding is authorized by Departmental Representative, weld reinforcement in accordance with CSA-W186.

.2 Welding of stainless steel reinforcement is not permitted.

3.3 HANDLING AND STORAGE

.1 Reinforcing steel shall be handled and stored at all times so that damage, surface contamination and loss of identification tags are avoided.

.2 Stainless steel reinforcing bars shall be stored clear of the ground on timbers or other suitable protective cribbing spaced to prevent sags in bundles. Stacks of bundles of straight bars shall have adequate blocking to prevent contact between the layers of bundles. Stainless steel reinforcing bars shall be stored separately from uncoated reinforcing steel bars with the bar tags maintained and clearly visible until ready for placing.

3.4 PLACING REINFORCEMENT

.1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1.

.2 Use plain round bars, where indicated on the Drawings, as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply an even film of mineral lubricating grease. Align bars for intended movement within hardened concrete.

.3 Prior to placing concrete, obtain Departmental Representative’s approval of reinforcing steel and placement.

.4 Ensure cover to reinforcement is maintained during concrete pour.

.5 Deviation from placement, such as for construction access, to be noted and submitted to Departmental Representative for review not less than fourteen (14) days prior to construction.

.6 Where reinforcing bars project temporarily from concrete structures already cast, protect the exposed bar portions from corrosion until subsequent concrete is placed.

3.5 FIELD TOUCH-UP AND REMEDIATION

.1 Prior to placing concrete, clean off loose rust, mill scale or oil coating which may reduce concrete bond.

.2 Prior to placing concrete, clean off salt deposits from surface of reinforcing bars.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply of concrete for all components of the work.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 01 31 (Dock Floor Concrete Topping)

.3 Section 03 01 32 (Dock Walls Concrete Repairs)

.4 Section 03 10 00 (Concrete Forming and Accessories)

.5 Section 03 13 15 (Waterstops)

.6 Section 03 20 00 (Concrete Reinforcing)

.7 Section 03 39 00 (In-Situ Concrete Structures)

.8 Section 04 05 12 (Grout)

.9 Section 05 50 00 (Metal Fabrications)

.10 Section 09 97 19 (Painting Exterior Metal Surfaces)

.11 Section 33 05 13 (Manholes and Catch Basins)

.12 Section 33 11 16 (Water Utility Distribution Piping)

.13 Section 33 41 00 (Storm Utility Drainage Piping)

.14 Section 35 59 29 (Mooring Devices)

1.3 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. Concrete shall be measured and paid for as specified in the relevant Sections.

.2 The cost of quality control shall be deemed to be incidental to the work and no separate payment will be made.

.3 The cost of Departmental Representative's quality assurance testing will be borne by Departmental Representative.

.4 No separate measurement or payment will be made for reinforcing steel. Refer to Section 03 20 00 (Concrete Reinforcing), Section 03 39 00 (In Situ Concrete Structures), Section 03 01 31 (Dock Floor Concrete Topping), and Section 03 01 32 (Dock Walls Concrete Repairs)

.5 Movement joints and construction joints will not be measured separately, but considered incidental to the work. All costs in connection with joints, including

waterstop where indicated, shall be included in the unit prices tendered for concrete covered by the relevant Sections.

.6 Miscellaneous steelwork items embedded in concrete shall be measured to Section 05 50 00 (Metal Fabrications), and payment will include all costs in connection with supplying and installing miscellaneous steelwork items.

.7 Permanent rock anchors embedded in concrete shall be measured to Section 31 68 00 (Rock Anchors), and payment will include all costs in connection with supplying and installing permanent rock anchors.

.8 No separate measurement or payment will be made for embedment of temporary anchors in concrete structures.

1.4 REFERENCES

.1 American Concrete Institute, hereinafter referred to as ACI:

- .1 ACI 305R Hot Weather Concreting
- .2 ACI 306R Cold Weather Concreting

.2 American Society for Testing and Materials, hereinafter referred to as ASTM:

- .1 ASTM C157: Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete
- .2 ASTM C171: Sheet Materials for Curing Concrete
- .3 ASTM C309: Liquid Membrane-Forming Compounds for Curing Concrete
- .4 ASTM C260: Standard Specification for Air-Entraining Admixtures for Concrete
- .5 ASTM C494: Standard Specification for Chemical Admixtures for Concrete
- .6 ASTM C1017: Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
- .7 ASTM C1202: Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
- .8 ASTM D994: Specification for Pre-Formed Expansion Joint Filler for Concrete (Bituminous Type)

.3 Canadian Standards Association, hereinafter referred to as CSA:

- .1 CSA A3000-18, Cementitious Materials Compendium
- .2 CSA-A23.1: Concrete Materials and Methods of Concrete Construction (refer to ASTM C260 and C494 for Admixtures)
- .3 CSA-A23.2: Test Methods and Standard Practices for Concrete
- .4 CSA A283, Qualification Code for Concrete Testing Laboratories

.4 Canadian General Standards Board, hereinafter referred to as CGSB:

.1 CAN/CGSB-19.24M Sealing Compound, Multi-Component, Chemical Curing

.2 CAN/CGSB-37.2M Emulsified Asphalt, Mineral-Colloid Type, Unfilled, for Damp-proofing and Waterproofing

.5 Concrete BC – Certification of Ready Mixed Concrete Production Facilities

1.5 DEFINITIONS

.1 Design Service Life: The time during which the structure performs its design function without unforeseen maintenance or repair.

1.6 CONCRETE SERVICE LIFE

.1 Notwithstanding any Design Service Life requirements specified elsewhere, the concrete incorporated in the work shall be designed for durability, for the specified exposure class, in conformance with the applicable clauses in CSA-A23.1 section 4.1, and for a Design Service Life of 75 years.

1.7 SUBMITTALS

.1 At least twenty-eight (28) days before the start of each type of concrete work submit, to Departmental Representative for their review, the following items in accordance with Section 01 33 00 (Submittal Procedures):

.1 Source of concrete.

.2 Source of cementitious material(s).

.3 Source of aggregates, including test report dated within one year demonstrating that aggregates meet the requirements of CSA-A23.1, including assessment of alkali-aggregate reactivity.

.4 Departmental Representative, at their discretion, may require samples of the proposed aggregates to be supplied by Contractor, at Contractor's cost, for independent testing purposes.

.5 Proposed admixtures and method of application.

.6 Mix design for each type of concrete, explicitly listing material constituent content of each component per m^3.

.7 **Quality Control Plan**, including proposed methods for early identification of trends in concrete properties and for taking corrective actions.

.8 Certification that proposed concrete materials and mix design conform to CSA-A23.1 and the requirements of this Section. Certification of aggregates shall include assessment of alkali aggregate reactivity in accordance with CSA-A23.1-19, Clause 4.2.3.5.1.

.9 Certification that proposed concrete production plant, including delivery equipment, conforms to CSA-A23.1 and the requirements of this Section. Submit valid Concrete BC certification.

.10 Details of proposed protective systems and procedures for placing and curing concrete, including situations when the ambient temperature is less than 5 degrees Celsius, or greater than 25 degrees Celsius.

.11 **Thermal Monitoring and Control Plan** for Mass Concrete elements, as defined by and in conformance with CSA A23.1. Plan shall include details on:

.1 Allowable maximum internal concrete temperatures.

.2 Allowable internal-external temperature differentials.

.3 Temperature monitoring methods.

.4 Methods for controlling internal and external concrete temperature.

.5 Methods for early identification of concrete temperature trends and corrective measures.

.12 Details of proposed patching, repair and finishing procedures.

.2 Quality control test results for plastic and hardened concrete samples.

.3 Submittals required by clause 3.6 of this Section shall be provided to Departmental Representative at least twenty-four (24) hours prior to the start of concrete placement, except that the check lists specified in clause 3.6.3 shall be provided at least four (4) hours prior to the start of concrete placement.

1.8 MIX DESIGN TRIALS

.1 At least twenty-eight (28) days before the use of each type of concrete mix, carry out a full-scale trial of the proposed mix design. A full-scale trial shall consist of a minimum of 5 m^3 of concrete batched at the plant designated as the source of that type of concrete.

.2 The trial shall include actual or simulated travel time from the concrete plant to site.

.3 Contractor shall arrange for sampling and testing of trial concrete. Failure to achieve the specified requirements or changes in source of materials or batching plant may require further mix design trials at Departmental Representative's discretion, and at Contractor's own cost.

.4 The cost of each trial, including all sampling and testing of trial concrete, shall be borne by Contractor.

.5 For each type of concrete, a full-scale trial is not required if (instead) Contractor submits to Departmental Representative acceptable evidence of adequate performance of concrete from previous comparable mix designs with the required concrete properties. Evidence of adequate long-term performance is also required, in order to assure compliance with the Design Service Life.

Part 2 Products

2.1 MATERIALS

.1 Portland cement:

- .1 Type MS to CSA-A3001.
- .2 Type GU cement may be used if tricalcium aluminate content is between 4.0 % and 7.5 %.
- .3 Type GUL cement may be used if tricalcium aluminate content is between 4.0 % and 7.5 %.

.2 Supplementary Cementing Materials:

- .1 Type F Fly Ash, to CSA-A3001.
- .2 Type S Granulated Ground Blast-Furnace Slag to CSA-A3001.
- .3 Type SF Silica Fume, to CSA-A3001.

.3 Water: to CSA-A23.1.

.4 Aggregates: to CSA-A23.1, normal density.

.5 Air entraining admixture: to CSA-A23.1 (which refers to ASTM C260).

.6 Chemical admixtures: to CSA-A23.1 (which refers to ASTM C494). Use of accelerating or set retarding admixtures during cold and hot weather placing to be subject to Departmental Representative's approval. Calcium chloride shall not be used. Chemical admixtures in all concrete shall be free of chloride ions.

.7 Superplasticizing admixtures: to CSA-A23.1 (which refers to ASTM C494 and ASTM C1017).

.8 Integral Hardener: Integral Concrete Hardener supplied in a dry powdered form and added to the concrete mix at the time of batching.

.9 Concrete fibers: Synthetic macro, or macro/micro blend, fiber reinforcement.

- .1 Length: 40 mm
- .2 Minimum Tensile Strength: 585 MPa
- .3 Minimum Aspect Ratio: 83

.10 Curing compound: to CSA-A23.1 white, or to ASTM C309, Type 1-1-chlorinated rubber Type 1-D with fugitive dye.

.11 Joint filler shall be pre-formed sponge rubber to ASTM D1752.

.12 Adhesive shall be a pressure sensitive adhesive compatible with the joint filler.

.13 Sealant primer shall be a resin-based primer specifically formulated for use with the joint sealant.

.14 Joint sealant shall be gun grade, two component, polysulphide sealant, grey or bronze in colour.

.1 For horizontal applications, use self -levelling sealant conforming to CAN/CGSB-19.24, Type 1, Class B.

.2 For vertical and overhead applications, use a non-sag sealant. conforming to CAN/CGSB-19.24, Type 2, Class A.

.3 Sealant properties:

.1 Tensile strength: 1 MPa minimum

.2 Movement: +/- 25%

.3 Elongation: 500%-550%

.4 Shore Hardness: 25-30

.15 Adhesive for drilled rebar shall be designed for use with hardened concrete.

.1 Adhesive: two-component 100% solids-based epoxy system supplied in manufacturer's standard side by side cartridge and dispensed through a static mixing nozzle supplied by manufacturer. Epoxy to meet the minimum requirements of ASTM C881 Specification for type I, II, IV, and V, grade 3, class B and C must develop a minimum 90 MPa compressive yield strength after a seven-day cure. Epoxy to have a heat deflection temperature of 58 degrees Celsius.

.2 Alternate anchoring materials shall be considered. Contractor shall submit proposed anchoring material data to Departmental Representative for review and approval.

.16 Bond breaker shall be asphaltic emulsion conforming to CAN/CGSB-37.2.

.17 Waterstops to Section 03 15 13 (Waterstops)

2.2 CONCRETE MIXES

.1 Concrete mixes shall be proportioned to provide a workable mix suitable for the complexity of that class of work, without segregation or bleeding.

.2 Proportion normal density concrete in accordance with CSA-A23.1 Alternative 1, for the specified exposure class, to give the properties stipulated in Table 1 of this Section for each concrete type.

.3 Slump shall be measured at time and point of discharge. Slump indicated is without superplasticizer. Concrete shall be placed at the lowest possible slump compatible with conditions of placement. Subject to approval by Departmental Representative, slump may be increased above the indicated maximum by the addition of an approved superplasticizer. The superplasticizing admixture, if used, shall not adversely influence the performance of the air-entraining admixture.

.1 Alternative slump ranges may be acceptable at the discretion of the Department Representative. The Contractor shall submit proposed slump range for each concrete mix in writing for review. Proposed slump shall be demonstrated with trial mixes.

TABLE 1 – CONCRETE PROPERTIES

Concrete Type	Exposure Class	Compressive Strength (MPa) @ Age	(1) Nominal Aggregate Size, max. (mm)	Slump, (mm)	Plastic Air Content (%)	Water / Cementing Materials Ratio, Max. (by mass)	Chloride Ion Penetrability Requirements and Age of Test
A	C-1/ S-3	35 @ 56 Days	20	80 ± 20	5 - 8	0.40	<1500 Coulombs within 91 days
B	-	100 @ 91 Days	20	80 ± 20	3 - 6	0.30	-
C	A-1/ S-3	35 @ 56 Days	20	80 ± 20	5 - 8	0.40	<1500 Coulombs within 91 days
D	C-3/ S-3	30 @ 56 Days	20	80 ± 20	5 - 8	0.50	-
E	C-XL/ S-3	50 @ 56 Days	28	80 ± 20	4 - 7	0.40	<1000 Coulombs within 91 days
F	C-1/ S-3	35 @ 91 Days	28	80 ± 20	4 - 7	0.40	<1500 Coulombs within 91 days

Note (1): See definition in CSA A23.1-19.

.4 Concrete mix types shall be used as follows:

.1 **Type A**: All Structurally Reinforced Concrete, unless noted otherwise. Including but not limited to: Dry Dock Walls, Access Chamber, and Lift Stations.

.2 **Type B**: High Performance Concrete (HPC) for Keel Block Strips in Dry Dock Floor Slab.

.3 **Type C**: Lift Station Sump Chamber Concrete Exposed to Sewage.

.4 **Type D**: Bedding, Cradles, Encasement, Supports, Manhole and Catch Basin Bases, Manhole Benching for Stormwater Drains, Thrust Blocks and Duct Banks.

.5 **Type E**: Dock Floor Concrete Topping per Section 03 01 31 (Dock Floor Concrete Topping). Top layer of Extension Dock Bottom Slab.

.6 **Type F**: Mass Concrete. Including but Not Limited To: Base layer of Extension Dock Bottom Slab.

.5 All concrete mixes shall be proportioned to minimize drying shrinkage. Measures shall include appropriate aggregate gradation and proportioning, and appropriate use of admixtures to reduce the water content of the mix:

.6 Special Requirements for **Type B**:

.1 The mix for concrete Type B shall be proportioned to minimize water content of the mix.

.2 Shall include Type SF Silica Fume. Minimum Dosage: 22.6 kg/m^3.

.3 Shall include Integral Hardening Admixture. Minimum Dosage: 40 kg/m^3.

.4 Shall include Synthetic fibers as described in this Section. Minimum Dosage: 2.3 kg/m^3 and as recommended by the Manufacturer.

.7 Special Requirements for **Type E**:

.1 Concrete Type E is specified as having 28 mm nominal maximum size aggregate. The whole coarse aggregate component must conform to the gradation requirements of CSA-A23.1-19, Table 11, Group 1, nominal size of aggregate of 28 mm - 5 mm.

.2 Shall include Type SF Silica Fume. Minimum Dosage: 11.3 kg/m^3, and as required to achieve chloride ion permeability requirements listed in Table 1 of this Section.

.3 Shall include Integral Hardening Admixture. Minimum Dosage: 40 kg/m^3.

.4 Shall include Synthetic fibers as described in this Section. Minimum Dosage: 2.3 kg/m^3 and as recommended by the Manufacturer.

.8 Special Requirements for **Type F**:

.1 Concrete Type F is specified as having 28 mm nominal maximum size aggregate. The whole coarse aggregate component must conform to the gradation requirements of CSA-A23.1-19, Table 11, Group 1, nominal size of aggregate of 28 mm - 5 mm.

.2 Per the Contractor's **Thermal Monitoring and Control Plan,** the mix for concrete Type F shall be designed to minimize temperature rise from hydration. The total quantity of cementitious materials shall be kept to the minimum necessary to achieve the compressive strength, permeability and water/cementing materials ratio specified in Table 1 of this Section.

.3 Dosage rate of Supplementary Cementing Materials shall conform to the requirements of CSA A3001, Table 9.

.9 For grout, refer to Section 04 05 12 (Grout).

Part 3 Execution

3.1 GENERAL

.1 All concrete work shall be in accordance with CSA-A23.1.

.2 No work shall commence until approval in writing is given by Departmental Representative for concrete materials and mix designs.

.3 No work shall commence until approval in writing is given by Departmental Representative for **Concrete Quality Control Plan** & **Thermal Monitoring and Control Plan.**

.4 Upon acceptance by Departmental Representative of a concrete mix design, including ingredients and sources of materials, changes or modifications in any manner will not be permitted without the prior approval of Departmental Representative.

3.2 MISCELLANEOUS EMBEDDED STEELWORK

.1 Contractor shall build into the concrete structures various inserts, access manholes, pits, etc. and fit same with metal covers, frames, etc. all to details shown on the Drawings.

.2 All reinforcing bar dowels and anchor bolts shall be placed before the concrete is poured, unless indicated otherwise.

.3 Contractor shall not damage metal fabrications in storing, handling and erecting during concrete placement.

.4 Adequate provision shall be made to keep metal fabrications plumb and in true alignment during erection and throughout concrete placement. Metal fabrications to be embedded in concrete, or grouted, shall be accurately set and held firmly in position while concrete or grout is being placed and cured. Templates shall be used to ensure correct placement.

.5 Any embedded fabrications that are incorrectly placed or that move during embedment to an extent that will affect their proper operation shall be removed and replaced correctly or shall be corrected by other means, subject to Departmental Representative's approval.

.6 All damage to coatings shall be restored by Contractor in accordance with Section 09 97 19 (Painting Exterior Metal Surfaces) to provide an unbroken coating film equal to the original coating.

3.3 MOVEMENT JOINTS

.1 Movement joints (i.e. for expansion or contraction) shall be provided at locations shown on the Drawings.

.2 The formed surface of the joint shall be cleaned of all accretions of concrete or foreign materials.

.3 The joint filler material shall cover the entire surface of the joint and fit around all openings and reinforcement. Exposed edges of the filler material shall be set back from the outer face as shown on the Drawings. Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative. The filler shall be secured to the concrete surface by stapling, the specified adhesive or other positive fastening. When more than

one piece is required for a joint, fasten abutting ends and hold securely to shape. All joints in the filler shall be so tight that mortar from fresh concrete cannot seep through to the opposite surface.

.4 The diameter of the back-up rod shall be from 25 to 50 percent larger than the width of the joint into which it is to be inserted. The back-up rod shall be positioned to maintain the distance, as shown on the Drawings, of the rod from the outer face of the concrete.

.5 Before application of the sealant, the sides of the joints shall be cleaned of curing compound, or other contaminants, by wire brushing. The joint shall then be blown free of all dirt and dust by oil-free compressed air. The depth to the back-up rod from outer face of concrete shall be checked and if it is more than ± 3 mm in error, it shall be corrected. The joint surface shall then be primed, after which the sealant shall be applied, and the exposed outer face lightly tooled to a smooth, neat surface. The aspect ratio of the joint sealant shall be 1:1.

.6 Install Waterstops to Section 03 15 13 (Waterstops)

3.4 CONSTRUCTION JOINTS

.1 Construction joints shall be provided only at locations shown on the Drawings, unless approved otherwise by Departmental Representative.

.2 The hardened surface of horizontal and vertical construction joints shall be roughened by mechanical means to full amplitude of 5 mm to CAN/CSA-A23.1-19 clause 7.2.2, to expose clean and sound aggregate, prior to casting the subsequent part of the structure. Roughen concrete surface by suitable methods authorized by Departmental Representative.

.3 The next layer of concrete above a horizontal construction joint shall be of the quality specified, but shall be proportioned with an excess of mortar, have a depth of approximately 150 mm, and be well-vibrated to achieve maximum bond, all as required by CSA-A23.1-19, clause 7.2.2.

.4 Reinforcing steel shall be continuous through construction joints.

.5 Where shown on the drawings, form a recess in the exposed edge(s) of construction joints and seal with back-up rod and sealant as for a movement joint.

3.5 CONCRETE SUPPLY

.1 The batch plant shall have an assured source of supply of cement at a temperature not exceeding 40º C.

.2 All concrete production and delivery equipment shall be capable of delivering successive batches of concrete at intervals not exceeding twenty (20) minutes. The rate of delivery shall not be greater than will allow for proper placement and consolidation of the concrete.

.3 The elapsed time from batching of concrete (measured from the time the cement is added to the aggregate) to commencement of discharge at the site shall not exceed 120 minutes. The use of hydration stabilizer requires the prior approval of Departmental Representative.

.4 Stationary and truck mixers with blades worn more than ten percent from original blade design profile will not be allowed. Accumulations of hardened mortar or concrete in the mixers shall be completely removed, or the equipment will not be allowed.

.5 All mixers and agitating equipment used in production of concrete will be subject to testing of batch uniformity for concrete by Departmental Representative.

3.6 PLACING CONCRETE

.1 Obtain Departmental Representative's approval before placing concrete. Provide twenty-four (24) hours notice prior to placing of concrete.

.2 Prior to placing of concrete, obtain Departmental Representative's approval of proposed method for protection of concrete during placing and curing.

.3 Prior to placing of concrete, review all applicable drawings for formwork blockouts, sleeves, reinforcement, embedded items (including electrical and mechanical), and submit to Departmental Representative a check list covering these items. The check list shall be signed off by each trade involved in that placement.

.4 All concrete placing methods shall be in accordance with CSA-A23.1. Concrete shall not be deposited by free fall into the forms when the drop exceeds 1.5 m. A drop pipe or other approved method shall be employed in such circumstances.

.5 Pumping of concrete is permitted. If pump placement is used, the mix designs may be modified to provide the desired properties at the point of discharge. Concrete mix changes shall be submitted for review by the Departmental Representative.

.6 When placing fresh concrete adjacent to hardened concrete restrained by continuous reinforcement, special consideration shall be given to the concrete curing, placing temperature, control of heat of hydration of the mix components, or use of insulation to guard against thermal and/or shrinkage cracking.

.7 Except where proprietary self-consolidating concrete products have been approved by Departmental Representative for use in the work, all concrete shall be consolidated by internal vibration using an adequate number of immersion vibrators with the correct frequency. One spare vibrator for each 3 operating ones shall be on hand during all concrete placement operations.

.8 Ensure reinforcement and inserts are not disturbed during concrete placement for all concrete work.

.9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.

.10 Do not place load upon new concrete until authorized by Departmental Representative.

3.7 CURING OF CONCRETE

.1 Concrete shall be protected and cured in accordance with the requirements of CSA A23.1-19. Curing type shall meet the requirements of CSA-A23.1-19, Tables 2 and 20, for the applicable exposure class, except as noted.

.2 Notwithstanding the requirements of CSA-A23.1-19 (Tables 2 and 20), curing Type 3 (extended) shall be used for:

.1 Dry Dock Floor Slab

.2 Dry Dock Walls

.3 Access Chamber,

3.8 COLD AND HOT WEATHER PRECAUTIONS

.1 All concrete work in cold or hot weather shall be executed strictly in accordance with CSA-A23.1 and ACI 305R or ACI 306R requirements, as applicable. Curing and protection of the fresh concrete shall conform to CSA-A23.1.

3.9 TOLERANCES

.1 The dimensional tolerances for concrete work shall be as given in CSA-A23.1-19 clause 6.4, unless noted otherwise.

3.10 FINISHING

.1 Finishing and treatment of concrete shall be in accordance with CSA-A23.1-19 clause 7.5 and Table 22 for Class A finish, unless noted otherwise.

.2 All exposed horizontal surfaces that are not intended to receive any additional concrete shall have a float finish as specified and shall conform accurately, within specified tolerance limits, to grades and elevations shown on the Drawings. Finished surfaces shall be free from open texturing, voids, bug holes, plucked aggregate, and local projections. Further trowel, broom or special finishes shall be performed as specified and where shown or required.

.3 Provide broom finish for the concrete wearing surface above access chamber (i.e. coping at dock apron level), and for the wearing surface inside the access chamber. Broom finish shall mean a fine, but slip-resistant, striated surface produced by brushing the newly troweled surface with a soft bristled broom. Brooming shall be performed when the concrete has been previously float finished and troweled and is sufficiently hard to retain the texture. Ensure brooming is aligned with concrete surface slopes to promote drainage runoff

.4 The broom finish shall be aligned with the slope of the finished concrete surface to facilitate water runoff. Broom finish shall mean a fine, but slip-resistant, striated surface produced by brushing the newly troweled surface with a soft bristled broom. Brooming shall be performed when the concrete has been previously float finished and troweled and is sufficiently hard to retain the texture.

.5 Dock Bottom Floor Finishing:

.1 Final finishing shall commence after the bleed water has disappeared and when the concrete has stiffened sufficiently to prevent the working of excess mortar to the surface. No additional water shall be used to facilitate finishing.

.2 After consolidating, screeding, and leveling concrete slabs, do not work surface until ready for floating. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, granular texture. Do not over finish concrete. The application of cement or other fine materials is not permitted.

.3 Apply a light broom finish to the slab surface. The orientation of the broom finish shall be parallel to the direction of water drainage flow. Do not apply a steel trowel finish to the slab surface.

.4 Allowable tolerances for the finished slab topping, when tested in accordance with ASTM E1155, shall be the following:

.1 FF $\geq$ 35

.2 FL - Does not apply.

.6 Formed finishes: to CSA A23.1 (smooth formed finish).

3.11 JOINT FILLERS

.1 Furnish filler for each joint in single piece for depth and width required for joint, unless otherwise authorized by Departmental Representative. When more than one piece is required for a joint, fasten abutting ends and hold securely to shape by stapling or other positive fastening.

.2 Locate and form movement joints as indicated. Install joint filler.

3.12 REPAIRS AND SURFACE PATCHING – NEW CAST-IN-PLACE CONCRETE STRUCTURES

.1 Immediately after removal of formwork, concrete surfaces shall be inspected for defects. Repairable defects shall be repaired as soon as practicable with patching mortar as described herein. If proper and effective repair of a defect is not feasible, or the repair work carried out is not successful, the elements affected shall be identified to Departmental Representative and shall be removed and replaced at Contractor's own cost.

.2 Immediately after removal of formwork, all bolts, ties, nails or other metal not required for further construction purposes, shall be removed or cut back to a depth

of at least 50 mm from the surface of the concrete. The cut out areas and cavities shall be repaired as soon as practicable with patching mortar as described herein.

.3 Surface irregularities, such as bulges, fins, lips or plugs shall be removed by chipping or grinding, and if necessary, shall be repaired as soon as practicable with patching mortar as described herein. Grinding, when used, shall not proceed until the concrete has sufficiently hardened to prevent dislodgement of coarse aggregate particles.

.4 Materials used to repair or patch surface defects shall be made of similar constituents and of approximately the same proportions as used for the concrete being patched, except that adjustments to the aggregate size and sand content may be made if required to provide similar finish to adjacent surfaces as determined by trial repair or patch. The quantity of mixing water shall be no more than necessary to facilitate handling and placing.

.5 Proprietary bagged patching materials may be used, subject to approval by Departmental Representative.

.6 The patching mortar shall colour-match the colour of the surrounding concrete.

.7 The patching mortar shall be mixed in advance and allowed to stand with frequent manipulation with a trowel, without addition of water, until it has reached the stiffest consistency that will permit placing.

.8 Bonding grout shall be a pre-bagged cementitious grout, mixed to the consistency of thick cream and then well brushed into the surfaces to be repaired or patched.

3.13 REPAIRS AND SURFACE PATCHING – EXISTING CONCRETE DOCK WALLS AND FLOOR REFURBISHMENT

.1 To Section 03 01 31 (Dock Floor Concrete Topping) and Section 03 01 32 (Dock Walls Concrete Repairs).

3.14 PROTECTION

.1 Take every precaution to prevent damage, abrasions and staining of surfaces and edges of concrete during the work. Provide plywood or insulation protection and polyethylene wrappings or other means as required to concrete elements that may be damaged by subsequent construction activities. Remove protective coverings at completion of construction.

.2 Barricades shall be erected to prevent traffic on newly finished surfaces.

3.15 QUALITY

.1 Quality control for concrete production and delivery shall be the responsibility of the Contractor.

.2 The contractor shall retain a testing laboratory, which shall be certified to the requirements of CSA A283 for all concrete field and laboratory testing.

.1 Frequency of concrete testing shall be in conformance with CSA A23.1, unless specified otherwise this in this or other specification sections.

.3 A Quality Control Plan approved by Departmental Representative shall be implemented throughout concrete production in accordance with the requirements of CSA-A23.1. In addition, as part of the Contractor's Quality Control Plan, the following shall be undertaken:

.1 Obtain and retain 1 sample of each lot of cement.

.2 Obtain and retain mill certificate for each lot of cement.

.3 Obtain and retain sieve analysis of all aggregates at least once each week.

.4 Maintain a record of each batch of concrete showing measured quantities of constituents.

.5 Each delivery shall be accompanied by a delivery slip which clearly identifies the concrete by mix number and class. Obtain and retain each delivery slip, for subsequent handover to Departmental Representative.

.6 Undertake sampling and testing of concrete materials and concrete products in accordance with CSA-A23.1.

.7 Maintain a record of concrete test results. During construction, analyze results at least weekly for early identification of trends in concrete properties and for pre-emptive corrective action as required. Advise Departmental Representative of corrective actions taken.

.8 Deliver to Departmental Representative weekly comprehensive Quality Control Reports.

.4 Departmental Representative may retain at his sole discretion a testing agency to undertake confirmatory testing, as and when Departmental Representative deems necessary. This quality assurance activity shall not relieve the Contractor of his responsibility for quality control measures outlined above.

.5 At Departmental Representative's sole discretion, Departmental Representative's testing agency may perform Quality Assurance as follows:

.1 Advise Departmental Representative on the suitability of aggregates, cementitious materials, admixtures and mix design for the various Types of concrete.

.2 Evaluate the Contractor's mix designs at the trials on the basis of the Contractor's samples and tests. If trials are not required, evaluate mix designs on evidence presented for approval.

.3 Perform sampling and testing at point of concrete deposit as required by Departmental Representative for quality assurance purposes.

.4 Provide overall review of Contractor's Quality Control Plan and perform checks during the progress of the work.

.5 Provide specialist advice on concrete technology.

.6 Inspection or testing by Departmental Representative and/or his testing firm will not augment or replace Contractor Quality Control, or relieve Contractor of his contractual responsibility for quality work.

END OF SECTION

Part 1 General

1.1 Section Includes

.1 This document provides a specification for the installation of shotcrete in repair areas of the graving dock walls using the wet-mix shotcrete process. It provides a specification for selection of materials, shotcrete mix proportioning, selection of shotcrete equipment, preparation for shotcreting, quality assurance, quality control testing, safety and clean up, shotcrete application, finishing, curing and protection.

.2 This Section does **not** apply to shotcrete work for shoring of rock excavations.

1.2 Related Requirements

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 35 33 (Health and Safety Requirements)

.3 Section 03 01 32 (Dock Walls Concrete Repair)

.4 Section 03 10 00 (Concrete forming and Accessories)

.5 Section 03 20 00 (Concrete Reinforcing)

.6 Section 03 30 00 (Cast-in-Place Concrete)

.7 Section 04 05 12 (Masonry Mortar and Grouting)

1.3 Measurement and Payment

.1 No measurement or payment will be made under this Section. Shotcrete shall be measured and paid for as specified in the relevant Sections.

.2 The cost of quality control shall be deemed to be incidental to the work and no separate payment will be made.

.3 The cost of Departmental Representative's quality assurance testing will be borne by Departmental Representative.

.4 No separate measurement or payment will be made for reinforcing steel. Refer to Section 03 20 00 (Concrete Reinforcing) and Section 03 39 00 (In Situ Concrete Structures).

.5 Movement joints and construction joints will not be measured separately, but considered incidental to the work. All costs in connection with joints, including waterstop where indicated, shall be included in the unit prices tendered for concrete covered by the relevant Sections.

.6 Miscellaneous steelwork items embedded in concrete shall be measured to Section 05 50 00 (Metal Fabrications), and payment will include all costs in connection with supplying and installing miscellaneous steelwork items.

.7 Permanent rock anchors embedded in concrete shall be measured to Section 31 68 00 (Rock Anchors), and payment will include all costs in connection with supplying and installing permanent rock anchors.

.8 No separate measurement or payment will be made for embedment of temporary anchors in concrete structures.

.9 Following items will not be measured for payment:

.1 Testing procedures.
.2 Surface preparation.
.3 Removal, disposal and replacement of defective concrete.
.4 Provision of reinforcement.
.5 Anchor bolts.
.6 Clean-up procedures.
.7 Scaffolding.
.8 Protective coating.

1.4 Qualifications

.1 The shotcrete contractor's crew foreman and nozzlemen shall meet the following requirements.

.1 Furnish proof that the shotcrete crew foreman has at least 5 years experience in shotcrete repair work.

.2 Furnish proof that the nozzlemen are certified to ACI C660, publication CP – 60 (15) for the wet-mix shotcrete process, vertical, and have successfully completed 3 projects of a similar size and character in the past 5 years.

1.5 Requirements

.1 The contractor shall furnish all labour, materials and equipment for the following:

.1 Supply, application, finishing, curing and protection of shotcrete.

.2 Provision of a quality control program to test the compliance of completed shotcrete work with the contract documents.

1.6 Safety

.1 The contractor shall implement a safety program which shall include but not be limited to the following:

.1 Ensuring that the structural integrity of the existing concrete and granite is maintained during the repairs by shoring or other suitable means as specified in the contract documents.

.2 Protecting all personnel and the public from falling debris, blasting grits and high-pressure water jets during the concrete removal process.

.3 Protecting all personnel and the public from pneumatically applied Shotcrete and rebound materials during the Shotcrete application process.

.4 Ensuring compliance with all local and WorkSafe BC regulations.

1.7 References

.1 Definitions:

.1 Two basic shotcreting processes are:

.1 Dry mix process where mix water is added at nozzle.

.2 Wet mix process where mix water is added before concrete enters delivery hose, and compressed air is added at nozzle.

.2 Overspray: shotcrete material deposited away from intended receiving surface.

.3 Rebound: shotcrete material which does not adhere to the repair surface during initial shooting operation.

.2 Reference Standards:

.1 American Concrete Institute (ACI)

.1 ACI 506R-16, Guide to Shotcrete.

.2 ACI 506.2-18, Specification for Shotcrete.

.3 ACI Certified Shotcrete Nozzleman.

.4 ACI C660 Publication CP – 60 (15).

.2 ASTM International

.1 ASTM C42/C42M Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

.2 ASTM C494, Specification for Chemical Admixtures for Concrete

.3 ASTM C618 Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

.4 ASTM C642 Standard Test Method for Density, Absorption, and Voids in Hardened Concrete.

.5 ASTM C1116 Standard Specification for Fibre-Reinforced Concrete.

.6 ASTM C1140 Standard Practice for Preparing and Testing Specimens from Shotcrete Test Panels.

.7 ASTM C1202 Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.

.8 ASTM C1436 Standard Specification for Materials for Shotcrete.

.3 CSA International

.1 CSA A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 (Submittal Procedures).

.2 Submit concrete materials in accordance with Section 03 30 00 (Cast-in-Place Concrete).

.3 The qualifications of the work crew, including the supervisor, shotcrete nozzlemen, pump operator and shotcrete blowpipe operators.

.4 Details of proposed shotcrete mixture including the mixture proportions and means of shotcrete supply.

.5 Results of preconstruction testing program and a description of the proposed construction quality control testing program, including the frequency of specific tests.

.6 Proposed scaffolding or other access system for workers and inspectors.

.7 Proposed falsework or temporary support system for the wall during the concrete removal operations.

1.9 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 (Common Product Requirements) and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 Materials

.1 Concrete mixes and materials: in accordance with Section 03 30 00 (Cast-in-Place Concrete) and as specified below.

.1 Shotcrete aggregate gradation: to CSA A23.1/A23.2 and the Gradation No. 2 of ACI 506R-16.

.2 Silica fume: to be Type SF conforming to CSA A3001.

.2 Reinforcing steel: Stainless steel in accordance with Section 03 20 00 (Concrete Reinforcing).

.1 Welded Wire Mesh: Stainless steel in accordance with Section 03 20 00 (Concrete Reinforcing).

.3 Shotcrete Fibre Reinforcing:

.1 Synthetic micro fibres shall meet the requirements of ASTM C1116, Type III. Fibres shall have a minimum length of 13 mm, a minimum modulus of elasticity of 9 GPa and a minimum tensile strength of 620 MPa. OR

.2 Cellulose micro fibres. Fibres shall be hydrophilic. Fibres shall have an average length of 2.1 mm and an average tensile strength of 620 MPa.

2.2 Mix Design

.1 The Contractor shall be responsible for shotcrete mixture proportioning and shall submit the proposed shotcrete mixture proportions to the Departmental Representative for review at least 10 working days prior to application of production shotcrete. As a minimum, the following information shall be submitted:

.1 An easily identifiable mix designation, number or code.

.2 Batch quantities of fine aggregate, coarse aggregate, cement, supplementary cementing materials, expected water demand (to include all water from moisture in aggregates, and water added at the batch site) and on site and all other shotcrete ingredients, in kg/m^3, based on saturated surface dry (SSD) aggregate conditions.

.3 Aggregate source, gradation, specific gravity at SSD and absorption.

.2 Allowance shall be made for the shooting orientation and rebound in shotcrete mixture proportioning.

.3 Shotcrete shall be proportioned to meet the performance requirements detailed herein.

.4 The Contractor shall submit shotcrete mix performance data from previous experience, if available, along with the shotcrete mix proportions for review by the Departmental Representative.

.5 Silica Fume:

.1 The silica fume content of silica fume shotcrete shall be between 8 and 10 percent by mass of cement.

.2 Silica Fume shall be used in conjunction with the addition of sufficient superplasticizing and water reducing admixture to control water demand of the mixture. The water demand of wet-mix silica fume shotcrete shall not exceed the water demand of a comparable Portland cement mixture without silica fume.

2.3 Performance Requirements

.1 Shotcrete shall conform to the performance requirements in Table 1.

Table 1. Wet Mix Shotcrete Performance Requirements

Test Description	Test Method	Age (days)	Specified Requirement
Max. Water-Cementitious Materials ratio	-	-	0.40
Fibre Content, kg/m^3	-	-	Micro-synthetic: 1.5 – 2.4, Or Cellulose: 9.8
Air Content – At pump, %	CSA A23.2 -4C	-	8.5 +/- 1.5
Air Content – As shot, %	CSA A23.2 -4C	-	5 +/- 1.5
Slump at discharge into pump, mm	CSA A23.2 -5C	-	60 +/- 20
Min. Compressive Strength, MPa	CSA A23.2 -9C	7 28	30 40
Max. Boiled Absorption, % Max. Volume of Permeable Voids, %	ASTM C642	7 7	8 17
Max. Rapid Chloride Permeability, Coulombs	CSA A23.2 -23C	91	<1000
Min. Bond Strength to existing concrete, MPa	CSA A23.2 -6B	28	0.9

2.4 EQUIPMENT

.1 Shotcrete equipment for wet mix process to ACI 506R.

.2 Batching equipment to proportion aggregate and cement mixtures on mass basis.

.3 Use air supply system that delivers air uncontaminated by oil and capable of maintaining constant air pressure.

.4 Provide separate air hose and blow pipe, capable of simultaneous operation with shotcreting operation, for removal of rebound, overspray and dust.

.5 Equipment subject to approval of Departmental Representative.

.1 Maintain equipment in proper working order.

.2 Provide additional test panels and test cores as required by Departmental Representative to demonstrate that equipment is functioning properly during shotcreting operation.

2.5 Preconstruction Trial

.1 The Contractor shall implement a preconstruction trial to enable the Departmental Representative to evaluate conformance of the proposed materials, shotcrete mixture, equipment and crew to the proposed specifications. Acceptance of the preconstruction trial results by the Departmental Representative is required prior to performance of any work detailed in the Contract Documents.

.2 The preconstruction trial shall be used to prequalify the nozzlemen proposed for the project. Nozzlemen who have not been prequalified shall not be permitted to apply shotcrete on the project.

.3 The preconstruction trial shall approximate actual working conditions, configuration, reinforcement, and shooting position as near as possible. The trial shall involve a workmanship demonstration in accordance with ACI C660. The trial shall be evaluated by core grading in accordance with ACI C660 CP-60. Cores for grading shall be taken from at least five locations of intersecting reinforcement, as directed by the Departmental Representative. Cores from any one panel shall be unacceptable if there are more than two core grade 3, or if any of the cores have a grade greater than 3.

.4 Core Grading shall be in accordance with ACI C660 CP-60.

.5 Preconstruction test panels shall be prepared, cured and tested in accordance with ACI 506.2-18.

.6 Three test specimens shall be extracted at each test age from the non-reinforced shotcrete for testing for the performance parameters specified herein.

.7 The Departmental Representative shall evaluate the quality of the extracted cores and test panel. When a prequalification test panel is rejected, the nozzleman shall be permitted to shoot two additional panels. If either of the additional test panels is also rejected, the nozzleman shall not be permitted to shoot on the project.

.8 If the preconstruction test specimens fail to meet the project performance requirements, then the contractor shall make the necessary adjustments in shotcrete materials, mixture design or application, and re-shoot the test panels. No work shall commence on the project until the preconstruction performance testing requirements have been met.

2.6 Quality Assurance

.1 A quality assurance program will be implemented for the project. This program will be administered by the Departmental Representative and will include the following:

.1 Review of Contractor submittals;

.2 Review of Contractors proposed materials, supply, equipment and crew. In particular all shotcrete nozzleman proposed for the project will be evaluated in the preconstruction testing program; only nozzleman approved in writing by the Departmental Representative shall be used on the project;

.3 Examination and approval of all areas prepared for shotcreting, including installation of anchors, reinforcement and devices to control line and grade, prior to application of shotcrete;

.4 Provision of inspectors to monitor the shotcrete installation, with the authority to require removal and replacement of defective shotcrete while still plastic;

.5 Regular monitoring of the quality control testing;

.6 Implementation of a program for in-place evaluation and acceptance or rejection of shotcrete.

2.7 Quality Control

.1 One construction test panel shall be shot by each nozzleman for each 20 cubic meters of Shotcrete production, but not more than once per day, and at least once per week. The panel shall be shot in the same position as the repair work being done.

.2 Test panels shall be produced in accordance with the requirements of ASTM C1140 but shall have minimum dimensions of 450 mm x 450 mm x 150 mm deep. They shall be constructed of wood and sealed plywood, with 45-degree sloped edge forms, to permit escape of rebound. Construction test panels shall contain no reinforcement or embedments. The panel shall be cored to provide three compression test specimens as described below.

.3 Construction test panels shall be prepared, cured and tested in accordance with ACI 506.2-18.

.4 Compressive strength test specimens shall be 75 mm diameter cores with a length to diameter ration close to 2:1 but not less than 1:1. Compressive strength tests shall be conducted in accordance with CSA A23.2 – 14C.

.5 Specimens for boiled absorption and volume of permeable voids for testing to ASTM C 642, shall be 75 mm cubes or extracted 75 mm diameter cores at least 100 mm long. Three specimens shall be tested at age 7 days after shooting.

Part 3 Execution

3.1 PREPARATION

.1 Prepare surfaces for shotcreting to ACI 506R.

.2 Remove unsound concrete and prepare bond surface in accordance with Section 03 01 32 (Dock Wall Concrete Repairs).

.3 Remove dirt, grease, oil or other substances which would interfere with bond of newly placed shotcrete.

.4 If required, and deemed acceptable by the Departmental Representative, additional welded wire mesh may be installed to support shotcrete installation, provided:

.1 The welded wire mesh meets the stainless-steel materials requirements outlined in Section 03 20 00 (Concrete Reinforcing)

.2 The specified concrete cover is maintained.

3.2 APPLICATION

.1 Shotcrete shall be applied in accordance with good practice as detailed in ACI 506R. Wherever possible, shotcrete shall be applied to the full thickness in a single layer.

.2 Do not apply shotcrete to surface having running or free-standing water.

.3 The concrete substrate shall be saturated the day before shotcreting and then re-wetted prior to shooting. At least one hour prior to application of shotcrete, all surfaces to be shotcreted shall be flushed with water of drinking quality standard. Wetted surfaces shall be allowed to dry to a saturated-surface-dry condition prior to application of shotcrete. If necessary, a blowpipe shall be used to facilitate removal of surface water. Only oil-free compressed air shall be used in the blowpipe. In the event a work stoppage longer than two hours takes place on any shotcrete layer prior to the time it has been built up to required thickness, the surface shall be rewetted prior to continuing. No shotcrete shall be applied to a dry surface or to a surface with free surface water.

.4 The minimum number of layers required to build up the full thickness of shotcrete without sagging, separation or sloughing shall be used.

.5 When using multiple-layer shotcrete construction, the first layer shall be prepared before application of a subsequent layer by either:

.1 Brooming the stiffened layer with a stiff bristle broom to remove all loose material, rebound, overspray or glaze, prior to the shotcrete attaining initial set; or

.2 If the shotcrete has set, surface preparation shall be delayed at least 24 hours, at which time the surface shall be prepared by sandblasting or high-

pressure water blasting to remove all loose material, rebound, hardened overspray, glaze, or other material that prevents adequate bond.

.6 When successive layers of shotcrete are required to build up the full shotcrete thickness, the first layer shall be prevented from drying out by fogging or wetting. The use of curing compound shall not be permitted between layers, except with the approval of the Departmental Representative in writing. If a curing compound is used, it shall be removed by abrasive blast cleaning or high-pressure water blasting, prior to application of the next layer of shotcrete. The first layer of shotcrete shall be free of surface water and in a saturated-surface-dry condition at the time of application of the next shotcrete layer.

.7 Care shall be exercised to protect adjacent surfaces from build up of rebound and overspray. Rebound shall not be permitted in the completed work. Hardened rebound and hardened overspray shall be removed prior to application of additional shotcrete, using abrasive blast cleaning, chipping hammers, high-pressure water blasting or other suitable techniques.

.8 The Contractor shall provide scaffolding or other temporary stable work platform (e.g., manlift, suspended work platform, etc.) at each repair location unless otherwise approved by the Departmental Representative. Plans for the proposed temporary work platform shall be provided to the Departmental Representative for review and approval prior to installation. All anchorages placed into the existing structure shall be removed when the platform is removed and the substructure repaired at no extra cost.

.9 Shotcrete nozzling shall follow acceptable shooting practice, as detailed in section 8.5 of ACI 506R. In particular:

.1 The nozzle shall be generally operated at a distance of 0.5 to 1.5 meters from the receiving surface, except as required to fill corners, cover edges and encase large diameter reinforcing steel.

.2 The combination of air pressure at the nozzle, moisture content of the shotcrete and distance of the nozzle from the receiving surface shall be optimized to achieve maximum compaction of the shotcrete.

.3 Care shall be taken while encasing reinforcing steel and anchors to keep the front face of the reinforcement clean during shooting operations, so that shotcrete builds up from behind, to encase the reinforcement and prevent voids and sand pockets from forming; and

.4 Accumulations of rebound and overspray shall be continuously removed by the nozzleman’s helper in advance of the deposition of new shotcrete. Rebound material shall not be reused.

.10 Do not apply shotcrete when temperature is below 5 degrees C or when it is raining. Shotcrete shall not be applied during periods of high wind which could

interfere with the shotcrete stream unless suitable protective covers, enclosures or wind breaks are installed.

.11 Apply shotcrete to build concrete surface to finished lines. Acceptable minus tolerance of finished surfaces is 3 mm. Provide minimum cover of 60 mm over steel reinforcement.

.12 Shotcrete shall be applied to the required line and grade and tolerance detailed in the contract drawings, using shooting wires depth gauges, guide strips, forms or other suitable devices that do not entrap rebound. Shotcrete shall be applied to provide the minimum cover to the reinforcing detailed in the drawings. A positive means of checking total thickness of the applied shotcrete shall be provided by the use of shooting wires which shall be removed after to the application of the finish coat.

3.3 Shotcrete Finishing

.1 The shotcrete shall be cut back to line and grade using trowels, cutting rods, screeds or other suitable devices. The shotcrete shall be allowed to stiffen sufficiently before cutting and trimming so as to prevent the formation of tears, cracks and delaminations. Shooting wires shall be removed on completion of cutting and trimming.

.2 The shotcrete shall be provided a **magnesium float finish**.

.3 All shotcrete and overspray shall be trimmed back from adjacent non-prepared concrete surfaces. The edges of all shotcrete repairs shall have a minimum square cut edge 40mm deep and shotcrete shall be finished up to this edge. Featheredging of shotcrete (including flash coats) is not permitted.

3.4 Curing

.1 On completion of finishing, shotcrete shall immediately be prevented from drying out by fogging or wetting or where permitted by the Contract documents, by application of a curing compound.

.2 Curing compounds if permitted by the Contract Documents, shall be removed prior to application of additional layers of shotcretes.

.3 Once shotcrete has attained final set, it shall be kept continuously moist for a minimum of **10 days** by one or more of the following methods:

.1 Covering the wall in wet burlap or other suitable fabric which has been soaked in water for 24 hours and covering the fabric in 6 mil polyethylene to retard drying.

.2 Installation of sprinklers, soaker hoses or other devices which will keep the shotcrete continuously wet. The use of procedures which allow the shotcrete to undergo intermittent wetting and drying during the curing period is not permitted.

3.5 Hot and Cold Weather Protection

.1 Per the general requirements of CSA A23.1 shall apply to shotcrete remedial work except the maximum temperature of the shotcrete shall not exceed 30 C.

.2 If the prevailing ambient conditions (relative humidity, wind speed air temperature and direct exposure to sunlight) are such that the shotcrete develops plastic shrinkage and/or early drying shrinkage cracking, shotcrete application shall be terminated.

.3 Shotcrete application shall be terminated if the ambient temperature rises above 30 C, unless the contractor adopts special hot weather shotcreting procedures which are approved by the Departmental Representative.

.4 During periods of cold weather, shotcreting may only proceed if the concrete substrate to which the shotcrete is to be applied is free of frost and the air temperature in contact with the repair surfaces is above 5 degrees C.

.5 The air temperature in contact with the repaired surfaces shall be maintained at 5 degrees C or greater for at least 3 days following shotcrete application. The means of maintaining the air temperature shall be approved by the Departmental Representative. The use of unvented heaters, which give rise to carbonation, is not permitted.

.6 The temperature of applied shotcrete shall be preferably in the range of 10 to 20 C but not outside the range of 5 to 30 C. Cooler mix temperatures are preferred during hot weather shotcreting and warmer mix temperatures during cold weather shotcreting.

3.6 CLEANING

.1 Progress Cleaning: clean in accordance with Section (01 74 11 – Cleaning).

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section (01 74 11 – Cleaning).

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes construction of the following in-situ concrete structures:

.2 Dry Dock Floor Slab,

.3 Dry Dock Walls, Access Chamber; and Lift Station.

.4 Crane Beams; and,

.5 Other miscellaneous reinforced and unreinforced concrete structures.

.6 Concrete construction for storm sewer catch basins, duct banks, and water main thrust blocks is covered in other Sections.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 01 31 (Dock Floor Concrete Topping)

.3 Section 03 01 32 (Dock Walls Concrete Repairs)

.4 Section 03 10 00 (Concrete Forming and Accessories)

.5 Section 03 20 00 (Concrete Reinforcing)

.6 Section 03 30 00 (Cast-In-Place Concrete)

.7 Section 04 05 12 (Grout)

.8 Section 05 50 00 (Metal Fabrications)

.9 Section 09 97 19 (Painting Exterior Metal Surfaces)

.10 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.11 Section 31 23 16.26 (Rock Excavation)

.12 Section 31 68 00 (Rock Anchors)

.13 Section 31 24 15 (General Fill)

.14 Section 32 11 16.01 (Granular Sub-Base)

.15 Section 32 11 23 (Aggregate Base Courses)

.16 Section 33 05 13 (Manholes and Catch Basins)

.17 Section 33 11 16 (Water Utility Distribution Piping)

.18 Section 33 41 00 (Storm Utility Drainage Piping)

.19 Section 35 59 29 (Mooring Devices)

1.3 MEASUREMENT AND PAYMENT

.1 Concrete covered by this Section will be measured in cubic metres incorporated into the work, determined by the details and dimensions shown on the Drawings. Blockouts, ducts, embedded pipe or other items creating voids where the volume is greater than 0.10 m^3 shall be deducted from the measurement. Refer to Clause 1.3.3 for concrete placed in the space between the Minimum Line of Excavation and the excavated rock surface.

.2 Concrete covered by this Section will be paid for at the relevant unit prices tendered for the Concrete types noted below. Except as noted in item 1.3.3 and 1.3.4, payment for concrete shall include for all costs in connection with the concrete, as specified and as shown on the Drawings, including all reinforcing steel, formwork, falsework, accessories and temporary support structures required for the work.

- .1 IN-SITU CONCRETE: TYPE F & E (for Dry Dock Floor in Extension).
- .2 IN-SITU CONCRETE: TYPE A (for Dry Dock Walls and Access Chamber).
- .3 IN-SITU CONCRETE: TYPE B (for Dry Dock Floor Keel Block Strip).
- .4 IN-SITU CONCRETE: TYPE C (for Crane Beams and other reinforced concrete structures not identified as Type A or B).
- .5 IN-SITU CONCRETE: TYPE D (for cover slabs over pipe trenches, thrust blocks, and other miscellaneous concrete not covered elsewhere).

.3 No measurement or payment will be made for concrete placed to correct unauthorized rock excavation or accidental removal of rock in the space between the Minimum Line of Excavation and the excavated rock surface.

.4 Concrete for repairs and refurbishment to the existing Section 3 Dock Floor (Type E) and Dock Walls (Shotcrete) will be measured and paid for in accordance with Sections 03 01 31 (Dock Floor Concrete Topping) and Section 03 01 32 (Dock Walls Concrete Repairs).

.5 No measurement or payment will be made for concrete placed to correct unauthorized demolition of existing concrete structures in the space between the Minimum Line of Excavation and the demolished concrete surface.

.6 Anchor pockets and anchor embedment at in-situ concrete structures will not be measured separately, but considered incidental to the work. All costs in connection with anchor embedment and the construction of anchor pockets, including grout where indicated, shall be included in the unit prices tendered for concrete.

.7 Concrete duct banks and vaults will be measured to Section 33 65 73 (Concrete Duct Banks and Manholes), and payment shall include all costs in connection

with supplying and installing concrete duct banks and vaults, including reinforcing steel.

.8 Ducts embedded in concrete structures (except duct banks) will not be measured separately, but considered incidental to the work. All costs in connection with ducts embedded in concrete structures (except duct banks) shall be included in the unit prices tendered for concrete.

.9 Concrete thrust blocks for firewater mains will not be measured separately, but considered incidental to the work. All costs in connection with thrust blocks for firewater mains shall be included in the unit prices tendered for concrete.

.10 Concrete for storm utility drainage piping system (cast-in-place and precast) will be measured to Section 33 41 00 (Storm Utility Drainage Piping). Payment shall include all costs in connection with supplying and installing the storm utility drainage system, including reinforcing steel.

.11 Trench drains covered by this section will be measured in linear meters incorporated into the work, determined by the details and dimensions shown on the Drawings except as noted otherwise.

.12 Trench drains associated with this Section will be paid for at the relevant unit rates tendered for DOCK FLOOR TRENCH DRAINS. Payment for trench drains shall include for all costs in connection with the cost of providing and installing, as specified and as shown on the Drawings, including reinforcing steel and applicable mounting hardware.

.13 Expansion joints, movement joints, contraction joints and construction joints will not be measured separately, but considered incidental to the work. All costs in connection with the construction of joints, including concrete anchorages at movement joints, and waterstop where required, shall be included in the unit prices tendered for concrete.

.14 Miscellaneous metal fabrications, including metal fabrications at movement joints, will be measured to Section 05 50 00 (Metal Fabrications), and payment shall include all costs in connection with supplying and installing miscellaneous metal fabrications.

.15 Crane rail sole plate anchor bolts, whether embedded in fresh concrete or drilled into hardened concrete, will be measured to Section 05 56 00 (Crane Rails) and payment shall include all costs in connection with supplying and installing the anchor bolts.

.16 Grounding of metal items will be measured to Section 26 05 27 (Grounding) and payment shall include all costs in connection with supplying, installing and connecting grounding.

.17 Granular base and granular sub-base under cast-in-place concrete structures will be measured to Section 32 11 23 (Aggregate Base Courses) and Section 32 11

16.01 (Granular Sub-Base), and payment shall include all costs in connection with granular base and granular sub-base, respectively.

.18 Excavation for concrete structures will be measured to Section 31 23 33.01 (Excavating, Trenching and Backfilling), or to Section 31 23 16.26 (Rock Excavation), as appropriate to the material type, and payment shall include all costs in connection with excavation.

.19 General fill adjacent to or under cast-in-place concrete structures will be measured to Section 31 24 15 (General Fill), and payment shall include all costs in connection with general fill.

1.4 REFERENCES

.1 ASTM A307, Specification for Carbon Steel Externally Threaded Standard Fasteners.

.2 ASTM F1554, Grade 36, Standard Specifications for Anchor Bolts.

.3 CSA-A23.1, Concrete Materials and Methods of Concrete Construction.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Submit shop drawings for Departmental Representative's review, in accordance with Section 01 33 00 (Submittal Procedures). Indicate the following items:

.1 Concrete Reinforcing, as stipulated by Section 03 20 00.

.2 Concrete Forming and Accessories, as stipulated by Section 03 10 00

.3 Metal Fabrications, as stipulated by Section 05 50 00.

.4 Rock anchors and anchor pockets, as stipulated by Section 31 68 00.

.5 Layout of crane rail anchor bolts, as stipulated by Section 05 50 00.

.2 Submit the concrete pour sequence, placing procedures, formwork, insulation and checklists for the dry dock floor slab, dry dock walls, access chamber and crane beams, for Departmental Representative's review, in accordance with Section 01 33 00 (Submittal Procedures).

1.7 OPERATING ENVIRONMENT

.1 Management of environmental effects on construction of cast-in-place concrete structures shall be the sole responsibility of the Contractor.

.2 The design ambient temperature range is from -5° C minimum to 23° C maximum.

Part 2 Products

2.1 MATERIALS

.1 Compacted backfill materials under concrete structures: to Section 31 24 15 (General Fill), Section 32 11 16.01 (Granular Sub-Base) or Section 32 11 23 (Aggregate Base Courses), as appropriate to the material described on the Drawings.

.2 Concrete mixes and materials: to 03 30 00 (Cast-In-Place Concrete)

.3 Reinforcing steel: to Section 03 20 00 (Concrete Reinforcing).

.4 Joint filler, adhesive, back-up rod, sealant primer, joint sealant, bond breaker, and to Section 03 30 00 (Cast-In-Place Concrete).

.5 Waterstop to Section 03 15 13 (Waterstops)

.6 Grounding materials and fixings: to Section 05 56 00 (Grounding).

.7 Ladders and their embedded fixings: to Section 05 50 00 (Metal Fabrications).

.8 Metal frames and covers: to Section 05 50 00 (Metal Fabrications).

.9 Crane rail sole plate anchor bolts: to Section 05 56 00 (Crane Rails).

.10 Mooring cleat anchor bolts: to Section 35 59 29 (Mooring Devices).

Part 3 Execution

3.1 GENERAL

.1 The sequencing of concrete pours shall make provision to minimize the effects of concrete shrinkage on the finished structure.

.2 Install movement joints, crack control joints and construction joints at locations shown on the Drawings, except as otherwise approved by Departmental Representative.

.3 Concrete mix design, initial concrete temperature, placing procedures, formwork and insulation shall be employed to ensure that the maximum temperature differential over the cross-section of any reinforced concrete element, is as required by CSA A23.1.

.4 For mass concrete, concrete thermal gradients shall be controlled to prevent cracking in accordance with the **Thermal Monitoring and Control Plan** per Section 03 30 00 (Cast-in-Place Concrete).

3.2 DRY DOCK FLOOR, DRY DOCK WALLS AND ACCESS CHAMBER

.1 Correct unauthorized rock excavation or accidental removal of rock by placing unreinforced (fill) concrete, of the same concrete structural

concrete pour (Type F). Fill concrete shall be integral (cast monolithically) with the structural concrete pour, in the space between the Minimum Line of Excavation and the excavated rock surface. Refer to Section 31 23 16.26 (Rock Excavation) for definition of "Minimum Line of Excavation".

.1 The **Thermal Monitoring and Control Plan** shall incorporate the field measured concrete thicknesses.

.2 Dry Dock Floor sections shall be cast continuously and monolithically, without horizontal pour breaks. The Dry Dock Floor shall consist of **Type F** concrete extending from the excavated rock surface to 300 mm below the finished concrete floor surface. The top 300 mm of the Dry Dock Floor shall be **Type E** concrete.

.1 The contractor shall place and consolidate the **Type F** and **Type E** concretes in a continuous operation with the same placement equipment to avoid horizontal pour breaks.

.3 After performance testing and proof testing of permanent rock anchors is completed and accepted by Departmental Representative, cast anchors into the concrete dock floor/wall structures as indicated on the Drawings. Ensure each bearing plate is aligned, positioned and held firmly in conformance with the requirements of Section 05 50 00 (Metal Fabrications) so that full bearing is achieved against anchor nut/washer during concrete placement.

.4 Place concrete for dry dock floor only after completion of rock excavation and clean-up of exposed rock surface as specified in Section 31 23 16.26 (Rock Excavation).

.5 Install crack control joints and construction joints at locations shown on the Drawings, except as otherwise approved by Departmental Representative.

3.3 CRANE BEAMS

.1 Prepare crane beam foundations and construct crane beams only after completion and acceptance of adjacent concrete structures, and only after completion and acceptance of subgrade preparation and compaction.

.2 Adjust crane beam formwork to Departmental Representative's approval to provide a final beam top of true line and level along the length of the beam, and to provide the specified crane rail gauge.

3.4 CONCRETE STRUCTURES FOUNDED ON COMPACTED FILL

.1 Remove unsuitable material at founding level to extent and depth as directed by Departmental Representative.

.2 Prepare foundations and construct miscellaneous concrete items only after completion and acceptance of sub-grade preparation and compaction.

3.5 CRANE RAILS

.1 Crane rail anchor bolts shall either be set in place within the concrete pour, or drilled-in after the crane beam concrete attains its specified compressive strength. If Contractor elects to set the anchors in place, then they shall be held firmly in place by templates while concrete is poured.

.2 Refer to Section 05 56 00 (Crane Rails) for other crane rail details and installation requirements.

3.6 MISCELLANEOUS EMBEDDED STEELWORK

.1 Build into the concrete structures the miscellaneous metal fabrications to details shown on the Drawings.

.2 Build into the concrete structures the access manholes and service manholes, and fit same with metal covers, frames, etc, all to details shown on the Drawings.

.3 Fit drainage trenches with grating frames.

3.7 GALVANIZING AND PAINTING

.1 Coat all miscellaneous steel as defined by Section 09 97 19 (Painting Exterior Metal Surfaces).

3.8 ERECTION OF METAL FABRICATIONS

.1 Do not damage metal fabrications in storing, handling and erecting.

.2 Adequate provision shall be made to keep the metal fabrications plumb and in true alignment during erection.

.3 Miscellaneous metal fabrications to be embedded in concrete, or grouted, shall be accurately set and held firmly in position while concrete or grout is being placed and cured. Any embedded fabrications that are incorrectly placed or that move during embedment to an extent that will affect their proper operation shall be removed and replaced correctly or shall be corrected by other approved means.

.4 All damage to painting shall be restored by touch-up painting by Contractor to provide an unbroken paint film equal to the original coating, as specified in Section 09 97 19 (Painting Exterior Metal Surfaces).

END OF SECTION

Part 1 General

1.1 Section Includes:

.1 This section provides a specification for selection of materials, repair mixes, mix proportioning, preparation for repair, quality assurance, quality control testing, safety and clean up, finishing, curing and protection for the following works:

- .1 Replacement of missing and or deteriorated bedding mortar located below existing altar granite blocks.
- .2 Repair of face damage (spalling) to granite blocks on dock bottom. (*Dock Bottom – Granite Face Repairs)*
- .3 Repair of cracking and spalling damage to altar granite blocks on dock walls (*Granite Block – Altar Crack Repairs)*.
- .4 Installation of hold down anchors in altar granite blocks (*Granite Block – Altar Anchors)*.
- .5 Installation of drainage slots in altar granite blocks (*Granite Block – Altar Drainage Slots).*
- .6 Repointing of deteriorated mortar joints, on:
  - .1 Dock bottom (*Granite Block Mortar Repointing –Blocks at Dock Bottom)*
  - .2 Altar granite blocks (*Granite Block Mortar Repointing – Altar Blocks at Dock Wall)*

1.2 Related Requirements

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 35 33 (Health and Safety Requirements)

.3 Section 03 01 31 (Dock Floor Concrete Repair)

.4 Section 03 01 32 (Dock Walls Concrete Repair)

.5 Section 03 20 00 (Concrete Reinforcing)

.6 Section 03 37 13 (Shotcrete)

1.3 Measurement and Payment Procedures

.1 Measurement for payment for this work will be on:

- .1 An area (m^2) basis for *Dock Bottom – Granite Face Repairs*
- .2 Lineal (lin. m.) for *Granite Block – Altar Crack Repairs*
  - .1 > 25 mm crack width, and
  - .2 < 25 mm crack width
- .3 Unit rate basis for *Granite Block – Altar Anchors*
- .4 Unit rate basis for *Granite Block – Altar Drainage Slots*
- .5 Lump Sum for *Granite Block – Dutchman Repairs*

.6 Lineal (lin.m.) for *Granite Block Mortar Repointing – Altar Blocks at Dock Wall.*

.7 Lineal (lin. m.) for *Granite Block Mortar Repointing –Blocks at Dock Bottom.*

.2 Replacement of bedding mortar below altar blocks is considered incidental to concrete repair works described in Section 03 01 32 (Dock Walls Concrete Repair).

.3 Unit rates will include costs associated with supplying materials, and executing work as described herein and reflected in contract.

1.4 Alternates

.1 Obtain Departmental Representative's written approval before changing procedures, manufacturer's brands, sources of supply of materials during entire contract.

1.5 References

.1 Definitions:

.1 Repair of Stone: mechanical or plastic repair, done to restore original appearance and function of partly deteriorated stones.

.2 Adhesive: material used to fasten broken/fractured stone elements by direct application at fracture interface and/or by application to added reinforcing elements such as dowels.

.3 Bedding Mortar: cementitious material used to fill voids below existing granite stones.

.4 Pointing Mortar: cementitious material used to fill existing mortar joints between granite blocks.

.5 Crack Repair Material: material used to fill (prepared) existing cracks located on the granite altar blocks.

.6 Surface (Spalling) Repair Material: cementitious material used to fill prepared surface damage areas on the floor granite blocks.

.2 Reference Standards:

.1 ASTM International

.1 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes.

.2 ASTM C881, Standard Specification for Epoxy Resin Base Bonding Systems for Concrete

.2 CSA International

.1 CSA A23.1/A23.2-19, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.

.2 CSA A3000-18, Cementitious Materials Compendium

.3 CSA A179-14, Mortar and Grout for Unit Masonry.

.3 International Concrete Repair Institute (ICRI)

.1 ICRI Concrete Surface Profiles (CSP’s)

1.6 Action and Informational Submittals

.1 Provide submittals in accordance with Section 01 33 00 (Submittal Procedures).

.2 Product Data:

.1 Provide manufacturer's printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations. Include:

.1 Application/installation instructions.

.2 Laboratory test reports certifying compliance of products with specification requirements.

.3 Manufacturer's material safety data sheets (MSDS) for safe handling of specified materials and products, in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

.3 Samples:

.1 Submit Ultra-High-Performance Concrete sample to verify colour.

.4 Certificates:

.1 Submit upon request by Departmental Representative purchase orders, invoices, suppliers test certificates and documents to prove materials used in contract meet requirements of specification. Allow free access to sources where materials were procured.

1.7 Closeout Submittals

.1 Record Documentation:

.1 Provide marked up set of drawings to provide referencing system identifying locations of stone repairs.

.2 Provide photographically record of dismantle and rebuilt stonework.

1.8 Quality Control

.1 Cementitious Mortar Quality Control Testing:

.1 Compressive strength samples (50 mm cubes) shall be cast for every repair mortar type, for every day of mortar preparation.

.2 Samples shall be cast and tested in conformance with CSA A3004-C2.

.3 Compressive strength tests shall be completed at an age of 7 days and 28 days. A compressive strength test shall be the average strength result of three (3) mortar cube samples.

.2 Ultra-High-Performance Concrete (UHPC) Testing:

.1 Complete testing in conformance with CSA A23.1 Annex U.

.2 Compressive strength samples shall be cast for every day of UHPC preparation.

1.9 Quality Assurance

.1 Qualifications:

.1 Manufacturers:

.1 Repair materials: manufactured by company specializing in production of cementitious materials with a minimum of 10 years experience in

production of mortar and/or concrete products and with a record of satisfactory in-service performance.

.2 Masonry Contractor:

.1 Work of this Section: executed by contractor specializing in historic stone conservation work of this nature, using similar stone repair techniques, and with a minimum 5-year record of successful performance.

.3 Foreperson:

.1 Provide competent trade foreperson specializing in type of work required.

.2 Experience: minimum 5 years experience in conservation work similar to work of this Section. Must be present on site throughout Work.

.4 Installers:

.1 Plastic repairs: executed by skilled trades people who have successfully completed a course of instruction provided by filling mortar manufacturer and hold a Training Workshop Certificate from said manufacturer. Maintain proof of credential for each installer at site.

.2 Experience: minimum 5-year record of successful masonry repairs.

.2 Mock-ups:

.1 Construct mock-up in accordance with Section 01 45 00 (Quality Control).

.2 Construct mock-up of a representative sample of each type of repair specified, with specified materials and methods. Mock-ups shall include:

.1 Spalling repair on dock bottom granite block

.2 Crack repair on altar block, > 25 mm width

.3 Crack repair on altar block, < 25 mm width

.4 Granite Altar Anchor

.5 Altar drainage slot

.6 Stone replacement (dutchman) repair

.7 Dock bottom repointing

.8 Altar block repointing

.3 Select locations of mock-ups in consultation with Departmental Representative.

.4 Notify Departmental Representative 48 hours before commencing each mock-up.

.1 Obtain approval from Departmental Representative before commencing mock-up.

.5 Allow 72 hours for inspection of mock-up by Departmental Representative before proceeding with stone repair work.

.6 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

.7 Clean mock-up to demonstrate cleaning operations to Departmental Representative before starting cleaning work.

1.10 Delivery, Storage and Handling

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements:

.1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.

.1 Identification with grade, batch and production date shown on container or packaging.

.2 Store materials in a clean, dry enclosed area and supported free of ground. Maintain a minimum ambient temperature of 10 degrees C in storage area.

1.11 Ambient Conditions

.1 Maintain a minimum temperature of 10 degrees C during and 48 hours after repair, throughout thickness of stone.

.2 Allow materials to reach minimum temperature of 10 degrees C prior to use.

.3 Maintain temperature between 21 ^{0}C and 24 ^{0}C during repair and 48 hours after, throughout thickness of stone.

.4 Provide temporary enclosures and heating equipment to maintain specified temperatures. Take precautions to avoid overheating masonry.

.5 Remove work exposed to lower temperatures as directed by Departmental Representative.

.6 Refer to manufacturer's instructions for environmental requirements of products.

.7 Hot weather requirement:

.1 Shade stones from direct sunlight.

Part 2 Products

2.1 Materials

.1 Use materials from same manufacturer throughout the Work.

.2 Portland cement: to CSA A3000.

.3 Sand: cleaned and graded in accordance to ASTM C144.

.4 Water: clean and free of deleterious materials such as acid, alkali and organic material in accordance to CSA A179.

.5 Dowels: threaded, stainless steel to ASTM A276, Type 304.

.1 Diameter per the project repair drawings.

.6 Stone:

.1 Shall be salvaged from the existing east end of the dry dock as identified on the Demolition Drawings.

.2 Unused portions of the salvage stone shall be removed from site and stored as directed by the Departmental Representative.

2.2 Mortar Mixes

.1 Mortar: in accordance with CSA A179 and CSA A23.1.

.2 Proportion Specification:

.1 In accordance with CSA A179.

.3 Property Specification:

.1 Dock Wall Granite Blocks:

.1 Bedding mortar: Type S.

.1 Mortar compressive strength at 28 days: minimum 20 MPa, maximum 50 MPa.

.2 Air entrainment: 8-12%.

.2 Pointing mortar:

.1 Pre-bagged non-shrink cementitious mortar/ grout.

.2 Maximum nominal aggregate size: 5 mm.

.3 Mortar compressive strength at 28 days: minimum 40 MPa, maximum 65 MPa.

.3 Altar Crack Injection Material: Epoxy Resin to ASTM C881

.1 High-Modulus, low-viscosity, high strength, epoxy grouting adhesive

.2 Compressive strength at 28 days: minimum 70 MPa.

.3 Modulus of Elasticity at 28 days: 2.41 GPa

.4 Viscosity: 450 – 550 cps

.4 Altar Crack Repair Material: Sanded Epoxy Resin Mortar

.1 High-Modulus, low-viscosity, high strength, epoxy grouting adhesive combined with clean well graded, oven dried silica sand per manufacturer's written recommendations.

.2 Compressive strength at 28 days: minimum 60 MPa.

.3 Modulus of Elasticity at 28 days: 5.59 GPa

.2 Dock Floor Granite Blocks:

.1 Pointing mortar:

.1 Pre-bagged non-shrink cementitious mortar/ grout.

.2 Maximum nominal aggregate size: 5 mm.

.3 Mortar compressive strength at 28 days: minimum 40 MPa, maximum 65 MPa.

.2 Surface (Spalling) Repair Material:

.1 Ultra-High-Performance Concrete (UHPC) in conformance with CSA A23.1 Annex U.

.2 Colour: To match existing granite.

.3 Compressive strength: 120 MPa at 28 days

.4 Pre-packaged material. Batched on site.

.5 Synthetic fibres: dosage rate recommended by the manufacturer.

2.3 Bonding Agent

.1 Structural epoxy bonding adhesive.

.1 Meeting the requirements of ASTM C881 for epoxy resin adhesive.

.2 Minimum slant shear bond strength, per ASTM C882 (plastic concrete to hardened concrete) = 13 MPa.

.3 Viscosity: 2500 - 3000 cps

.4 Compressive strength at 28 days: minimum 60 MPa.

2.4 Anchoring Adhesive

.1 In conformance with Section 03 01 32 (Dock Wall Concrete Repairs)

Part 3 Execution

3.1 Site Verification of Conditions

.1 Review areas of deteriorated stone with Departmental Representative to receive approval and instructions for repair locations, drainage slot locations and anchor locations before proceeding with repair work.

.2 Areas of repair shall be marked on site and documented in as-built drawings.

.3 Stop work in that area and report to Departmental Representative immediately any evidence of hazardous materials.

3.2 Preparation

.1 Obtain Departmental Representative's approval for tools to be employed prior to commencing work.

.2 Obtain Departmental Representative's approval for repair methodology and tools to be employed prior to commencing work.

3.3 Protection

.1 Prevent damage to stone surfaces and mortar joints which are to remain. Make good damage incurred.

.2 Protect surrounding components from damage during work.

.3 Take utmost care not to damage historic fabric. Make good damage incurred.

.4 Obtain Departmental Representative's approval for repair methodology.

3.4 Replacement of Granite Bedding Mortar

.1 This work shall be completed in conjunction with concrete repair works below the altar block, see Section 03 01 32 (Dock Walls Concrete Repairs).

.2 Once concrete removal has been completed and the existing bedding mortar has been exposed:

.1 Use manual raking tool to remove existing mortar to a minimum depth of 50 mm (measured from the damaged concrete surface). Ensure square corners and a flat surface at back of cut. Clean out any voids or cavities encountered.

.2 Where active water leakage is occurring, treat the water leakage as described in Section 03 01 32 (Dock Walls Concrete Repairs).

.3 Clean surfaces of existing filled joints with a low-pressure water wash.

.4 Flush open joints and voids with low pressure water stream and natural bristle brush.

.5 Ensure that no standing water is left.

.6 Dampen joints and ensure masonry is kept damp throughout re-bedding process.

.7 Completely fill open joint with new bedding mortar in layers not exceeding 12 mm in depth. Allow necessary time to ensure each layer sets prior to placement of any overlying layers.

.8 Pack mortar solidly into voids and joints; tool and compact using jointing tool to force mortar into joint.

.9 The new bedding mortar shall be installed flush with the concrete repair face.

.3 Protection

.1 Cover all completed or partially completed work at end of each work day.

.2 Maintain ambient temperature of at least 10 degrees C for a minimum of 2 weeks after repointing masonry.

.3 Protect the mortar from damage, especially due to concrete surface preparation works.

3.5 Granite Block – Altar Crack Repairs (> And < 25 Mm in Width)

.1 This work shall not commence until the concrete repair works below the altar block, see Section 03 01 32 (Concrete Wall Repairs) has been completed.

.2 Layout extent of the repair area and provide cores holes at the corners of the layout.

.1 Core hole diameter: 25 mm. Minimum depth: 25 mm

.3 Square saw cut edges of repair between core hole locations. Overcutting of corners of repair is not permitted. Chip out the sound stone to the depth of the cut.

.4 Install 6 mm diameter vertical holes within the crack opening to a depth of not less than 150 mm. The vertical holes shall be spaced at 300 mm on center along the length of the crack.

.5 Roughen the stone bond surfaces with a method approved by the Departmental Representative. Roughened surfaces shall be a roughness equivalent to ICRI Concrete Surface Profile (CSP) 6 – 7.

.6 Where damage extends to the edge of the block, provide formwork to honor existing mortar joints between granite blocks.

.7 The bond surface shall be prepared by suitable means, including but not limited to sand blasting or hydrodemolition, to remove all bruised, loose, and deteriorated stone material.

.8 Thoroughly clean the bond surface of any dirt and or debris.

.9 Fill the cracks and vertical holes with the epoxy *Altar Crack Injection Material*. Allow the epoxy to flow into the crack opening and re-fill as required. Fill the crack to the mouth of the opening (at least 25 mm from the finished face of granite).

.10 Mix and install the *Altar Crack Repair Material* (sanded repair epoxy mortar) in conformance with manufacturer's written recommendations. When the thickness of the repair exceeds the maximum allowable by the manufacturer, install the epoxy repair mortar in suitable lifts, as recommended by the manufacturer.

.11 Apply oven-dry silica sand to the top surface of the epoxy repair mortar. Apply the silica sand to refusal.

.12 Cure repair mortar in conformance with manufacturer's written recommendations.

3.6 Granite Block – Dutchman Repair

.1 Remove damaged portions of the existing granite blocks. Square edges of the remaining altar section to allow for tight fit of the new blocks.

.2 Remove the exposed portions of the existing bedding mortar.

.3 At the bond face, insert 19 mm diameter dowels, 150 mm long into existing stone and apply specified adhesive to holes and interface.

.4 Cut new stone insert to exactly fit the cut in existing stone.

.1 Allow for thickness of stone adhesive.

.5 Drill holes of diameter and depth to match dowels on the existing stone.

.6 Align holes on each side of fracture.

.7 Install dowels at maximum spacing of 400 mm. Use minimum 2 dowels per fracture.

.8 Cut dowels slightly shorter than full depth of hole.

.9 Make horizontal grooves 6 mm deep at interface of existing and new stone slabs.

.10 Apply bonding agent to grooves and interface of existing stone.

.11 Fill holes on one side of joint with specified adhesive. Insert and rotate dowels in new adhesive.

.12 Fill dowel holes and grooves of new stone slab with the epoxy bonding agent.

.13 Install new bedding mortar as required.

.14 Erect new stone slab into position. Secure stone to allow adhesive to set for 72 hours.

.15 Repoint with the repointing mortar. Joints to match existing.

3.7 Dock Bottom – Granite Face Repairs

.1 Layout extent of the repair area and provide cores holes at the corners of the layout.

.1 Core hole diameter: 25 mm. Minimum depth: 25 mm

.2 Square saw cut edges of repair between core hole locations. Overcutting of corners of repair is not permitted. Chip out the sound stone to the depth of the cut.

.3 Roughen stone surfaces with a method approved by the Departmental Representative. Roughened surfaces shall be a roughness equivalent to ICRI Concrete Surface Profile (CSP) 6 – 7.

.4 Provide formwork to honor existing mortar joints between granite blocks, where damage extends to the edge of the block.

.5 The bond surface shall be prepared by suitable means, including but not limited to sand blasting or hydrodemolition, to remove all bruised, loose, and deteriorated stone material.

.6 Thoroughly clean the bond surface of any dirt and or debris.

.7 The prepared bond surface shall be saturated with water prior to placing repair material. Existing stone surfaces shall be in a Saturated Surface Dry (SSD) condition when placing repair materials.

.8 Apply epoxy bonding agent in conformance with manufacturers recommendations.

.9 Mix and install Ultra High-Performance Concrete product in conformance with manufacturer's written recommendations.

.10 Cure UHPC in conformance with manufacturer's written recommendations.

3.8 Granite Block – Altar Drainage Slot

.1 Locate the new drainage slots with the Departmental Representative. Drainage slots to be located at low (water collection) points on the altar.

.2 Use procedures approved by the Departmental Representative to cut and smooth the granite surface. Overcutting of corners of repair is not permitted.

3.9 Granite Block – Altar Anchors

.1 Locate the new granite anchors with the Departmental Representative.

.2 Drill and epoxy set new anchors per the repair drawings.

.3 Provide a 50 mm diameter, 50 mm deep core hole at the top surface of the new anchor and fill with *Altar Crack Repair Material* (sanded repair epoxy mortar), with the top surface sanded to rejection.

3.10 Granite Block Mortar Repointing – Altar Blocks & Dock Bottom Blocks

.1 Areas of granite block mortar repointing shall be located with the Departmental Representative.

.2 Mortar joint repointing shall commence only once all other concrete and stone repair activities have been completed in the area of repointing work. The granite masonry shall be protected from vibration throughout the repointing works.

.3 Maintain masonry temperature between 10 ^{0}C and 25 ^{0}C for duration of work activities.

.4 When temperature is below 10 ^{0}C:

.1 Store cements and sands for immediate use within an enclosure heated to maintain an internal temperature between 10 degrees C and 25 degrees C. Allow cement and sands to reach minimum temperature of 10 degrees C prior to use.

.5 Raking Mortar Joints:

.1 Use manual raking tool to remove existing mortar exposing sound mortar materials at required depth. Ensure square corners and a flat surface at back of cut. Clean out any voids or cavities encountered.

.2 Required depth of raking shall be the lesser of: 20 mm, or twice the joint thickness. Where joint erosion is greater than 20 mm, do not remove any additional sound material; clean joint of dirt and debris as directed below.

.3 Ensure that no masonry units are inadvertently chipped, altered or otherwise damaged in the process of raking mortar.

.4 Clean surfaces of existing filled joints with a low-pressure water wash without damaging the texture of exposed joints or masonry units.

.5 Flush open joints with low pressure water stream and natural bristle brush.

.6 Ensure that no standing water is left.

.6 Repointing

.1 Dampen joints and ensure masonry is kept damp throughout repointing process.

.2 Completely fill open joint with new mortar in layers not exceeding 12 mm in depth. Allow necessary time to ensure each layer sets prior to placement of any overlying layers.

.3 Maintain joint width. If surface of adjacent masonry units has worn or rounded edges, adjust depth of new mortar placement to ensure that appropriate joint thickness remains.

.4 Pack mortar solidly into voids and joints; tool and compact using jointing tool to force mortar into joint. Ensure that joints are tooled to match existing profile.

.5 Remove excess mortar from masonry face before it sets.

.7 Protection

.1 Cover all completed or partially completed work at end of each work day.

.2 Maintain ambient temperature of at least 10 degrees C for a minimum of 2 weeks after repointing masonry.

3.11 Cleaning

.1 Clean in accordance with Section 01 74 11 (Cleaning).

.2 Obtain Departmental Representative's approval of cleaning operations before starting cleaning work. Clean stone work surfaces after repairs have been completed and mortar has set. Clean stone surfaces of adhesive or mortar residue resulting from work performed without damage to stone or joints.

.3 Clear site of debris, surplus material and equipment, leaving work area in clean and safe condition.

3.12 Protection of Completed Work

.1 Protect finished work from impact damage.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes the requirements for grout for the following applications:

- .1 As a bed under the mooring cleats installed at concrete structures;
- .2 As a bed under the crane rail sole plates;
- .3 For rock anchors and at anchor pockets;
- .4 For miscellaneous applications, such as bearing pads for metal fabrications as described on the Drawings.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 10 00 (Concrete Forming and Accessories)

.3 Section 03 30 00 (Cast-in-Place Concrete)

.4 Section 03 39 00 (In-Situ Concrete Structures)

.5 Section 05 56 00 (Crane Rails)

.6 Section 31 68 00 (Rock Anchors)

.7 Section 35 59 29 (Mooring Devices)

1.3 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under the relevant Sections for which grout or grouting is required.

1.4 DEFINITIONS

.1 NOT USED

1.5 SUBMITTALS

.1 For each type of grout proposed for use in the work, at least twenty-eight (28) days prior to commencing work, submit the following in accordance with Section 01 33 00 (Submittal Procedures) to Departmental Representative for review:

- .1 Manufacturer’s product data sheets and printed instructions;
- .2 Proposed admixtures;
- .3 Proposed Quality Control Plan;
- .4 List of all equipment to be used for grouting;
- .5 Calibration certificates for all gauges to be used for grouting; and,

.6 Certification that each type of grout will comply with the Specification.

.2 Submit grouting records, to Departmental Representative for review, in timely fashion during the work.

1.6 REFERENCES

.1 CAN/CSA-A23.1-M, Concrete Materials and Methods of Concrete Construction.

.2 CAN/CSA-A23.2-M, Methods of Test for Concrete.

.3 Additional material and testing standards listed in CAN/CSA-A23.1-09 section 2.

.4 ASTM C1116 / C1116M - 10a, Standard Specification for Fiber-Reinforced Concrete.

Part 2 Products

2.1 MATERIALS

.1 Grout shall be non-metallic and shrinkage compensating cementitious "flowable" grout, and shall be proportioned and mixed to give the properties in Table 1, unless noted otherwise:

TABLE 1 – GROUT PROPERTIES

Grout Property	Test Method	Limit
Plastic:		
Bleeding:	CAN/CSA-A23.2-1B	< 1.0 %
Expansion:	CAN/CSA-A23.2-1B	Range = 0.0 % to 2.0 %
Workability (flow):	CAN/CSA-A23.2-1B	Range = 20 to 30 seconds
Hardened:		
28-day Compressive Strength:	CAN/CSA-A23.2.1B	> 35 MPa

.2 Refer to Section 05 56 00 (Crane Rails) for specific materials requirements and properties for grout under crane rail sole plates.

.3 Refer to Section 31 68 00 (Rock Anchors) for specific materials requirements and properties for grout at rock anchors and at anchor pockets.

.4 Refer to Section 35 59 29 (Mooring Devices) for installation requirements for bedding grout at mooring devices.

GROUTING EQUIPMENT

.2 All plant and equipment for mixing and placing grout, including head-box, any circulating hoses and fittings, shall be of a type and size and mechanical condition suitable for doing the work in an efficient and effective manner.

.3 Demonstrate to the satisfaction of Departmental Representative the ability of the grout mixing and pumping equipment to produce the specified grout mix in a pre-construction field trial.

.4 Grout mixer parameters:

.1 Provide a high speed, high shear (colloidal) mixer of sufficient capacity to provide a continuous supply of uniformly mixed, stable suspension grout. Paddle or shear vane mixers may be used, subject to Departmental Representative's review;

.2 Provide a head-box to ensure continuous grout flow; and,

.3 Mixing unit to be equipped with an accurate water metering unit for controlling the amount of mixing water used in the grout.

.5 Maintain all grouting equipment in a fully serviceable condition, capable of continuous and efficient performance during any grouting operation.

Part 3 Execution

3.1 MIXING AND PLACING GROUT

.1 Grout shall be mixed to a flowable consistency and in accordance with good practice.

.2 Place grout continuously from one side (or from bottom to top in vertical spaces) to ensure that all air is expelled as the grout front advances.

.3 Ensure that grout attains 100 % contact with the contact area shown on the Drawings.

.4 Refer to Section 05 56 00 (Crane Rails) for specific mixing and placing requirements for grout under crane rail soleplates.

.5 Cure grout by moist cure with burlap for minimum twenty-four (24) hours

.6 Protect grout from freezing until it has attained compressive strength 20 MPa.

.7 If grout will be subject to freezing within 14 days of placement, the grout shall contain entrained air in conformance with CAN/CSA-A23.1-09 clause 6.8.4.3.

3.2 TESTING GROUT

.1 Testing of grout properties shall be to CAN/CSA A23.2.1B.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply, fabrication, and installation of the removable roadway bridge at the east end of the extended dock.

1.2 RELATED REQUIREMENTS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 02 41 16.01 (Structure Demolition)

.3 Section 03 30 00 (Cast-in-Place Concrete)

.4 Section 03 39 00 (In-Situ Concrete Structures)

.5 Section 05 50 00 (Metal Fabrications)

.6 Section 09 97 19 (Painting Exterior Metal Surfaces)

.7 Section 26 05 27 (Grounding)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Work items related to the removable bridge will not be measured individually. All work items related to removable bridge will be paid for at the Lump Sum price tendered for REMOVABLE BRIDGE. Payment shall be full compensation for all work in connection with the supply, fabrication, and installation of steel removable bridge, splices, bearings, bolts, nuts and washers, survey, levelling, testing, aligning and grouting:

.1 Ensure lump sum price includes radiographic examination of optional shop splices and additional field splices.

1.4 REFERENCES

.1 American Association for State Highway and Transportation Officials (AASHTO)

.1 AASHTO Standard Specifications for Highway Bridges-[17th Edition 2002].

.2 ASTM International

.1 ASTM A325M-[09], Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength [Metric].

.2 ASTM A490M-[09], Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints.

.3 CSA International

.1 CSA G40.20/G40.21-[04(R2009)], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-[M92(R2003)], Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CAN/CSA S6-19, Canadian Highway Bridge Design Code.

.4 CSA S16-14, Design of Steel Structures.

.5 CSA S269.1-[1975(R2003)], Falsework for Construction Purposes.

.6 CSA W48-[06], Filler Metals and Allied Materials for Metal Arc Welding.

.7 CSA W59-[03(R2008)], Welded Steel Construction, (Metal Arc Welding).

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 (Submittal Procedures).

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for structural steel and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of British Columbia, Canada.

.2 Indicate shop and erection details including shop splices, cuts, copes, connections, holes, bearing plates, threaded fasteners, rivets and welds. Indicate welds by CSA W59, welding symbols.

.3 Proposed welding procedures to be stamped and approved by Canadian Welding Bureau.

.4 Submit description of methods, temporary bracing and strengthening, sequence of erection and type of equipment proposed for use in erecting structural steel.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle in accordance with Section [01 61 00 - Common Product Requirements].

.2 Provide protective blocking for lifting, transportation and storing.

.1 Exercise care during fabrication, transportation and erection so as not to damage girders and beams.

.2 Do not notch edges of members.

.3 Do not cause excessive stresses.

.3 Mark mass on members weighing more than 3 tonnes.

.4 Ensure that no portion of steel comes into contact with ground.

.5 Provide Departmental Representative with delivery schedules minimum 14 days prior to shipping.

.6 Replace defective or damaged materials with new.

1.7 QUALITY ASSURANCE

.1 Preconstruction Testing:

.1 Provide suitable facilities and cooperate with Departmental Representative in carrying out inspection and tests required.

Part 2 Products

2.1 MATERIALS

.1 All bridge steel to be hot dip galvanized.

.2 Structural steel: to CSA G40.20/G40.21, grade and types 350WT Category 2.

.3 High strength bolts, nuts and washers: to ASTM A325M, galvanized.

.4 Anchor bolts, washers and nuts: to ASTM A193 GRB8 Class 2..

.5 Bearings: elastomer bearing pads of neoprene, grade 60 to CAN/CSA S6.

.6 Welding electrodes: to CSA W48 series.

.7 Hot dip galvanizing: to CAN/CSA G164, minimum zinc coating of [600] g/m^2.

.8 Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents.

2.2 SOURCE QUALITY CONTROL

.1 Steel producer qualifications: certified in accordance with CSA G40.20/G40.21.

.2 Submit Departmental Representative 2 copies of certified test reports for Charpy V-notch test.

.3 Provide suitable facilities and co-operate with Departmental Representative in carrying out inspection and tests required.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify conditions of substrates previously installed under other Sections or Contracts are acceptable for structural steel installation in accordance with manufacturer's written instructions.

.1 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.2 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Clean steel surfaces as directed by Departmental Representative when staining or defacing occurs.

.2 Verify location of substructure units, elevations of bearing seats and location of anchor bolts before erection of structural steel; report discrepancies to Departmental Representative.

.3 Restrict drifting during assembly to minimum required to bring parts into position without enlarging or distorting holes, and without distorting, kinking or sharply bending metal of any unit.

.1 Enlarge holes if necessary by reaming only after receipt of written approval from Departmental Representative.

.2 Ensure reamed holes are 2 mm maximum larger than bolt size used.

.4 Bridge elements to be trial assembled prior to galvanizing of individual elements.

.5 Fabricate and install bearings as indicated.

3.3 INSTALLATION

.1 Do falsework in accordance to CSA S269.1.

.2 Do fabrication and erection of structural steel in accordance with CAN/CSA S6, Design of Highway Bridges.

.3 Do welding in accordance with CSA W59, except where specified otherwise.

.1 For CSA G40.20/G40.21, grade 350WT steel, deposited weld metal to have Charpy V-Notch value not lower than that of steel.

.2 Do welding in shop unless otherwise permitted by Departmental Representative.

.3 Weld only at locations indicated.

.4 High strength bolting: in accordance with CAN/CSA S6. Use 'turn-of-nut' tightening method.

.5 Finish: members true to line, free from twists, bends, open joints, sharp corners and sharp edges.

.6 Allowable tolerance for bolt holes:

.1 Matching holes for bolts to line up so that dowel 2 mm less in diameter than hole passes freely through assembled members at right angles to such members.

.2 Finish holes not more than 2 mm in diameter larger than diameter of rivet or bolt unless otherwise specified by Departmental Representative.

.3 Centre-to-centre distance between any two holes of group to vary by not more than 1 mm from dimensioned distance between such holes.

.4 Centre-to-centre distance between any two groups of holes to vary not more than maximum of the following:

Centre-to-Centre distance in metres	Tolerance in plus or minus mm
less than 10	1
10 to 20	2
20 to 30	3

.5 Correct mispunched or misdrilled members only as directed by Departmental Representative

.7 Span length tolerances:

.1 Girders and beams: plus or minus 6 mm

.2 Centre-to-centre of bearing stiffeners and bearing plates: plus or minus 3 mm.

.8 Shop splices:

.1 Use complete joint penetration groove welds finished flush.

.2 Details of butt joints to CSA W59.

.3 Use only as approved by Departmental Representative.

.9 Camber:

.1 Camber tolerances for plate girders to be to CSA W59.

.2 Record measurements of camber of each girder, at points indicated.

.3 Submit diagram to Departmental Representative showing camber for each girder fabricated.

.4 Advise Departmental Representative immediately when camber of fabricated girder is greater than specified tolerances.

.5 Submit proposal for corrective measures.

.6 Undertake remedial measures as approved by Departmental Representative.

.10 Shop erection:

.1 Support each girder on its bearing points and measure and record deflection at same points indicated for measurement of camber.

.2 Measure deflections in plane of girder web.

.3 Submit diagram to Departmental Representative showing deflection measurements for each girder before delivery.

.11 Mark members in accordance with CSA G40.20/G40.21.

.1 Do not use die stamping.

.2 Place marking at locations hidden when viewed from exterior after erection when steel is to be left in unpainted condition.

.12 Match marking: shop mark bearing assemblies and splices.

.13 Protect exposed concrete surfaces of substructures from staining.

.1 Use galvanized anchors for anchorage to concrete.

.2 Submit details of installation and methods of support to Departmental Representative for review prior to commencing protection work.

3.4 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, protecting and cleaning of steel.

.2 Submit manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Ensure manufacturer's representative is present before installation, during critical periods of installation and during construction of field joints and testing.

.4 Schedule site visits:

.1 After delivery and storage of products, and when preparatory Work, or other Work, on which the Work of this Section depends, is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of the Work, after cleaning is carried out.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply, fabrication and installation of: access hatches and ship service hatches (covers, frames and ladders) at the service tunnel access chamber; framing and grating at drainage sump in service tunnel; edge protection; handrails; drainage trench covers and frames in dock floor; and miscellaneous steel fabrications.

.2 Bolting material and other fabricated metal items not described elsewhere shall also be fabricated in accordance with this Section.

.3 The removable roadway bridge is covered under Section 05 12 33 (Structural Steel for Bridges)

.4 For grounding requirements for metalwork items, refer to Section 26 05 27 (Grounding).

.5 For mooring bollards and cleats, refer to Section 35 59 29 (Mooring Devices).

.6 For cable trays, pipe supports and other electrical supports, refer to the Section relevant for each item.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 02 41 16.01 (Structure Demolition)

.3 Section 03 01 31 (Dock Floor Concrete Topping)

.4 Section 03 01 32 (Dock Walls Concrete Repair)

.5 Section 03 30 00 (Cast-in-Place Concrete)

.6 Section 03 39 00 (In-Situ Concrete Structures)

.7 Section 05 12 33 (Structural Steel for Bridges)

.8 Section 09 97 19 (Painting Exterior Metal Surfaces)

.9 Section 26 05 27 (Grounding)

.10 Section 33 05 13 (Manholes and Catch Basins)

.11 Section 33 41 00 (Storm Utility Drainage Piping)

.12 Section 35 59 29 (Mooring Devices)

1.3 MEASUREMENT AND PAYMENT

.1 Covers, frames, ladders and metalwork for access hatches and ship service hatches at the service tunnel, framing and grating metalwork at the service tunnel drainage sump, dock floor/wall edge protection angles, handrails, and other miscellaneous metal items described on the Drawings, will not be measured individually. All the aforementioned metal items are collectively termed miscellaneous metal fabrications, regardless of steel grade or type, and will be paid for at the Lump Sum price tendered for METAL FABRICATIONS: MISCELLANEOUS. Payment shall be full compensation for supply and installation of these metal fabrications.

.2 Anchor bolts, brackets, bearing pads and other miscellaneous steel fabrications will not be measured separately, but considered incidental to the work. All costs in connection with anchor bolts and other miscellaneous steel fabrications shall be included in the unit prices tendered for the associated items of work. Anchor bolts, brackets, bearing pads and other miscellaneous steel fabrications will not be measured separately, but considered incidental to the work of this Section. All costs in connection with anchor bolts, brackets, bearing pads and other miscellaneous steel fabrications shall be included in the price tendered for the associated items of work.

.3 Supply, fabrication, and Installation of the removable roadway bridge shall be paid for within then lump sum price tendered for REMOVABLE BRIDGE covered under Section 05 12 33 (Structural Steel for Bridges).

.4 Covers, frames and miscellaneous metalwork for storm utility drainage manholes and catch basins, deck drains/covers/bends/tees and deck drain junction boxes, are considered incidental to the work and will be paid for within the lump sum price tendered for Storm Utility Drainage under Section 33 41 00 (Storm Utility Drainage Piping).

1.4 REFERENCES

.1 Canadian Standards Association (CSA):

.1 CAN/CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 .2CAN/CSA-W47.l, Certification of Companies for Fusion Welding of Steel.

.3 CAN/CSA-W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

.4 CAN/CSA-W59, Welded Steel Construction.

.5 CSA W59.2-[M1991(R2008)], Welded Aluminum Construction.

.6 CAN/CSA-W178.1, Certification of Welding Inspection Organizations.

.7 CAN/CSA-W178.2, Certification of Welding Inspectors.

.8 CAN/CSA-S16.1, Limit States Design of Steel Structures.

.2 American Society for Testing and Materials (ASTM):

.1 ASTM A27/27M, Specification for Steel Castings, Carbon, for General Applications

.2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.3 ASTM A108, Low Carbon Steel.

.4 ASTM A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.5 ASTM A153/Al53M, Standard Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware.

.6 ASTM A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.7 ASTM A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

.8 ASTM A276, Standard Specification for Stainless Steel Bars and Shapes.

.9 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

.10 ASTM A325M, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric).

.11 ASTM A351, Standard specification for Castings, Austenitic, Austenitic-Ferrite (Duplex), for Pressure-Containing Parts.

.12 ASTM A403M, Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings

.13 ASTM A536, Standard Specification for Ductile Iron Castings.

.14 ASTM A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar Type.

.15 ASTM A890 / A890M, Standard Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion-Resistant, Duplex (Austenitic/Ferritic) for General Application.

.16 ASTM B209M-[07], Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric].

.17 ASTM B210M-[05], Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes [Metric].

.18 ASTM B211M-[03], Standard Specification for Aluminum and Aluminum Alloy Bar, Rod and Wire [Metric].

.3 Other standards:

.1 CGSB l-GP-40M, Standard for: Primer, Structural Steel, Oil Alkyd Type.

.2 American Welding Society (AWS): AWS - A5.10/A5.10M[1999(R2007)], Specification for Bare Aluminum and Aluminum Alloy Welding Electrodes and Rods.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Submit shop drawings, in accordance with Section 01 33 00 (Submittal Procedures), to Departmental Representative a minimum of twenty-eight (28) days prior to commencing fabrication (this also applies to adaption and re-use of salvaged steelwork items).

.2 Indicate materials, core thicknesses, finishes, connections, joints, methods of anchorage, number of anchors, supports, reinforcement, details and accessories.

.3 Review of shop drawings by Departmental Representative will not relieve Contractor of responsibilities for the accuracy of the detail dimensions, general fit-up of parts to be assembled, adequacy of connection details, nor errors or defects contained in the shop drawings.

1.7 QUALITY CONTROL SUBMITTALS

.1 If requested, submit to Departmental Representative certified copies of mill reports, analyses, and tests covering chemical and physical properties of materials used in the work.

.2 Welding of the gangway and gangway support shall be inspected and certified by an independent testing agency. These costs to be paid for by the Contractor.

Part 2 Products

2.1 MATERIALS

.1 Steel sections and plates: to CAN/CSA-G40.2l, Grade 350W (or Grade 300W for plates / sections not commonly available in Grade 350W, subject to Departmental Representative’s review and approval).

.2 Aluminum and Aluminum-Alloy Extruded Bar, Rods, Wire, Shapes, and Tubes: to ASTM B221M.

.3 Aluminum sheet or plate: to ASTM B209M.

.4 Aluminum drawn tubes: to ASTM B210M.

.5 Aluminum bolts and rivets: to ASTM B316M.

.6 Aluminum welding wire: to AWS - A5.10/A5.10M.

.7 Steel pipe (except where indicated otherwise): to ASTM A53/A53M, galvanized finish.

.8 For pipe pile materials, refer to Section 31 62 16.20 (Steel Pipe Piles).

.9 Deck drains/covers: stainless steel type 316L to ASTM A351.

.10 Bends and tees: stainless steel type 316L to ASTM A403M.

.11 Flanges on bends and tees: stainless steel type 316L to ASTM A182.

.12 Flange adaptors: ductile iron to ASTM A536.

.13 Junction box: stainless steel type 316L to ASTM A167.

.14 Welding materials: to CSA W59.

.15 Bolts and anchor bolts: to ASTM A325 and A307, respectively, except where noted otherwise.

.16 Concrete anchors: Approved Products are as follows:

.1 Nelson studs (where specified as uncoated) to ASTM A108.

.2 Nelson studs (where specified as stainless steel) to ASTM A276, Type 316L.

.17 Galvanizing: hot dipped galvanizing with zinc coating 6l0 g/m2 to ASTM A123/A123M or ASTM A153/Al53M as appropriate.

.18 Shop coat primer: to CGSB l-GP-40M.

.19 Stainless steel to ASTM A167 Type 316L, remainder to ASTM A276 Type 316L.

.20 Manhole and catch basin frames, covers and gratings to Section 33 05 13 (Manholes and Catch Basins).

Part 3 Execution

3.1 FABRICATION

.1 Fabrication, connection design and detailing of all structural steelwork shall conform to CAN/CSA-S16.1 (Limit States Design of Steel Structures).

.2 Welding of structural steelwork shall conform to CAN/CSA-W59 (Welded Steel Construction) and shall be performed by certified welders. Fabrication shops shall be approved by the Canadian Welding Bureau to CAN/CSA-W47.1.

.3 Do structural aluminum work: to CAN/CSA-S157.

.4 Do aluminum welding: to CSA W59.2.

.5 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.6 Use welded connections for exterior metalwork unless indicated otherwise, or approved otherwise by Departmental Representative.

.7 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush. Seal exterior steel fabrications to provide corrosion protection in accordance with CAN/CSA-S16.l.

.8 Where possible, fit and shop assemble work, ready for erection.

.9 All Nelson Stud anchor welding to be made in accordance with recommendations of the Nelson Stud Welding Co., Lorain, Ohio.

3.2 CORROSION PROTECTION

.1 Unless otherwise noted in Section 09 97 19 (Painting Exterior Metal Surfaces), and except for stainless steel items, all steel fabrications covered by this Section shall be galvanized after fabrication.

.2 For steel fabrications specifically noted in Section 09 97 19 (Painting Exterior Metal Surfaces), surfaces shall be painted in accordance with that Section.

3.3 QUALITY ASSURANCE INSPECTION

.1 Departmental Representative, at his sole discretion, may inspect the steel prior to galvanizing for the degree of cleanliness to check for compliance with ASTM A123/A123M or ASTM A153/A153M as appropriate. In the event that Departmental Representative elects to inspect the steel prior to galvanizing, no galvanizing shall be allowed until Departmental Representative has accepted the surface preparation.

.2 Departmental Representative, at his sole discretion, may measure the dry film thickness (DFT) of the galvanizing on the steel fabrications to check for compliance with these specifications

3.4 ERECTION

.1 Erection of all structural steelwork shall conform to CAN/CSA-S16.1 (Limit States Design of Steel Structures).

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Departmental Representative such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Hand items over for casting into concrete to appropriate trades together with setting templates.

.5 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection as follows:

.1 Galvanized surfaces with zinc rich primer.

.2 Coated surfaces in accordance with Section 09 97 19 (Painting Exterior Metal Surfaces).

.6 Refer to Section 26 05 27 (Grounding) for grounding requirements for metalwork items.

END OF SECTION

1. PART 1 – GENERAL

1.1 Description

.1 This Section covers the installation of re-used crane rails, rail splices, rail clips and sole plates. This Section also covers the supply and installation of the rail anchorage system, and grouting for crane rails.

.2 Refer to the Drawings and to Section 02 41 13 (Selective Site Demolition) for temporary removal and storage of existing crane rails, splices and sole plates.

1.2 Related Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 02 41 13 (Selective Site Demolition)

.3 Section 03 30 00 (Cast-In-Place Concrete)

.4 Section 03 39 00 (In-Situ Concrete Structures)

.5 Section 04 05 12 (Grout)

.6 Section 26 05 27 (Grounding)

1.3 Measurement and Payment Procedures

.1 Work items related to crane rails will not be measured individually. All work items related to crane rails will be paid for at the Lump Sum price tendered for CRANE RAILS AND RAIL FIXATION. Payment shall be full compensation for all work in connection with the installation of re-used crane rails, rail splices, rail clips and sole plates, the supply and installation of sole plate anchor bolts, nuts and washers, rail survey, levelling, aligning and grouting.

1.4 References

.1 ASTM A759, Standard Specification for Carbon Steel Crane Rails.

.2 CAN/CSA G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.3 AREA Manual for Railway Departmental Representative.

.4 CAN/CSA-W47.l, Certification of Companies for Fusion Welding of Steel.

.5 CAN/CSA-W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

.6 CAN/CSA-W59, Welded Steel Construction.

.7 Federation Europeenne de la Manutention (F.E.M.), Section 1 Heavy Lifting Appliances, Rules for the Design of Hoisting Appliances, Booklet 8, Test Loads and Tolerances, Tolerances for Crane Tracks.

.8 CAN/CSA-A23.l, Concrete Materials and Methods of Concrete Construction (refer to ASTM C260 and C494 for admixtures).

.9 CAN/CSA-A23.2, Methods of Test for Concrete.

.10 CAN/CSA-A23.5, Supplementary Cementing Materials.

.11 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60000 psi Tensile Strength.

.12 ASTM A325M, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength.

.13 ASTM C260-01, Standard Specification for Air-Entraining Admixtures for Concrete.

.14 ASTM C494/C494M-05, Standard Specification for Chemical Admixtures for Concrete.

1.5 Definitions - Not Used

1.6 Submittals

.1 Submittals are to be in accordance with Section 01 33 00 (Submittal Procedures).

.2 At least twenty-eight (28) days prior to commencing work, submit to Departmental Representative for approval the name and evidence of experience (resume) of the rail installation supervisor who will direct the work of this Section

.3 At least twenty-eight (28) days prior to commencing work, submit to Departmental Representative for approval details of crane rail anchor bolts, grout materials, grout mix design, grouting procedures, and rail system installation procedures.

.4 At least twenty-eight (28) days prior to start of crane rail installation, submit to Departmental Representative for approval tests of the proposed mix for the rail-bed grout.

1.7 Quality Control

.1 The Contractor shall employ at least one supervisory person who is thoroughly trained and experienced in installation of crane rails and who shall direct the work of this Section.

2. PART 2 – PRODUCTS

2.1 General

.1 The crane rail fixation system shall be as shown on the Drawings, and shall match the existing rail system except as noted otherwise.

2.2 Sole Plates, Rail Clips, Crane Rails and Rail Splices

.1 Re-use existing sole plates, rail clips, crane rails and rail splices. Clean items to be re-used in the Work.

2.3 Rail Fixation

.1 Use existing rail clips.

.2 No resilient pad is required under the rail.

.3 Crane rail sole plate anchor bolts to ASTM A325, or ASTM A193 Grade B7 Type 2.

.4 Use half (jam) nuts with a plastic washer between the nuts and the sole plate, or jacking bolts, for levelling before grouting.

2.4 Grout

.1 For grout products and grouting equipment, refer to Section 04 05 12 (Grout), except as stipulated by this Section.

.2 Grout to be used under the crane rail sole plates shall be non-metallic and shrinkage compensating cementitious “flowable” grout, and shall be proportioned and mixed to give the properties in Table 1.

.3 Superplasticizing admixtures: CAN/CSA-A23.1, and refer to ASTM C260 and ASTM C494 for admixtures.

.4 Use of accelerating or set retarding admixtures to be subject to Departmental Representative’s review.

TABLE 1 – RAIL GROUT PROPERTIES

Rail Grout Property	Test Method	Limit
Plastic:		
Bleeding:	CAN/CSA-A23.2-1B	< 0.5 %
Expansion:	CAN/CSA-A23.2-1B	Range = 0.5 % to 3.0 %
Height Change:	ASTM C877	> 0.3 %
Workability:		
a) If no coarse aggregate is used;	CAN/CSA-A23.2-1B (flow)	± 5 sec. deviation from value in trial.
b) If 10 mm coarse aggregate is added.	CAN/CSA-A23.2-5C (slump)	± 20 mm deviation from value in trial.
Air Entrainment:	CAN/CSA-A23.2-4C	0.0 % to 3.0 % (after adding superplasticizer)
Hardened:		
Compressive Strength:	CAN/CSA-A23.2.1B	
a) 3 day		> 30 MPa
b) 28 day		> 50 MPa
Porosity, 28 days Boiled Absorption:	CAN/CSA-A23.2.1B for casting cube; and ASTM C642 for test procedure.	< 12 %
Expansion, at 56 days:	ASTM C1090, but using curing in ASTM C1107.	> 0.00 %
Aggregates:		
Fine Aggregate:	CSA/A23.1-09	Gradation limits do not apply.
Coarse Aggregate:	CSA/A23.1-09	The Contractor may add up to 50 % by volume of coarse aggregate (10 mm maximum size).

3. PART 3 – EXECUTION

3.1 Rail Survey

.1 Just prior to the work of this Section, the Contractor shall conduct a precise survey of the northern 50 m length of the existing crane rails (survey data points for alignment and elevation to be at 5 m intervals along each rail) to determine whether any minor adjustment to the specified nominal rail gauge, or to the specified nominal rail head elevation, is required when re-installing the crane rails.

3.2 Rail Installation

.1 The re-used rails shall be set to match existing rail gauge, unless approved otherwise by Departmental Representative in writing. See Clause 3.1 of this Section.

.2 Rails shall be installed to the following F.E.M. Standards:

.1 Horizontal divergence of the centerline of each crane rail from the specified axis shall not exceed ± 5 mm;

.2 Rate of divergence of the centerline at any point in the horizontal direction shall not exceed ± 1 mm in 2.0 m length of rail;

.3 Divergence of the top of the rail from the set elevation shall not exceed ± 2 mm;

.4 Rate of change in elevation of the top of the rail shall not exceed ± 2 mm in 2.0 m length of rail;

.5 Inclination of the rail base from the horizontal plane shall not exceed 0.3% laterally, nor 0.3% longitudinally, at any point along the rail; and,

.6 Deviation of track gauge from specified gauge shall not exceed ± 3 mm.

.3 Sole plates are to be set to the correct elevation using jacking bolts or levelling nuts with plastic washers. Take care that sole plates are evenly supported, to the correct alignment, during rail installation.

.4 Attach rail to sole plates using the rail clips, and install rail splices. Check alignment of rail, and re-align if necessary. The alignment and elevation of the rail head must be approved by Departmental Representative before grouting the sole plates.

.5 Attach grounding system to rails and crane stops as described in Section 26 05 27 (Grounding) and as shown on the Drawings.

.6 Grout under all sole plates as described in this Section and as shown on the Drawings.

3.3 Mixing and Placing Grout

.1 For grout execution, refer to Section 04 05 12 (Grout), except as stipulated by this Section.

.2 Place grout continuously from one side to ensure that all air is expelled as the grout front advances.

.3 The Contractor shall determine amount of “strapping” required to remove air voids/bubbles under the sole plates during grout placement.

.4 Grout is to be consolidated by vibration of the sole plate during initial placing.

.5 After a period of approximately one hour, depending on whether bleeding is still occurring, the grout is to be re-vibrated through the plate to remove bleed water and air voids.

.6 Grouting procedures shall be recorded by the Contractor, and shall be used for the all rail installation unless directed otherwise by Departmental Representative.

.7 Cure grout by moist cure with burlap for minimum twenty-four (24) hours.

.8 Protect grout from freezing until it has attained compressive strength 20 MPa.

.9 If grout will be subject to freezing within fourteen (14) days of placement, the grout shall contain entrained air in conformance with CAN/CSA-A23.1-09 clause 6.8.4.3.

3.4 Adjustment of Existing Crane Rails

.1 If, in the judgment of Departmental Representative, it is necessary to re-level or re-align the eastern end of the existing crane rails to optimize the performance of the complete rail system, Departmental Representative may order re-levelling and/or re-alignment work for which the Contractor will be paid as an extra work item in accordance with the provisions of the Contract.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply of all labour, materials and equipment required to clean and coat miscellaneous steel items specifically identified within this Section.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 39 00 (In-Situ Concrete Structures)

.3 Section 05 50 00 (Metal Fabrications)

.4 Section 35 59 29 (Mooring Devices)

1.3 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under the relevant Sections for which application of coatings to metal items and field touch up is required.

1.4 REFERENCES

.1 SSPC-PS COM, Commentary on Painting and Coatings Systems.

.2 SSPC-SP COM, Surface Preparation Commentary for Steel and Concrete Structures

.3 SSPC-PA 1, Shop, Field and Maintenance Painting of Steel.

.4 SSPC-SP 1, Solvent Cleaning.

.5 SSPC-SP 10, Near White Blast Cleaning.

.6 SSPC-VIS1, Pictorial Surface Preparation Standards for Painting Steel Surfaces.

.7 SSPC-AB 1, Mineral and Slag Abrasives

.8 SSPC-AB 2, Cleanliness of Recycled Ferrous Metallic Abrasives

.9 SSPC-AB 3, Ferrous Metallic Abrasives

.10 SSPC-Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Non-Porous Substrates

.11 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Coating product literature including case histories, references and colour availability shall be submitted in accordance with Section 01 33 00 (Submittal Procedures) for Departmental Representative's approval, no less than twenty-eight (28) days prior to application.

1.7 OPERATING ENVIRONMENT

.1 The work covered by this Section is located above, within and below the intertidal and splash zones.

.2 The design ambient temperature is from -5°C minimum to 23°C maximum.

Part 2 Products

2.1 MATERIALS

.1 Abrasive blasting materials shall conform to SSPC-SP COM, SSPC-SP 10 and SSPC-AB 1 or SSPC-AB 2 and 3.

.2 The abrasive size shall be selected to achieve a profile height that satisfies the requirements of the manufacturer for the specified protective coating system.

.3 Coatings shall be a high solids, surface tolerant, abrasion resistant, low temperature cure two-component epoxy paint system which may be applied to a high film thickness, designed for immersion in saltwater with a proven history of use in marine environments under saltwater immersion conditions.

.4 Solvents and other cleaners that are used to remove oil, grease and other soluble contaminants such as salts shall be as recommended by the coating manufacturer and shall conform to SSPC-SP 1.

Part 3 Execution

3.1 SURFACE PREPARATION

.1 Any areas that are contaminated with oil and grease shall be solvent cleaned prior to abrasive blast cleaning, as per SSPC-SP1.

.2 All steel surfaces, whether fabrication or casting, shall be abrasive blast cleaned to SSPC-SP10 and the appearance shall approximate the visual standard SP10 of SSPC VIS1.

.3 The surface profile shall be as specified by the coating manufacturer.

.4 All traces of abrasive materials shall be removed from the surface by blowing clean, dry compressed air onto the surface.

.5 The compressed air shall have water/oil traps on the line to prevent contamination of the steel by oil or water.

3.2 APPLICATION OF COATINGS

.1 All coating application shall be done in accordance with the coating manufacturers' recommendations and in conformance with SSPC-PA1.

.2 All steel must be clean and dry prior to coating application. Any cleaned steel not coated within eight hours shall be blast cleaned again.

.3 All coating material shall be delivered to the project site in the original factory-sealed containers bearing the coating manufacturer's labels identifying the product number, batch number, name, colour, instructions for use and WHMIS requirements. Material Safety Data Sheets shall accompany the material and remain on site at all times.

.4 The shelf life of all coating materials, as recommended by the coating manufacturer of each specific product, shall not be exceeded.

.5 All coating materials shall be stored in an area which shall protect the materials from weather and temperature extremes.

.6 . No coating applications work shall be performed under unfavourable weather conditions unless a suitable enclosure is provided which shields the steel from precipitation.

.7 No coatings shall be applied if the conditions for relative humidity, ambient temperature and steel temperature do not satisfy the coating manufacturer's requirements.

.8 All products shall be thoroughly mixed as per the coating manufacturer's recommended procedures.

.9 Thinning shall not be allowed except as recommended by the coating manufacturer.

.10 Monitor and record the wet film thickness of the coatings during application to ensure the proper thickness is attained, as recommended by the coating manufacturer for each specific product.

.11 Measure and record the dry film thickness (DFT) of the coatings on the painted items to ensure that the thickness conforms to these specifications.

.12 Ensure the coating system is dried hard prior to handling and transporting the painted items.

.13 When two repair coats are to be applied to the steel, re-wash the first repair coat with the biodegradable cleaner, thoroughly rinse it, dry the surface and then apply the second coat by brush.

.14 Containers of the coating material shall be kept sealed when not in use. A solvent float, as recommended by the coating manufacturer, shall be used to re-seal partially full containers.

3.3 QUALITY ASSURANCE INSPECTION

.1 Departmental Representative, at his sole discretion, may inspect the steel prior to paint application for the degree of cleanliness to check for compliance with SSPC-SP10. No coating work shall be allowed until Departmental Representative has approved the surface preparation.

.2 Departmental Representative, at his sole discretion, may measure the dry film thickness (DFT) of the coatings on the painted items to check for compliance with these specifications.

3.4 MISCELLANEOUS METAL ITEMS

.1 Unless noted otherwise, all miscellaneous metals not directly referenced within this Section are to be hot dip galvanized to CAN/CSA-G164.

.2 Mooring cleats shall be painted with one primer coat and a two coat application of the topcoat as described within clauses 3.4.4 and 3.4.5 of this Section.

.3 Apply 75 to 100 microns (3 to 4 mils) DFT of primer by spray application to metal surfaces. Allow adequate cure time, as specified by the coating manufacturer, for differing conditions of temperature and relative humidity.

.4 Then apply two coats of topcoat, 125 to 175 microns (5 to 7 mils) DFT per coat, by spray application to metal surfaces. Allow adequate cure time, as specified by the coating manufacturer, for differing conditions of temperature and relative humidity, between coats and after the final coat.

.5 Where fabrications are cast within concrete, the faces cast within the concrete are not to be coated with topcoat, but are to be coated with primer.

.6 Crane rails, sole plates, rail clips, clip bolts, and sole plate anchor bolts are not to be coated.

.7 Mask all threaded components.

.8 Ensure all painted steel fabrications are handled by padded slings once they are coated.

.9 The painted steel fabrications shall be stored and shipped on wooden dunnage padded with carpet at contact points.

3.5 QUALITY ASSURANCE INSPECTION

.1 Departmental Representative, at his sole discretion, may inspect the steel prior to paint application for the degree of cleanliness to check for compliance with SSPC-SP10. No coating work shall be allowed until Departmental Representative has approved the surface preparation.

.2 Departmental Representative, at his sole discretion, may measure the dry film thickness (DFT) of the coatings on the painted items to check for compliance with these specifications.

3.6 FIELD REPAIRS

.1 Weld The coating system on painted items shall be repaired for any damage caused by Contractor's forces prior to Substantial Completion.

.2 Repairs to coating damage shall be performed by washing the steel and surrounding intact coating with the biodegradable cleaner, followed by thorough rinsing. Moisture shall be removed by wiping with a clean cloth. The steel shall then be tool cleaned to remove rust and loose coating. Edges of intact coating shall be feathered and new coating applied as specified herein.

END OF SECTION

1 GENERAL

1.1 References

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  .1 Material Safety Data Sheets (MSDS).

.2 CSA Standard B51, Boiler, Pressure Vessels and Pressure Piping Code

.3 CAN/CSA-Z234.1, Canadian Metric Practice Guide.

.4 Model National Energy Code of Canada for Buildings

.5 ANSI/ASHRAE/IESNA 90.1, Energy Standards for Buildings,

1.2 Related Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 78 00 (Closeout Submittals)

.3 Section 01 91 13 (Commissioning Requirements)

.4 Section 20 05 10 (Basic Mechanical Materials and Methods)

.5 Section 20 05 15 (Seismic Control and Restraint)

.6 Section 20 05 40 (Demolition and Revision Work)

.7 Section 20 05 55 (Testing, Adjusting and Balancing)

.8 Section 21 11 16 (Fire Hydrants)

.9 Section 22 11 16 (Domestic Water Piping and Valves)

.10 Section 22 13 16 (Drainage Waste and Vent Piping and Valves)

.11 Section 22 13 29 (Drainage Pumps and Accessories)

.12 Section 22 15 00 (General Service Compressed Air System)

.13 Section 22 20 00 (Site Services)

.14 Section 22 42 00 (Plumbing Fixtures and Fittings)

1.3 Note Re: Bold Lettering

.1 "**Bold**" type lettering is used throughout this Specification in an attempt to enhance the readability of the text. The use of "**bold**" lettering does not indicate a greater level of importance.

1.4 Submittals

.1 Submittals to be in accordance with Section 01 33 00 (Submittal Procedures)

.2 Submit the following to the Departmental Representative:
  .1 **Notice for field reviews:** written notice for attendance at the site for field reviews

.2 **Project close-out documentation:** O & M Manuals, record as-built drawings, and all associated data

.3 **Progress payment breakdown:** a detailed breakdown of the mechanical work cost

.4 **Contractor's P. Eng. Documentation:** the name, qualifications, and evidence of current liability insurance for all professional engineers to be retained by the Contractor to perform work associated with the Contract

.5 **Extended Warranties:** copies of all extended warranties specified.

.6 **List of Acceptable Manufacturers:** a completed List of Acceptable Manufacturers to clearly indicate the names of the manufacturers of products on which the bid price is based

.7 **O & M Training Schedules & Modules:** a proposed schedule of demonstration and training dates and times, and a preliminary copy of the training manual developed for operational and maintenance training

1.5 Definitions

.1 The following are definitions of words found in mechanical work Sections of the Specification and on associated drawings:

.1 "Concealed" – means work hidden from normal sight in furred spaces, shafts, tunnels, ceiling spaces, walls and partitions

.2 "Exposed" – means work normally visible, including work in equipment rooms and similar spaces

.3 "Provide" (and tenses of provide) – means supply and install complete

.4 "Install" (and tenses of install) – means install and connect complete

.5 "Supply" – means supply only

.6 "Finished area" - means any area or part of an area which receives a finish such as paint, or is factory finished

.7 "Governing authority" and/or "regulatory authority" and/or "Municipal authority" – means all government departments, agencies, standards, rules and regulations that apply to and govern the mechanical work and to which the work must adhere

.2 Wherever the words "indicated", "shown", "noted", "listed", or similar words or phrases are used in the specification they are understood, unless otherwise defined, to mean that the product referred to is "indicated", "shown", "listed", or "noted" on the drawings.

.3 Wherever the words "approved", "satisfactory", "as directed", "submit", "permitted", "inspected" or similar words or phrases are used in the specification or on the drawings they are understood, unless otherwise defined, to mean that work or product referred to is "approved by", "inspected by", etc., the Consultant.

.4 In the mechanical specification, singular may be read as plural, and vice-versa.

1.6 Quality Assurance

.1 All mechanical work is to be done by journeyman tradesmen who perform only the work that their certificates permit, or by apprentice tradesmen under direct on-site

supervision of an experienced journeyman tradesman. The use of apprentice tradesmen is to be limited and the journeyman/apprentice ratio is subject to the Departmental Representative's approval.

.2 All journeyman tradesmen are to have valid trade certificates available at the site for review by the Departmental Representative at any time.

.3 An experienced and qualified superintendent is to be on-site at all times when mechanical work is being performed.

1.7 Codes, Regulations, and Standards

.1 All Codes, Regulations, and Standards referred to in this Section and in Sections to which this Section applies are the latest edition of the Codes, Regulations, and Standards in effect at the time of bidding on this Project.

.2 All work is to be in accordance with requirements with Codes, Regulations, and Standards applied by governing authorities.

.3 All mechanical piping system work, including equipment, must comply in all respects with requirements of local technical standards authorities and CSA Standard B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, mechanical work products must bear a CRN number.

.4 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted. Pay all associated costs associated with these submittals.

.5 All electrical items associated with mechanical equipment are to be certified and bear the stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.

.6 Requirements of the Contract Documents are to take precedence when they are more stringent than codes, ordinances, standards, and statutes.

1.8 Imperial and Metric Measurements

.1 Conform to requirements of CAN/CSA-Z234.1, Canadian Metric Practice Guide.

.2 Both Metric and Imperial units of measurement are indicated in the mechanical Specification. Metric measurements are "soft" and have been rounded off.

1.9 Examination of Site and Documents

.1 When estimating the cost of the work and prior to submitting a bid for the work carefully examine all of the bid documents and visit the site to determine and review all existing site conditions that will or may affect the work, and include for all such conditions in the bid price.

.2 Report to the Departmental Representative, prior to bid submittal, any existing site condition that will or may affect performance of the work as per the drawings and specifications. Failure to do so will not be grounds for additional costs.

1.10 Drawings and Specification

.1 Read the mechanical work drawings in conjunction with all other Contract Documents.

.2 The mechanical drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of the building are to be taken at the site. Do not scale the drawings, and do not use the drawings for prefabrication work.

.3 The drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at contractor cost, all offsets, fittings, transformations, and similar products required as a result of obstructions and other architectural and structural details but not shown on the drawings.

.4 The locations of equipment and materials shown may be altered, when reviewed by the Departmental Representative, to meet requirements of the equipment and/or materials, other equipment or systems being installed, and of the building, all at no additional cost.

.5 Sections of the mechanical specification are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and the Sections are to be read as a whole.

.6 The mechanical specification does not generally indicate the specific number of items or extent of material required. The specification is intended to provide product data and installation requirements. It is necessary to refer to drawing schedules, layouts, schematic diagrams, riser diagrams, and details to determine correct quantities.

.7 The mechanical drawings and specification are intended to be cooperative. Perform all work that is shown, specified, or reasonably implied on the drawings but not mentioned in the specification, or vice-versa, as though fully covered by both.

1.11 Planning and Layout of The Work, and Associated Drawings

.1 Properly plan, coordinate, and establish the locations and routing of services with all subcontractors affected prior to installation such that the services will clear each other as well as any obstructions, including structural components of the building. Unless otherwise specified, the order of right-of-way for services is to be as follows:

- .1 Piping requiring uniform pitch
- .2 Piping 100 mm (4") diameter and larger
- .3 Large ducts (main runs)
- .4 Electrical cable tray and bus duct
- .5 Conduit 100 mm (4") diameter and larger
- .6 Piping less than 100 mm (4") diameter
- .7 Smaller branch ductwork
- .8 Conduit less than 100 mm (4") diameter

.2 Install piping, ductwork, and similar services as high as possible to conserve headroom and/or ceiling space. Notify the Departmental Representative where headroom or ceiling space appears to be inadequate prior to installation of the work.

.3 Revise or alter the arrangement of work that has been installed without proper coordination, study and review, even if it was completed in accordance with the Contract Documents, to allow the installation of other work, at no additional cost. In addition, pay for the cost of alterations in other work required by the alterations to the work.

.4 All shut-off valves, balancing devices, equipment and similar products, must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.

.5 **Layout Drawings:** Do not use the Contract Drawing measurements for prefabrication and layout of piping work. Locations and routing are to generally be in accordance with the Contract Drawings, however, layout drawings are to be prepared for all such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for the work of other trades, accurately layout the work, and be entirely responsible for all work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with the Contract Drawings, notify the Departmental Representative prior to proceeding with the work.

.6 **Interference Drawings:** Prepare dimensioned working interference drawings, supplementary to the Contract Drawings for all areas where multiple services and/or equipment occur, or where the work due to architectural and structural considerations requires special study and treatment. Review interference drawings with the Departmental Representative before the work is installed. Where work has been installed in such areas without preparation of interference drawings and conflicts occur, revise work to suit at no additional cost.

1.12 Coordination of the Work

.1 Review all the Contract Documents and coordinate the work with the work of all subcontractors. Coordination requirements are to include, but not be limited to, the following:

- .1 Preparation of electronic coordination drawings as required, submitted as for shop drawings, with drawing scale as required to indicate the necessary details
- .2 Written notification of all concrete work such as housekeeping pads, sumps, bases, etc., required for mechanical work, and including required dimensions, operating weight of equipment, location, etc.
- .3 Depth and routing of excavation required for mechanical work, and requirements for bedding and backfill
- .4 Schematic wiring for all wiring work required for mechanical equipment and systems but not specified to be done as part of the mechanical work, including termination points, wiring type and size, and any other requirements

1.13 General Re: Installation of Equipment

.1 Unless otherwise specified all equipment is to be installed in accordance with the equipment manufacturer's recommendations and instructions, Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.

.2 Ensure that proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Remove and replace any equipment which does not meet this requirement.

1.14 Energy Efficiency Standards

.1 All applicable mechanical equipment has been selected to meet energy efficiency requirements of the Model National Energy Code of Canada for Buildings or ANSI/ASHRAE/IESNA 90.1, Energy Standards for Buildings, and shop drawings/product data submittals for such equipment must indicate compliance with this Standard or they will be returned for correction and re-submittal.

1.15 Permits, Fees, and Certificates

.1 Apply for, obtain and pay for all permits required to complete the mechanical work.

.2 Submit to the Departmental Representative, all approval/inspection certificates issued by governing authorities to confirm that the work as installed is in accordance with the rules and regulations of the governing authorities. Pay any costs associated with issue of the certificates.

.3 Include a copy of all approval/inspection certificates in each operating and maintenance manual.

1.16 Workplace Safety

.1 Work in accordance with Section 01 35 33 (Health and Safety Requirements).

.2 Comply with requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding the use, handling, storage and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for all products where required, and maintain one copy at the site in a visible and accessible location available to all personnel.

.3 Comply with all requirements of Occupational Health and Safety Regulations and all other regulations pertaining to health and safety, including worker's compensation/ insurance board and fall protection regulations.

.4 **Asbestos, Mould, Lead Paint, Etc.:** If at any time during the course of the work asbestos containing materials, black mould, lead paint, or any other hazardous materials are encountered or suspected, immediately report the discovery to the Departmental Representative and cease all work in the area in question. Do not resume work in affected areas without written approval.

1.17 Shop Drawings and Product Data Sheets

.1 Submit shop drawings and product sheets in accordance with Section 01 33 00 (Submittal Procedures).

.2 Prior to supplying any products to the site, submit for review, shop drawings and/or product data sheets indicating in detail the design, construction, and performance of products as requested in Sections of this Specification.

.3 Shop drawings are those prepared specifically for the Project. Product data sheets are copies of manufacturer's standard catalogue, etc., literature.

.4 Shop drawings and product data sheets must confirm that the product proposed meets all requirements of the Contract Documents.

.5 Each shop drawing or product data sheet is to be properly identified with the project name and the product drawing or specification reference, i.e. "Exhaust Fan EF-1", and all shop drawing or product data sheet dimensions are to be either SI or Imperial to match dimensions on the drawings.

.6 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure that this requirement is clearly indicated on the submission.

.7 Carefully review each shop drawing and product data sheet prior to submittal to ensure that the proposed product is correct and meets with all requirements of the Project. Endorse each copy of each shop drawing or product data sheet "Correct for Review By Departmental Representative", or "Certified to Be In Accordance with All Requirements" and include the company name, the submittal date, and the signature of an officer of the company to indicate your review and approval as above.

1.18 Scaffolding, Rigging, and Hoisting

.1 Do not place major erection loads on any portion of the structure without approval from the Departmental Representative.

1.19 Trial Usage

.1 When directed by the Departmental Representative, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with the Specification and governing Codes and Regulations, prior to Substantial Performance of the work.

.2 When, in the opinion of the Departmental Representative, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.

.3 All tests are not to be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the equipment or system due to the test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.

.4 When, in the Departmental Representative's opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from the site and replace them with acceptable equipment and/or products, at no additional cost.

1.20 Project Closeout Submittals

.1 Prior to application for Substantial Performance, submit all required items and documentation specified, including the following:
- .1 Operating and Maintenance Manuals
- .2 As-built record drawings and associated data
- .3 Extended warranties for equipment as specified
- .4 All operating test certificates,
- .5 Final commissioning report and TAB report
- .6 Identified keys for mechanical equipment and/or panels for which keys are required, and all other items required to be submitted
- .7 Other data or products specified

.2 **Operating and Maintenance Manuals:**

.3 Submit Manuals in accordance with Section 01 78 00 (Closeout Submittals).

.4 Operating and Maintenance Manuals are to include the following:
- .1 An Introduction sheet listing the Contractor's and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses
- .2 A Table of Contents sheet, and corresponding index tab sheets
- .3 A copy of each "Reviewed" or "Reviewed As Noted" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, and the email address for local source of parts and service
- .4 Pressure test reports, and certificates issued by governing authorities
- .5 **Operating Data:** Operating data is to include:
  - .1 A description of each system and its controls
  - .2 Control schematics for equipment/systems including building environmental controls
  - .3 If applicable, the building automation system (BAS) architecture and all required operating data
  - .4 Description of operation of each system at various loads together with reset schedules and seasonal variances
  - .5 Operation instruction for each system and each component
  - .6 Description of actions to be taken in event of emergencies and/or equipment failure
  - .7 Valve tag schedule, and flow diagrams to indicate valve locations
- .6 **Maintenance Data:** Maintenance data is to include:
  - .1 Servicing maintenance, operation and trouble-shooting instructions for each item of equipment and each system
  - .2 Schedules of tasks, frequency, tools required, and estimated task time
  - .3 Complete parts lists with numbers
- .7 **Performance Data:** Performance data is to include:

.1 Equipment and system start-up data sheets
.2 Equipment performance verification test results, and final commissioning report
.3 Final testing adjusting and balancing reports

.8 **Review Submittal:** Assemble one copy of the O & M Manual and submit to the Departmental Representative for review prior to training and instructions, and assembling the remaining copies. Incorporate all comments into the final submission.

.9 **Digital O & M Manuals:** Submit digital versions of the hard copy manual using the latest version of Adobe Acrobat Portable Document format and enhanced with bookmarks, internet links, and internal document links.

.5 **Record "As-Built" Drawings and Data:** As work progresses at the site, clearly mark in red in a neat and legible manner on a set of white prints of the Contract Drawings, all significant changes and deviations from the routing of services and locations of equipment shown on the Contract Drawings and resulting from the issue of Addenda, Site Instructions, Change Orders, and job conditions. Use notes marked in red as required. Maintain the white print red line as-built set at the site for the exclusive use of recording as-built conditions, keep the set up-to-date at all times, and ensure that the set is always available for periodic review. The as-built set is also to include the following:

.1 The dimensioned location of all inaccessible concealed work
.2 The locations of control devices with identification for each
.3 The location of all piping system air vents and water hammer arrestors
.4 The location and tag identification for all tagged valves
.5 For underground piping, including service entrance/exit piping, record dimensions, invert elevations, all offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks that will be preserved after construction is complete
.6 The location of all concealed services terminated for future extension

1.21 Progress Payment Breakdown

.1 Submit, prior to submittal of the first progress payment draw, a breakdown of the cost of the mechanical work to assist the Departmental Representative in reviewing and approving monthly progress payment claims.

.2 The payment breakdown is subject to the Departmental Representative’s approval and progress payments will not be processed until an approved breakdown is in place.

.3 Equipment, material and labour costs are to be indicated for site services, plumbing and drainage, fire protection, piping, controls, and insulation work, etc., in the same manner as they will be indicated on the monthly progress draw.

1.22 Requirements for Contractor Retained Engineers

.1 All professional engineers retained by the Contractor to perform the work of this Section, i.e. seismic engineer, structural engineer, are to be registered members in good standing with the Engineers and Geoscientists of British Columbia.

1.23 Equipment and Material Manufacturer Requirements

.1 Equipment and materials scheduled or specified on the drawings or in the Specification have been selected to establish a performance and quality standard.

.2 In most cases acceptable equipment and material manufacturers are listed for any product specified by manufacturer's name and model number. Unless otherwise stated the bid price may be based on products supplied by any of the manufacturers named as acceptable for the particular product. If acceptable manufacturers are not listed for a particular product, base the bid price on the products supplied by the specified manufacturers.

.3 If products supplied by a manufacturer named as acceptable are used in lieu of the products specified by manufacturer's name and model number, ensure that the product is equivalent in performance and operating characteristics (including energy efficiency if applicable) to the specified product. Pay for any additional costs and changes to associated or adjacent work resulting from the use of products supplied by a manufacturer other than the specified manufacturer. In addition, in equipment spaces where products named as acceptable are used in lieu of the specified products and the dimensions of such products differ from the specified products prepare and submit for review, if requested, accurately dimensioned layouts of the rooms affected to prove that all the equipment in the room will fit properly.

1.24 List of Acceptable Manufacturers and Suppliers

.1 Within 14 days after award of a Contract, submit to the Departmental Representative for review, a list to indicate the name of the manufacturers/suppliers you propose to use for each item of equipment, material, or service listed, except for items such as pipe and fittings, insulation, and similar products. Manufacturers and/or suppliers on the list must be named in the Specification or on the drawings.

1.25 Substituted or Alternative Products

.1 Products supplied by a manufacturer/supplier other than a manufacturer specified as acceptable may be considered for acceptance by the Departmental Representative if requested in writing a minimum of five full working days prior to the bid closing date.

.2 Each request for acceptance of a proposed substitution or alternative product must be accompanied by detailed catalogue and engineering data, fabrication information, and performance characteristics to permit the Departmental Representative to make an informed decision.

.3 Pay for any additional costs and changes to associated or adjacent work resulting from the use of products supplied by a substituted or alternative manufacturer. In addition, in equipment spaces where substituted or alternative products are used in lieu of the specified or acceptable products and the dimensions of such products differ from the specified or acceptable products, prepare and submit for review, if requested, accurately dimensioned layouts of the rooms affected to prove that all the equipment in the room will fit properly.

.4 The Departmental Representative's decision regarding any proposed substitution or alternative product is final.

1.26 Phasing of The Work

.1 Phasing of the work is required to maintain the existing site in operation, all as specified in Division 01. Include all costs for phasing the work including all required extended hours premium time labour costs.

1.27 Equipment and System Start-Up

.1 When installation of equipment/systems is complete, but prior to commissioning, perform start-up for equipment/systems as specified in mechanical work Sections in accordance with the following requirements:

.1 Submit a copy of each equipment/system manufacturer's blank start-up report sheet to the Departmental Representative for review, and incorporate any comments

.2 Under direct on-site supervision and involvement of the equipment/system manufacturer's representative, start-up the equipment/systems, make any required adjustments, document the procedures, leave the equipment/systems in proper operating condition, and submit a complete set of start-up documentation sheets signed by the manufacturer/supplier and the Contractor

1.28 Equipment and System Commissioning

.1 Commission mechanical equipment and systems in accordance with the Section 01 91 13 (Commissioning Requirements).

1.29 Equipment and System O & M Demonstration & Training

.1 Refer to equipment and system operational and maintenance training requirements specified in Section 01 91 13 (Commissioning Requirements).

.2 Train the Departmental Representative's designated personnel in all aspects of operation and maintenance of equipment and systems as specified in mechanical work Sections of the Specification. All demonstrations and training is to be performed by qualified technicians employed by the equipment/system manufacturer/supplier.

.3 For each item of equipment and for each system for which training is specified, Operating and Maintenance Manuals are to be used during the training sessions, and training sessions are to include:

.1 **Operational Requirements and Criteria:** Requirements and criteria are to include but not be limited to equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations.

.2 **Troubleshooting:** Troubleshooting is to include but not be limited to diagnostic instructions, test and inspection procedures.

.3 **Documentation:** Documentation is to include but not be limited to equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like.

.4 **Maintenance:** Maintenance requirements are to include but not be limited to inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools.

.5 **Repairs:** Repair requirements are to include but not be limited to diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.

.4 Schedule demonstrations and training at mutually agreed to times with a minimum of 7 working days notice.

.5 **Demonstration and Training Confirmation:** Obtain a list of personnel to receive demonstration and training from the Departmental Representative, and have each participant sign the list to confirm that he/she understood the demonstration and training session.

END OF SECTION

1 GENERAL

1.1 References

.1 Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture

.2 ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod

.3 EEMAC Standard MG1

.4 CAN/CSA C747

.5 CAN/CSA C390

.6 ASTM A-193

.7 ASTM A-194, CL-2H.

.8 ASTM B828, Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings

1.2 Related Sections

This Section specifies products, common criteria and characteristics, and methods and execution that are common to one or more mechanical work Sections of the Specification, and it is intended as a supplement to each Section and is to be read accordingly.

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 20 05 05 (Mechanical Work General Instructions)

.3 Section 20 05 15 (Seismic Control and Restraint)

.4 Section 20 05 40 (Demolition and Revision Work)

.5 Section 20 05 55 (Testing, Adjusting and Balancing)

.6 Section 21 11 16 (Fire Hydrants)

.7 Section 22 11 16 (Domestic Water Piping and Valves)

.8 Section 22 13 16 (Drainage Waste and Vent Piping and Valves)

.9 Section 22 13 29 (Drainage Pumps and Accessories)

.10 Section 22 15 00 (General Service Compressed Air System)

.11 Section 22 20 00 (Site Services)

.12 Section 22 42 00 (Plumbing Fixtures and Fittings)

1.3 Submittals

.1 Submit the following for review:
  .1 **Product data sheets:** submit for:
    .1 Pressure gauges
    .2 Strainers
    .3 Drain valves
    .4 Electric motors (submit with equipment they are associated with)

.2 **Additional submittals:** submit any other submittals specified in this Section or other mechanical work Sections of the Specification.

2 PRODUCTS

2.1 Pipe Sleeves

.1 **Waterproof Sleeves:** Schedule 40 stainless steel pipe with a welded-on square stainless steel anchor and water stop plate at the sleeve midpoint, or a premanufactured watertight pipe penetration sleeve.

2.2 Waterproofing Seal Materials

.1 Modular, mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so that when the bolts are tightened the links expand to seal the opening watertight. The seal assemblies are to be selected to suit the pipe size and the sleeve size or wall opening size.

2.3 Piping Hangers and Supports

.1 **General:** Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with the Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to the following requirements:
  .1 Unless otherwise specified, all ferrous hanger and support products are to be completely made of **stainless steel**
  .2 Hangers and supports for insulated piping are to be sized to fit around the insulation and the insulation jacket

.2 **Horizontal Suspended Piping:** Hangers and supports are to be:
  .1 Adjustable stainless steel clevis hanger – Anvil Fig. 260SS

.3 **Horizontal Pipe On Vertical Surfaces:** See details on mechanical drawings

.4 **Vertical Piping on Vertical Surfaces:** See details on mechanical drawings.

.5 **Special Hangers and Supports:** Special hangers and supports for various applications are as follows:

.1 **For bare horizontal copper piping** – generally as above but factory vinyl coated to prevent direct copper/steel contact

.2 **For bare copper vertical piping** – corrosion resistant ferrous clamps with flexible rubber gasket type material (not tape) to isolate the pipe from the clamp

.6 **Hanger Rods:** Stainless steel round, threaded, complete with stainless steel machine nuts and washers at hangers, sized to suit the loading in accordance with Table 3 in MSS SP-58, but, in any case, minimum 9.5 mm (3/8") diameter and in accordance with ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000PSI Tensile Strength, and ASME B18.31.3, Threaded Rods (Inch Series).

.7 **Acceptable Manufacturers:** Acceptable hanger and support material manufacturers are:

.1 E. Myatt & Co. Inc.
.2 Anvil International Inc.
.3 Empire tool & Mfg. Co. Inc.
.4 Hunt Manufacturing Ltd.
.5 Unistrut Canada Ltd.
.6 Nibco Inc. "Tolco"
.7 Taylor Pipe Supports

2.4 Electric Motors

.1 Unless otherwise specified, motors are to conform to EEMAC Standard MG1, applicable IEEE Standards, and applicable CSA C22.2 Standards, and are to meet NEMA standards for maximum sound level ratings under full load. Confirm motor voltages prior to ordering.

.2 **AC Motor Efficiency:** The efficiency of single phase AC motors to 1 HP is to be in accordance with CAN/CSA C747. The efficiency of all three phase motors 1 HP and larger is to be in accordance with CAN/CSA C390 or IEEE 112B.

.3 **Explosion-Proof Three Phase AC Motors:** totally enclosed fan cooled motors in accordance with CSA C22.2 No. 145, generally as specified above for standard 3 phase motors but suitable for use in Class 1 Group D hazardous locations and with a 1.0 service factor at 40° C (105° F) ambient temperature.

2.5 Motor Starters and Accessories

.1 Loose motor starters and accessories, disconnect switches, and motor control centres for mechanical equipment will be provided as part of the electrical work.

2.6 Mechanical Work Identification Materials

.1 **Equipment Nameplates:** Minimum 1.6 mm (1/16") thick 2-ply laminated coloured plastic plates, minimum 12 mm x 50 mm (½" x 2") for smaller items such as damper motors and control valves, minimum 25 mm x 65 mm (1" x 2½") for equipment,

and minimum 50 mm x 100 mm (2" x 4") for control panels and similar items. Additional requirements are as follows:

.1 Unless otherwise specified or required, each nameplate is to be white, complete with bevelled edges and black engraved capital letter wording to completely identify the equipment and its use with no abbreviations;

.2 Wording is generally to be as per the drawings, i.e. Fan ef-1, and is to include equipment service and building area/zone served, but must be reviewed prior to engraving;

.3 Supply stainless steel screws for securing nameplates in place;

.4 Nameplates for equipment suspended above floor level or generally not within easy viewing from floor level are to be increased in size so as to be easily readable from floor level.

.2 **Standard Pipe Identification:** Standard pipe identification is to be equal to Smillie McAdams Summerlin Ltd. or Brady vinyl plastic with indoor/outdoor type vinyl ink lettering and directional arrows, as follows:

.1 For pipe to and including 150 mm (6") diameter, coiled type snap-on markers of a length to wrap completely around the pipe or pipe insulation;

.2 For pipe larger than 150 mm (6") diameter, saddle type strap-on markers with 2 opposite identification locations and complete with nylon cable ties.

.3 **Standard Pipe Identification Wording and Colours:** Identification wording and colours for pipe identification materials are to be as follows:

PIPE SERVICE	IDENTIFICATION COLOUR	LEGEND
Domestic cold water	Green	DOM. COLD WATER
Storm drainage	Green	STORM
Sanitary drainage	Green	SAN.
Plumbing vent	Green	SAN. VENT
Compressed air	Yellow	….kPa COMP. AIR
Control air	Green	CONTROL AIR

.4 **Colours for Legends & Arrows:** Colours for pipe identification legends and directional arrows are to be as follows:

IDENTIFICATION COLOUR	LEGEND & ARROW COLOUR
Yellow	Black
Green	White
Red	White

3 EXECUTION

3.1 General Piping Installation Requirements

.1 Unless otherwise specified, locate and arrange horizontal pipes so that under consideration of all other work in the area, the maximum ceiling height and/or usable space is maintained. If required to maintain ceiling heights, reroute with Departmental Representative's approval.

.2 Install all pipes parallel to building lines and to each other.

.3 Neatly group and arrange all exposed work.

.4 **Service and Maintenance Access:** Locate all work to permit easy access for service or maintenance as required and/or applicable. Locate all valves, and any other equipment which will or may need maintenance or repairs and which are installed in accessible construction so as to be easily accessible from access doors. Where valves, dampers and similar piping or accessories occur in vertical services in shafts, pipe spaces or partitions, locate the accessories at the floor level.

.5 **Dissimilar Metal Pipe Connections:** Make all connections between pipes of different materials using proper approved adapters. Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe.

.6 **Cleaning:** Carefully clean all pipe and fittings prior to installation. Temporarily cap or plug ends of pipe, ducts and equipment which are open and exposed during construction.

.7 **Surfaces to Receive Work:** Inspect surfaces and structure prepared by other trades before performing work. Verify that surfaces or the structure to receive work have no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing. Installation of work will constitute acceptance of such surfaces as being satisfactory.

.8 **Piping Rust and Dirt:** Any ferrous piping that exhibits in excess of 5% surface rust, either inside or outside or both is to be wire brush cleaned to bare metal and coated with suitable primer. Steel pipe, fittings and accessories are to be free of corrosion and dirt when work is complete or prior to being concealed from view. Where dirt is evident, clean the piping prior to being concealed.

.9 **Repair of Finished Surfaces:** for factory applied finishes, repaint or refinish all surfaces damaged during shipment and installation. The quality of the repair work is to match the original finish. This requirement also applies to galvanized finishes.

.10 **Elbows and Eccentric Reducers:** Unless otherwise specified and except where space limitations do not permit, all piping elbows are to be long radius. Eccentric reducers are to be installed with the straight side at the top of the piping.

3.2 Pipe Joint Requirements

.1 Do not make pipe joints in walls or slabs.

.2 Ream all piping ends prior to making joints.

.3 **Flanged Joints:** Unless otherwise specified, make all flanged joints with EDPM gasket materials to suit the application, and bolts and nuts. Bolts are not to be longer than the length necessary to screw the nut up flush to the end of the bolt. Bolts used for flanged connections in all piping with a working pressure of 690 kPa (100 psi) and greater are to be ASTM A-193, Grade B-7, with heavy hexagon nuts to ASTM A-194, CL-2H. Provide suitable washers between each bolt head and the flange and between each nut and the flange.

.4 **Examination of Flanged Joints:** A random check of bolted flanged connections will be made to verify that flanged connections are properly mated with no shear force acting on bolts. Supply all labour to disconnect and reconnect the selected flanged joints. If improperly mated joints are found, remove and reinstall the affected piping so that the flanges mate properly. If improperly mated joints are found, additional joints will be checked, and the Contractor will be responsible for the repair of any other improper joints discovered.

.5 **Soldered Joints:** Unless otherwise specified make all soldered joints in copper piping using flux suitable for and compatible with the type of solder being used. Clean the outside of the pipe end and the inside of the fitting, valve, or similar accessory prior to soldering. Comply with requirements of ASTM B828, Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

.6 **Mechanical Joints:** Install mechanical joint fittings and couplings in accordance with the manufacturer's instructions.

.7 **Grooved Pipe & Coupling Joints:** Make arrangements with the coupling and fitting manufacturer for shop and/or site instructions and demonstrations as required, and adhere to the manufacturer's instructions with respect to pipe grooving, support, type of gasket required, anchoring and guiding the grooved piping system.

3.3 Installation of Pipe Sleeves

.1 Where pipes pass through new concrete and/or masonry surfaces provide pipe sleeves as follows:

.1 **In poured concrete slabs:** unless otherwise specified - minimum #16 gauge flanged stainless steel

.2 **In concrete or masonry walls:** Schedule 40 stainless steel steel pipe

3.4 Sleeve and formed Opening Location Drawings

.1 Prepare and submit for review, white print drawings indicating the size and location of all required sleeves, recesses and formed openings in new poured or precast concrete work.

.2 Such drawings are to be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum, and are to

take into account structural items such as grade beams, column caps, and column drop slabs.

.3 Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Contract.

3.5 Installation of Fastening and Securing Hardware

.1 Provide all fastening and securing hardware required for mechanical work 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 structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.

.3 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. Provide reinforcing or connecting supports where required to distribute the loading to the structural components. Submit support details for review prior to installation.

.4 Obtain written consent before using explosive actuated fastening devices. If consent is obtained, comply with requirements of CSA Standards CAN3-Z166.1 and CAN3-Z166.2.

3.6 Installation of Pipe Hangers and Supports

.1 Provide all required pipe hangers and supports.

.2 Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting pipe. Unless otherwise shown or specified, hang or support pipes from the structure only.

.3 **Underground (in earth/backfill) Piping:** Support requirements for underground piping in earth/backfill) are as follows:

- .1 Support in accordance with the drawing detail
- .2 Support, unless otherwise specified, on a well compacted bed of dry, natural, undisturbed earth free from rocks or protrusions of any kind, or on compacted material as specified
- .3 Support underground service piping penetrating building exterior walls or foundations to prevent pipe damage if minor building settlement occurs
- .4 Ensure that all bedding and supports for underground pipes are flat and true and that allowances are made for pipe hubs, couplings, or other protrusions so that no voids are left between the pipe and the bedding

.4 **Horizontal Piping in service tunnel:** Unless otherwise shown or specified, hang and/or support horizontal pipe above ground by means of hangers and/or supports specified in Part 2 of this Section. Unless otherwise shown or specified, hangers for

suspended pipe to and including 25 mm (1") diameter are to be clevis type or adjustable ring type, and hangers for suspended pipe 40 mm (1½") diameter and larger are to be adjustable clevis type. Space hangers and supports in accordance with the following:

.1 **Copper and steel pipe:** hang or support at spacing in accordance with the following schedule:

PIPE DIA.	MAX. SPACING STEEL (meters)	MAX. SPACING COPPER (meters)
To 25 mm (1")	2.4 m (8')	1.8 m (6')
40 mm (1½")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2½")	3.6 m (12')	3.0 m (10')
75 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3½")	3.6 m (12’)	3.6 m (12')
100 mm (4")	4.2 m (14')	3.6 m (12')
250 mm (10")	6.0 m (20')	

.2 **Flexible grooved pipe/coupling joint piping:** as above but with not less than 1 hanger or support between joints

.3 **Changes in direction:** where pipes change direction, either horizontally or vertically, provide a hanger or support on the horizontal pipe not more than 300 mm (12") from the elbow, and where pipes drop from tee branches, support the tees in both directions not more than 50 mm (2") on each side of the tee

.4 **Grouped piping:** when pipes with the same slope are grouped and a common hanger or support is used, space the hanger or support to suit the spacing requirement of the smallest pipe in the group and secure pipes in place on the common hanger or support

.5 **Vertical Piping:** Unless otherwise shown or specified, support vertical piping by means of supports specified in Part 2 of this Section, spaced in accordance with the following:

.1 Support vertical pipes at maximum 3 m (10’) intervals or at every floor, whichever is lesser

.2 For sections of vertical piping with a length less than 3 m (10'), support the pipe at least once

.3 For vibration isolated piping risers, provide rubber-steel-rubber vibration isolation pads between the riser clamps and the floor

.6 **Isolation for Bare Copper Tubing:** Each hanger, support or securement for horizontal bare copper tubing is to be plastic coated to prevent direct contact between the pipe and the ferrous hanger. Each wall or floor clamp for vertical bare

copper piping is to be isolated from the pipe by means of strips of flexible rubber inserts. The use of painted ferrous hangers and supports, including those painted with copper coloured paint, is not acceptable. Site application of tape or other types of isolation is not acceptable.

3.7 Installation of Piping Drain Valves

.1 Provide a drain valve at the bottom of piping where pipes enter the service tunnel from underground.

.2 Locate drain valves so that they are easily accessible.

3.8 General Re: Installation of Valves

.1 Generally, valve locations are indicated or specified on drawings or specified in Sections of the Specification where the valves are specified, however, regardless of locations shown or specified, the following requirements apply:

- .1 Install shut-off valves with handles upright or horizontal, not inverted, and located for easy access
- .2 Unless otherwise specified, provide a check valve in the discharge piping of each pump
- .3 Valve sizes are to be the same as the connecting pipe size
- .4 The manufacturer's name, valve model or figure number, and the pressure rating are to be clearly marked on each valve

3.9 Mechanical Work Identification

.1 Identify all new/relocated mechanical work in accordance with existing identification standards at the site.

.2 **Equipment:** Provide an identification nameplate for each new piece of equipment, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place, approximately at eye level if possible, with stainless steel screws unless such a practice is prohibitive, in which case use epoxy cement applied to cleaned surfaces. Locate all nameplates in the most conspicuous and readable location. Unless otherwise specified, equipment identification terminology is to be as per drawing identification.

.3 **Motor Starters and Disconnect Switches:** Provide an identification nameplate for each new motor starter or disconnect switch located in a motor control centre or on a motor starter panel, and on each individually mounted starter which supplied by the Contractor, and on each disconnect switch provided as part of the electrical work for motorized equipment provided.

3.10 Finish Painting of Mechanical Work

.1 Touch-up paint all damaged factory applied finishes on mechanical work products.

3.11 Pipe Leakage Testing

.1 Before new piping has been insulated or concealed, and before equipment, fixtures and fittings have been connected, test all piping for leakage.

.2 Tests are to be witnessed by the Departmental Representative, and, where required, representatives of governing authorities. Give ample notice of tests in writing and verify attendance. Have completed test report sheets dated and signed by those present to confirm proper test results.

.3 When circumstances prevent scheduled tests from taking place, give immediate and adequate notice of cancellation to all who were scheduled to attend.

.4 **Gravity Drainage & Vent Piping:** Securely close all openings and pipe ends and fill piping with water up to the highest level, and ensure that the water stands at the same level for a minimum of 2 hours. After the fixtures and fittings are set and the pipes connected to the building drain or drains, turn on water into all pipe, fixtures, fittings and traps in order to detect any imperfect material or workmanship. Make a smoke test if required by the Municipality. Contractor's option to drain and vent piping may be pressure tested with cold water at 345 kPa (50 psi) for 2 hours with zero leakage.

.5 **Pumped Drainage Piping:** Test piping with cold water at a pressure of 1½ times normal working pressure and maintain the pressure for a minimum of 2 hours.

.6 **Domestic Water Piping:** Test piping with cold water at a pressure of 1½ times normal working pressure and maintain the pressure for a minimum of 2 hours.

.7 **Compressed Air Piping:** Test piping with dry compressed air or nitrogen at 690 kPa (100 psi) for a minimum of 2 hours. Test all piping joints with a water-soap solution while the piping is under pressure to detect leaks.

.8 **General Re: All Testing:** The following requirements apply to all testing:

- .1 Ensure that all piping has been properly flushed, cleaned and is clear of foreign matter prior to pressure testing
- .2 Temporarily remove or valve off all piping system specialties or equipment which may be damaged by test pressures prior to pressure testing the systems, and flush piping to remove foreign matter
- .3 Include for temporary piping connections required to properly complete the tests
- .4 Piping under test pressure is to have zero pressure drop for the length of the test period
- .5 Make tight leaks found during tests while the piping is under pressure, and if this is impossible, remove and refit the piping and reapply the test until satisfactory results are obtained
- .6 Where leaks occur in threaded joints in steel piping, no caulking of these joints will be allowed under any conditions
- .7 Tests are to be done in reasonably sized sections so as to minimize the number of tests required

.8 In addition to the leakage tests specified above, demonstrate proper flow throughout the systems including mains, connections and equipment, as well as proper venting and drainage, and Include for any necessary system adjustments to achieve the proper conditions

3.12 Supply of Motor Starters and Accessories

.1 Motor starters for mechanical equipment, except for starters integral with packaged equipment and starters factory installed in equipment power and control panels, will be provided as part of the electrical work.

3.13 Electrical Wiring Work for Mechanical Work

.1 Unless otherwise specified or indicated, the following electrical wiring work for mechanical equipment will be done as part of the electrical work:

.1 "Line" side power wiring to motor starters or disconnect switches in motor control centres and starters or disconnects on motor starter panels, and "load" side wiring from the starters or disconnects to the equipment

.2 "Line" side power wiring to individual wall mounted starters, and "load" side wiring from the starters to the equipment

.3 Provision of receptacles for plug-in equipment

.4 Provision of disconnect switches for all motors that are in excess of 10 m (30') from the starter location, or that cannot be seen from the starter location, and all associated power wiring

.2 Mechanical wiring work not listed above or specified herein or on the drawings to be done as part of the electrical work is to be installed in conduit and is to be done as part of the mechanical work in accordance with wiring requirements specified for the electrical work.

3.14 Interruption to and Shut-Down of Mechanical Services and Systems

.1 Co-ordinate all shut-down and interruption to existing mechanical systems with the Departmental Representative.

.2 Upon award of a Contract, submit a list of anticipated shut-down times and their maximum duration.

.3 Prior to each shut-down or interruption, inform the Departmental Representative in writing 14 days in advance of the proposed shut-down or interruption and obtain written approval to proceed. Do not shut-down or interrupt any system or service without such written approval.

.4 Perform work associated with shut-downs and interruptions as continuous operations to minimize the shut-down time and to reinstate the systems as soon as possible, and, prior to any shut-down, ensure that all materials and labour required to complete the work for which the shut-down is required are available at the site.

3.15 Excavation and Backfill Work

.1 Excavation, backfill and related work such as dewatering required for mechanical work will be performed as part of the excavation and backfill work, except for final hand grading work which is to be done as part of the mechanical work.

.2 Inverts and locations of existing site services have been shown on the drawings. The inverts and locations shown are approximate, and it is the Contractor's responsibility to confirm that the inverts and locations as shown are correct, prior to commencing site service work.

.3 Accurately mark-out the location and routing of excavation required for work, as well as the required depth.

.4 Ensure that all underground piping has a minimum of 1.0 m of cover.

.5 Ensure that pipe bedding is proper prior to laying pipes. Hand excavate under pipe hubs, couplings, flanges and similar items to ensure even bearing along the entire barrel of each length of pipe.

.6 Ensure that piping is inspected, leakage tested and approved prior to backfilling. Supervise the initial backfilling operation to ensure that the buried work is not disturbed.

3.16 Cutting, Drilling, and Patching for Mechanical Work

.1 Do all cutting, drilling and patching of the existing building for the installation of work. Perform all cutting and drilling with proper tools and equipment. Confirm the exact location of cutting and drilling with the Departmental Representative prior to commencing the cutting and/or drilling work.

.2 Patch surfaces, where required, to exactly match existing finishes using tradesmen skilled in the particular trade or application worked on.

.3 Where new pipes pass through existing construction, core drill an opening. Size openings to leave 12 mm (½") clearance around the pipes or pipe insulation.

.4 Prior to drilling or cutting an opening in poured concrete construction, determine the location, if any, of existing services concealed in the construction to be drilled or cut. X-ray or Ferro Scan Test the walls or slabs if required.

.5 The Contractor will be responsible for the repair of any damage to existing services, exposed or concealed, caused as a result of cutting or drilling work.

3.17 Waste Management and Disposal

.1 Separate and recycle waste materials in accordance with requirements specified in Section 01 74 21 (Waste Management and Disposal).

3.18 Seismic Restraint Anchor Points for Equipment

.1 All mechanical equipment requiring seismic restraint (see the mechanical work Section entitled Seismic Control and Restraint) is to be complete with manufacturer

designed and rated seismic restraint anchor points and attachments, certified by the equipment manufacturers, so that the equipment may be bolted down or restrained in the field.

.2 The equipment to be restrained must be designed such that the strength and anchorage of the internal components of the equipment exceeds the force level used to restrain and anchor the equipment itself to the supporting structure.

END OF SECTION

1.1 General

1.2 Related Sections

.1 This Section specifies seismic control and restraint requirements that are common to mechanical work Sections of the Specification, it is a supplement to each Section and is to be read accordingly.

.2 Section 01 33 00 (Submittal Procedures)

.3 Section 20 05 05 (Mechanical Work General Instructions)

.4 Section 22 11 16 (Domestic Water Piping and Valves)

.5 Section 22 13 16 (Drainage Waste and Vent Piping and Valves)

.6 Section 22 13 29 (Drainage Pumps and Accessories)

.7 Section 22 15 00 (General Service Compressed Air System)

.8 Section 22 20 00 (Site Services)

.9 Section 22 42 00 (Plumbing Fixtures and Fittings)

1.3 Seismic Consultant

.1 Retain and pay for the services of an experienced Seismic Consultant who is a registered professional engineer licensed in the area of the work and a member in good standing with Engineers and Geoscientists BC.

.2 The Seismic Consultant is to:

.1 Determine the proper seismic hazard level, design, recommend, and review all proposed mechanical work seismic restraint shop, placement and securing drawings, and sign and stamp all drawings prior to submittal for review as specified below;

.2 Supervise installation of all mechanical work seismic restraint and, when work is complete, certify in writing that the seismic restraint work has been installed in accordance with signed, stamped and reviewed drawings;

.3 Prepare and submit to the Municipality and authorities having jurisdiction, on a form approved by the Municipality and authorities having jurisdiction, at the beginning of seismic restraint work and when the work is complete, original signed and sealed Letters of Assurance for the design, installation and field review of all seismic restraint work.

1.4 Submittals

.1 **Shop Drawings/Product Data Sheets:** Obtain all required equipment information and submit manufacturer's shop drawings/product data sheets for all restraining devices and steel bases. Include placement data, and details of attachment to both the equipment and the structure meeting requirements of the forces involved. All product data sheets and drawings are to be signed and stamped by the Seismic Consultant referred to above.

.2 **Seismic Consultant's/Seismic Control Product Manufacturer's Certification Letters:** Submit copies of the Seismic Consultant's Letters of Assurance as specified above. Submit copies of the Seismic Consultant and seismic control manufacturer's certification letters as specified in Part 3 of this Section.

.3 **Samples:** If requested, submit samples of seismic restraint materials for review.

1.5 Quality Assurance

.1 Seismic restraints are to be designed by a Seismic Consultant as specified above, and are to be installed by qualified tradesmen under the supervision of and to the approval of the Seismic Consultant.

.2 Unless otherwise specified seismic control and restraints are to be designed in accordance with

- .1 National Building Code of Canada
- .2 CAN/CSA-S832, Seismic Risk Reduction of Operational and Functional Components (OFC's) of Buildings
- .3 ANSI/SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems
- .4 P.P.I.C. Manual Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems
- .5 Local Code requirements

.3 All restraint products must be tested in an independent testing laboratory, or certified by the Vibration Isolation and Seismic Control Manufacturer's Association and the Contractor's Seismic Consultant, to confirm that the restraint products meet all requirements of this Section, i.e. dynamic ultimate limit load state as required by the Code, "Fail Safe" design, etc. If particular tests are carried out to represent a restraint type, the test is to be valid for the full load range of the restraint. Submit such tests or certification when requested.

.4 Seismic control and restraint product manufacturers are to provide all required assistance during the installation, and, when the installation is complete, submit written reports from the manufactures listing any deficiencies to the installation.

2 PRODUCTS

2.1 General

.1 Isolation, anchors, bolts, bases, restraints, etc., are to be designed to withstand without failure or yielding, the dynamic G load as specified in the Code for the seismic zone in which the building is located. Design loads are ultimate limit state loads (1.5 times working load) acting through the centre of gravity of the anchored or restrained equipment. "Fail Safe" designs are acceptable.

.2 For both isolated and non-isolated floor mounted equipment, i.e. tanks, heat exchangers, boilers, etc., design and provide anchors and bolts to withstand, without failure or yielding, a dynamic ultimate limit state load as defined in the Code, of the

greater of 0.3 g or as required by the Code, applied horizontally through the centre of gravity.

.3 Where impact forces may be significant, use ductile materials.

.4 Seismic restraining devices which are factory supplied with equipment are to meet all requirements of this Section.

2.2 Acceptable Manufacturers

.1 Acceptable seismic restraint product manufacturers are:
- .1 Mason Industries Inc.
- .2 Kinetics Noise Control
- .3 Vibro-Acoustics Ltd.
- .4 The VCM Group

2.3 Slack Cable Restraints

.1 Galvanized steel aircraft cable slack cable restraints meeting all current requirements of the Building Code, sized to suit the application and complete with all required cable ties, anchor hardware (selected for a load equal to twice the weight of the equipment), and similar connection accessories.

2.4 Anchor Bolts

.1 Equal to Mason Industries type SAB seismic anchor bolts. Acceptable alternates: Grainger, or Hilti

2.5 Vibration Isolation Products

.1 Refer to the mechanical work Section entitled Mechanical Vibration Control.

3 EXECUTION

3.1 Installation of Seismic Restraint Materials

.1 Provide seismic restraint for all mechanical equipment and piping, as per the requirements of the current edition of all local Codes and Standards, and this Section of the Specification.

.2 **Mechanical Components Restraint Guide:** The following Mechanical Components Restraint Guide is to be used as a general guide only to establish appropriate restraint methods, hardware, and attachments, however, due to the differences in construction, size, weight, and configuration of different manufacturer's equipment and the variety of ways and means that the equipment and components can be installed, specific restraint methods are to be confirmed in the field. All seismic restraint materials and methods are to be reviewed and approved by the Contractor’s Seismic Consultant.

MECHANICAL COMPONENT RESTRAINTS GUIDE

ITEM	TYPE OF RESTRAINT	MINIMUM NO. OF RESTRAINTS	NOTES
Piping	SCR TSR	As required	As per Specification

LEGEND	
SCR	Slack cable restraint (bolted to structure)
TSR	Threaded support rod (bolted or clamped to structure)

.3 Space restraints under equipment so that the minimum distance between adjacent corner restraints is at least equal to the height of the centre of gravity of the equipment. Include the height of the centre of gravity on shop drawings, otherwise, design for increased forces on the supports and submit design calculations with shop drawings.

.4 Requirements pertaining to seismic control work are as follows:

.1 Execute seismic control and restraint work in accordance with drawing details, reviewed product data and shop drawings, and all specified/governing Codes and Standards

.2 Seismic control systems are to work in all directions

.3 Fasteners and attachment points are to resist the same maximum load as the seismic restraint

.4 Drilled or power driven anchors and fasteners are not permitted

.5 No equipment, equipment supports or mounts are to fail before failure of the structure

.6 Supports of cast iron or threaded pipe are not permitted

.7 Seismic control measures are not to interfere with the integrity of firestopping

.8 All equipment is to be bolted to the structure, and all bolts are to fitted with isolation washers

.9 The number, size, type, and installation of anchor bolts are to be as recommended by the anchor bolt manufacturer and the Contractor’s Seismic Design Consultant

.10 Where more than a 3 mm (1/8") differential exists between an anchor or attachment bolt diameter, an anchor and attachment point hole, or an isolator gap attachment bolt and equipment anchor attachment hole, pack the air gap with reinforced epoxy putty

.11 All hung equipment and pipe hangers are to be fitted with a means of preventing upward movement, and non-isolated equipment and pipe hanger rods are to be fitted with oversized steel washers and nuts above and below the hanger or equipment attachment point, locked tight to prevent uplift of the equipment or hanger

.12 Where suspended equipment hanger rod length exceeds 50 rod diameters between the structure and the equipment attachment point, reinforce the rods with angle iron to prevent bending due to uplift forces

.13 Seismic control measures are not to jeopardize noise and vibration isolation systems, and 6 mm (¼") to 9 mm (3/8") clearance during normal operation of equipment and systems is to be provided between seismic restraint and equipment

.14 Where hold-down bolts for seismic restraint equipment penetrate roofing membranes coordinate with roofing trade for installation of pitch pockets/"gum cups" and sealing compound to maintain the water-tight integrity of the roof

.15 Where friction type clamps are used for support of equipment and connecting services, secure clamps to steel work by means of welding or other positive means to prevent slippage or loosening of the clamps due to seismic forces

.5 **Slack Cable Restraint Requirements:** Provide slack cable restraint assemblies for:

.1 All piping 32 mm (1¼") diameter and larger located in equipment rooms

.2 All horizontal and vertical piping 65 mm (2½") diameter and larger

.6 **Slack Cable Restraint Installation Requirements:** Installation requirements for slack cable restraints include the following:

.1 Connect slack cable restraints to ceiling hung equipment in such a way that the axial projection of the wires passes through the centre of gravity of the equipment

.2 Orient restraint wires on ceiling hung equipment at approximately 90º to each other (in plan), and tie back to the ceiling slab at an angle not exceeding 45º to the slab

.3 Install cables using appropriate grommets, shackles, and other hardware to ensure alignment of the restraints and to avoid bending the cables at connection points, and, where feasible, wrap cables directly around pipes as opposed to using collars

.4 For piping systems, provide transverse slack cable restraints at a maximum spacing of 12.5 m (40'), and longitudinal restraints at 25 m (80') maximum spacing, or as limited by anchor/slack cable performance

.5 For piping less than 250 mm (10") diameter, reduce transverse restraint spacing to 6 m (20'), and note that smaller piping may be rigidly tied to larger piping for restraint, but not the reverse

.6 Vary adjacent spacing of restraints on a piping run by 10% to 30% to avoid coincident resonance

.7 Transverse bracing for one pipe section may also act as longitudinal bracing for the piping connected perpendicular to it if the bracing is installed within 600 mm (24") of the elbow or tee, and if the connected piping is the same or smaller dia., and note that branch lines are not to be used to restrain main lines

.8 Provide flexibility in piping joints or sleeves where piping penetrates building seismic or expansion joints

.9 Wherever possible, support the weight of vertical piping risers at a point or points above the centre of gravity of the riser, and provide lateral guides at the

top and bottom of the riser, and at intermediate points not to exceed the transverse spacing specified above for horizontal pipes, with guide clearance not exceeding 3 m (10')

.10 Install restraints at least 50 mm (2") clear of all other equipment and services

.11 Adjust restraint cables such that they are not visibly slack, or such that the flexibility is approximately 40 mm (1½") under thumb pressure for a 1.5 m (5') cable length, with an equivalent ratio for other cable lengths, and adjust the clearance of cable strap/spacer piece restraints so as not to exceed 6 mm (¼")

.12 Provide transverse and axial restraints within 4 m (12') of a vertical bend

.13 Do not bridge vibration isolators with slack cable restraints

.14 Other approved restraint systems are conventional pipe guides, rigid restraint where piping passes through a block or concrete wall, or a cable strap and spacer piece attached to the structure and used where the piping is adjacent to a wall and conventional slack cable restraints cannot be used

3.2 Installation of Flexible Piping Connectors

.1 Supply flexible piping connectors for all (including plumbing) connections to seismically restrained equipment. Hand the connectors to the appropriate piping trade at the site for installation.

3.3 Site Inspection and Letters of Certification

.1 When all seismic control products have been installed, arrange for the seismic control product manufacturer and the Contractor’s Seismic Consultant to examine the installation of all seismic control products and to certify in writing (separate letters) that the products have been properly installed in accordance with governing Codes and Regulations, reviewed shop drawings and product data, and recommendations and instructions. The Contractor’s Seismic Consultant is to apply a signed and dated professional stamp to the letter.

END OF SECTION

1 GENERAL

1.1 Application

.1 This Section specifies requirements, criteria, methods and execution for mechanical demolition work that are common to one or more mechanical work Sections, and it is intended as a supplement to each Section and is to be read accordingly.

1.2 References

.1 Perform demolition work in accordance with requirements of CAN/CSA-S350, Code of Practice for Safety in Demolition of Structures.

2 EXECUTION

2.1 Disconnection and Removal of Existing Mechanical Work

.1 Where indicated on the drawings, disconnect and remove existing mechanical work, including hangers, supports, insulation, and similar items. Disconnect at the point of supply, remove obsolete connecting services and make the system safe. Cut back obsolete piping behind finishes, identify, and cap water-tight unless otherwise specified.

.2 The scope and extent of the demolition or revision work is only generally indicated on the drawings. Estimate the scope, extent and cost of the work at the site during the bidding period scheduled site visit(s).

.3 If existing isolation valves are not available to isolate sections of piping to be removed, provide such valves as required.

.4 Where existing valves are removed, remove the valve tags, revise existing valve tag charts, and hand the obsolete tags to the Departmental Representative.

.5 If any re-design is required due to discrepancies between the mechanical drawings and site conditions, notify the Departmental Representative.

.6 Where existing mechanical services extend through, or are in an area to serve items which are to remain, maintain the services in operation. Include for rerouting existing services concealed behind existing finishes and which become exposed during the renovation work, so as to be concealed behind new or existing finishes.

.7 Unless otherwise specified, remove from the site and dispose of all existing materials which have been removed and are not to be relocated or reused.

2.2 Hazardous Materials and Waste

.1 If hazardous waste not listed in the Specification is found, stop the associated work and notify the Departmental Representative immediately.

End of Section

1 GENERAL

1.1 Related Sections

.1 This Section specifies mechanical system testing, adjusting, and balancing requirements that are common to mechanical work Sections of the Specification and it is a supplement to each applicable Section and is to be read accordingly.

.2 Section 01 33 00 (Submittal Procedures)

.3 Section 20 05 05 (Mechanical Work General Instructions)

.4 Section 21 11 16 (Fire Hydrants)

.5 Section 22 11 16 (Domestic Water Piping and Valves)

.6 Section 22 13 16 (Drainage Waste and Vent Piping and Valves)

.7 Section 22 13 29 (Drainage Pumps and Accessories)

.8 Section 22 15 00 (General Service Compressed Air System)

.9 Section 22 20 00 (Site Services)

1.2 Submittals

.1 **Name and Qualifications of Testing and Balancing Agency:** within 14 days of Contract award, submit the name and qualifications of the proposed testing and balancing agency in accordance with requirements of the article below entitled Quality Assurance.

.2 **Sample Test forms:** Submit sample test forms, if other than those standard forms prepared by the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) are proposed for use.

.3 **Drawing Evaluation Report:** Submit a report by the Agency to indicate the Agency's evaluation of the mechanical drawings with respect to service routing and location or lack of balancing devices. Include the set of drawings used and marked-up by the Agency to prepare the report.

.4 **Site Visit Reports:** Submit a report by the Agency after each site visit made by the Agency during the construction phase of this Project.

.5 **Draft Report:** Submit a draft report, as specified in Part 3 of this Section.

.6 **Final Report:** Submit a final report, as specified in Part 3 of this Section.

.7 **Warranty:** Submit a testing and balancing warranty as specified in Part 3 of this Section.

.8 **Post Construction Site Visit Reports:** Submit reports listing observations and results of post construction site visits as specified in Part 3 of this Section.

1.3 Definitions

.1 The following are definitions of words used in this Section:

.1 "TAB" – means testing, adjusting and balancing to determine and confirm quantitative performance of equipment and systems and to regulate the specified fluid flow rate at the terminal equipment.
.2 "Hydronic systems" – includes heating water, chilled water, glycol-water solution, condenser water, and any similar system
.3 "Flow rate tolerance" – means the allowable percentage variation, minus to plus, of actual flow rate values in the Contract Documents
.4 "Report forms**"** – means test data sheets arranged for collecting test data in logical order for submission and review, and these forms, when reviewed and accepted, should also form the permanent record to be used as the basis for required future testing, adjusting and balancing
.5 "Terminal" – means the point where the controlled fluid enters or leaves the distribution system, and these are supply inlets on water terminals, return outlets on water terminals.
.6 "Main" – means the pipe containing the system's major or entire fluid flow
.7 "Sub-main" – means the duct or pipe containing part of the systems' capacity and serving two or more branch mains
.8 "Branch main" – means duct or pipe servicing two or more terminals
.9 **"**Branch" – means duct or pipe serving a single terminal

1.4 Quality Assurance

.1 **Testing and Balancing Agency:** Engage and pay for the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the mechanical systems to produce the design objectives. The testing, adjusting and balancing agency is to have successfully completed testing, adjusting and balancing of mechanical systems for a minimum of five projects similar to this Project within the past three years, and is to be certified as an independent agency **in all required categories** by 1 of the following:
.1 AABC - Associated Air Balance Council
.2 NEBB - National Environmental Balancing Bureau

.2 **Standards:** Testing, adjusting and balancing of the complete mechanical systems is to be performed over the entire operating range of each system in accordance with 1 of the following publications:
.1 National Standards for A total System Balance published by the Associated Air Balance Council
.2 Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by the National Environmental Balancing Bureau
.3 Chapter 37, Testing, Adjusting, and Balancing of ASHRAE Handbook HVAC Applications

2 EXECUTION

2.1 Scope of Work

.1 Perform total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications and comfort conditions, and recording and reporting the results.

.2 Mechanical systems to be tested, adjusted and balanced include:

.1 **Sump pumps:** TAB of sump pump systems is also to include all float switch and control panel operation.

2.2 Testing, Adjusting and Balancing

.1 **General Requirements:** Conform to the following requirements:

.1 The Agency is to carefully examine a white print set of mechanical drawings with respect to routing of services and location of balancing devices, and is to issue a report listing the results of the evaluation

.2 Testing, adjusting and balancing is not to begin until:

.1 Mechanical systems are complete in all respects, and have been checked, started, and adjusted

.3 All mechanical systems to be tested, adjusted and balanced are to be maintained in full, normal operation during each day of testing, adjusting and balancing

.4 Obtain copies of reviewed shop drawings of all applicable mechanical plant equipment, control diagrams and sequences

.5 The Agency is to walk each system from the system "head end" equipment to terminal units to determine variations of installation from design, and the system installation trades will accompany the Agency

.6 The Agency is to check all valves and dampers for correct and locked position, and temperature control systems for completeness of installation before starting equipment

.7 Wherever possible, the Agency is to lock all balancing devices in place at the proper setting, and permanently mark settings on all devices

.8 **Noise:** the Agency is to balance all systems with due regard to objectionable noise which is to be a factor when adjusting motor speeds and performing terminal work such as adjusting flow quantities, and should objectionable noise occur at the design conditions, the Agency is to immediately report the problem and submit data, including sound readings, to permit an accurate assessment of the noise problem to be made

.9 **Tolerances:** the Agency is to perform testing, adjusting and balancing to within ± 5% of design values, and make and record measurements which are within ± 2% of actual values

.2 **Preparation of Reports:** Prepare reports as indicated below.

.1 **Draft Reports:** Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on AABC or NEBB forms. Draft reports may

be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.

.2 **Final Report:** Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports. Use units of measurement (SI or Imperial) as used on the Project Documents.

.3 **Report format:** Report forms are to be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, 3-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the divisions listed below, separated by divider tabs:

.1 General Information and Summary
.2 Plumbing Systems
.3 Special Systems

.4 **Report Contents:** The Agency is to provide the following minimum information, forms and data:

.1 Inside cover sheet to identify the Agency, the Contractor, and Project, including addresses, and contact names and telephone numbers and a listing of the instrumentation used for the procedures along with the proof of calibration

.2 The remainder of the report is to contain the appropriate forms containing as a minimum, the information indicated on the standard AABC or NEBB report forms prepared for each respective item and system

.3 The Agency is to include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "as-built" diagram indicating and identifying all equipment, terminals, and accessories

.4 The Agency is to include report sheets indicating building comfort test readings for all rooms

.3 **Certification and Warranty:** When the final report has been accepted, the Contractor is to submit to the Departmental Representative, in the name of the Departmental Representative, a certificate equal to the AABC National Guaranty Certification or a NEBB Quality Assurance Program Bond, and in addition, the Contractor is to submit a written extended warranty from the Agency covering 1 year, during which time any balancing problems which occur, with the exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by the Agency and reported on to the Departmental Representative, and if it is determined that the problems are a result of improper testing, adjusting and balancing, they are to be immediately corrected without additional cost to the Contract.

END OF SECTION

1 GENERAL

1.1 References

.1 Fire hydrants and connecting piping are to be in accordance with all Municipal requirements, and the following Codes and Standards:

.1 ANSI/AWWA C502, Dry Barrel Fire Hydrants

.2 ANSI/AWWA C900, AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings

.3 FM 1510, Fire Hydrants (dry barrel type) for Private Fire Service

.4 CAN/ULC-S520, Fire Hydrants

.5 CSA B137.2, PVC Injection-Molded Gasketed Fittings for Cold-Water Pressure Services

.6 CSA B137.3, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications

.7 AWWA C509, Resilient Seated Gate Valves for Water-Supply Service

1.2 Related Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 20 05 10 (Basic Mechanical Materials and Methods)

.3 Section 20 05 05 (Mechanical Work General Instructions)

1.3 Submittals

.1 Submit Product Data I accordance with Section 01 33 00 (Submittal Procedures)

.2 **Product Data:** Submit product data sheets for all products specified in Part 2 of this Section, except pipe and fittings.

2 PRODUCTS

2.1 Pipe, Fittings and Joints

.1 ULC listed, rigid, Class 200, DR14, 1380 kPa (200 psi) pressure rated bell and spigot pattern PVC pipe and CSA certified fittings to CSA and ANSI/AWWA Standards, complete with gasket joints, mechanical restraints, and a mechanical restraint collar for each thrust block required as per Part 3 of this Section.

2.2 Fire Hydrants

.1 FM approved and ULC listed compression type, dry top, non-freeze hydrants manufactured to meet or exceed requirements of ANSI/AWWA and CAN/ULC Standards, designed for a 1035 kPa (150 psi) service pressure and a hydrostatic test pressure of 2070 kPa (300 psi), and complete with:

.1 A flanged intermediate section painted with a bituminous black or epoxy coating, and with a length to suit the depth of the underground water main

.2 Two 65 mm (2½") dia. Hose connections, each with a cap and chain and threaded to csa standard b89.2 to suit local fire department and pumper connection requirements

.3 A bronze operating nut which opens in a counter-clock-wise direction, and a 140 mm (5½") dia. Compression type main valve

.4 Bronze to bronze interface between removable parts of the main valve assembly and the hydrant body

.5 Hydrant barrel complete with breakaway section at the ground line, with all exposed bolts and nuts of rust and corrosion resistant alloy

.6 A 150 mm (6") diameter elbow inlet connection to suit the underground piping

.7 2 coats of weatherproof epoxy enamel with colour(s) to local Municipal requirements

.2 Acceptable products are:

.1 Clow Canada M67 "Brigadier"

.2 Mueller Canada "Centurion"

.3 Terminal City Iron Works Ltd.

2.3 Fire Hydrant Shut-Off Valves

.1 Resilient seated, 1380 kPa (200 psi) rated, non-rising stem, FM approved and ULC listed wedge gate valves to AWWA C509, each with hub ends suitable for mechanical joint pipe connection, and an adjustable cast iron valve box (length to suit) with cover.

.2 Acceptable products are:

.1 Clow Canada Co. #F-6100 Series valve with box and cover. Acceptable manufacturers are: Mueller, or Terminal City

3 EXECUTION

3.1 Installation of Fire Hydrants

.1 Provide fire hydrants where shown. Confirm exact locations and orientations prior to roughing-in.

.2 Equip each hydrant with a shut-off valve and connect with piping. Piping is to be rigid PVC.

.3 Conform to Municipal installation standards, including provision of concrete thrust blocks at piping elbows and similar fittings.

.4 Set each valve box cover flush with finished grade in a formed 300 mm x 300 mm x 100 mm (12" x 12" x 4") thick concrete pad with a sack rubbed finish.

.5 Regardless of what is specified elsewhere in this Specification regarding provision of concrete, provide the thrust block and valve box pad concrete.

.6 When installation is complete, remove all hydrant nozzle caps and fully open to completely flush the assembly and to test operation.

.7 Touch-up paint any damaged hydrant finish.

END OF SECTION

1 GENERAL

1.1 References

.1 ASTM – American Society for Testing and Materials International Inc
  .1 ASTM A312/A312M
  .2 ASTM A403/A403M

.2 AWWA - American Water Works Association.

.3 NSF/ANSI/CAN 61

.4 CAN/CSA B356, Water Pressure Reducing Valves for Domestic Water Supply Systems

1.2 Related Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 20 05 05 (Mechanical Work General Instructions)

.3 Section 20 05 10 (Basic Mechanical Materials and Methods)

.4 Section 20 05 40 (Demolition and Revision Work)

1.3 Submittals

.1 **Product Data**: Submit product data sheets for all products specified in Part 2 of this Section except for pipe and fittings, and chlorine.

.2 **Water Purity Data**: Submit laboratory water purity test results indicating chlorine residual prior to application for Substantial Performance.

1.4 NSF/ANSI 61, Drinking Water System Components-Health Effects

.1 All pipe, valves, fittings, accessories, factory supplied products as well as fabricated assemblies/spools that will come in contact with domestic (potable) water shall be tested and certified to NSF/ANSI/CAN 61 and 372 for commercial hot and cold water ratings (as applicable). Before any work commences on-site, the installing contractor must provide evidence of agency certification to the afore-mentioned standards through official certification documents and/or online certification Listings including tested and Approved water contact temperature(s). Any products found to be non-compliant with these requirements will be replaced at the contractor's expense.

2 PRODUCTS

2.1 Pipe, Fittings and Joints

Above ground pipe (such as in service tunnel)

.1 **Stainless Steel Pressed Joint**: Schedule 10 Type 304/304L to ASTM A312/A312M with Press joint couplings, fittings and valves for piping up to 50 mm (2"): Fittings to have grade "H" HNBR elastomer O-ring seals; suitable for working pressure up

to 3450 kPa (500 psi) and listed and certified to NSF/ANSI/CAN 61 for cold +73°F/+23°C or hot +180°F/+82°C as applicable as well as NSF/ANSI 372 low lead requirements.

.2 **Stainless Steel Grooved Joint:** Schedule 10 Type 304/304L to ASTM A312 with RX roll grooves for piping larger than 40 mm (1-1/2") diameter with grooved end coupling, fittings, and valves. Couplings to have Grade "P" Fluoroelastomer gaskets meeting NSF/ANSI/CAN 61 requirements, that are engineered, blended, and extruded in-house by the coupling housing manufacturer, and have an integral center leg to ensure correct alignment of the coupling key with the prepared pipe ends and that are suited for vacuum up to 29.9 in Hg/760 mm Hg. Ensure RX roll sets specifically designed for grooving schedule 10 stainless steel pipe are used. Couplings must be rated for 300psi on Schedule 10 pipe. All components will form a complete system by the same manufacture, unless a required product is not manufactured as part of their offering.

.3 Stainless Steel Mechanical Couplings: Manufactured in two segments of cast stainless steel, conforming to ASTM A-351, A-743, and A-744. Mechanical coupling bolts shall be stainless steel, type 316, meeting the physical properties of ASTM A-193, grade B8M, Class2.

.1 Rigid Type: Cast with key designed to clamp the bottom of the groove to provide an essentially rigid joint. Victaulic Series 489.

.2 Flexible Type: Use in locations where vibration attenuation and stress relief are required. Victaulic Series 475 to 4" and 77S 6" and above.

.4 If grooved mechanical joints are used for the domestic water system, the following criteria must be followed. Grooved couplings, fittings, Isolation, pressure reducing valves, check valves and strainers shall be used.

.5 If pressed system is used for the domestic or recirculation system, the following criteria must be followed. All press joint fittings, couplings, isolation valves of the same manufacturer shall be used. System & components must be rated to a minimum of 400psi

.6 **Semi-Rigid Polyethylene Tubing**: 12 mm (½") diameter, high density, semi-rigid polyethylene tubing, 1380 kPa (200 psi) rated.

2.2 Dielectric Unions

.1 Lead-free dielectric unions, each complete with a thermoplastic liner and rated minimum 1725 kPa (250 psi) at 120º C (250º F).

.2 Grooved dielectric transition fittings composed of a copper silicon casting conforming to UNS C87850 and are UL classified in accordance with NSF/ANSI/CAN 61 and NSF/ANSI 372 for ambient +86°F/+30°C and hot +180°F/+82°C potable water.

2.3 Shut-Off Valves for pipes exposed in tunnel – (Not buried underground)

.1 **Ball Valves Grooved end:** Grade CF8M stainless steel body, 316 stainless steel ball and stem, TFE seats, Fluor elastomer seals, standard port, two-piece valve.

.2 **Stainless Steel Ball Valve:** CF8M stainless steel body, 3 piece, full port ball, and stem, PTFE seats, 304 stainlesss steel handle, nut, and stem washer, with Schedule 10S stainless steel press and or grooved ends. Rated for services to 2750kPa (400 psi).

.3 **Butterfly Valves – Stainless steel Grooved Joint:** Lead free, non-corrosive, minimum 2068 kPa (300 psi) suitable for bi-directional and dead-end service to full rated pressure. Grooved end stainless steel body and disc, grade CF8M, conforming to ASTM A351, with blow-out proof 17-4PH stainless steel stems to ASTM A564. Disc shall be connected to the stem without the use of fasteners or pins and be offset from the disc centerline to provide a full 360° continuous contact with the seating surface when closed. Seat shall be pressure responsive, Grade P Fluoroelastomer. Valves with an elastomer coated disk or body are unacceptable. Valve may be automated with electric, pneumatic, or hydraulic operators Valves must be of same manufacture as the mechanical grooved couplings.

.4 **Grooved End Check Valves:** – 2" – 12" (50 – 300 mm): 300 psi (2065 kPa CWP), grooved end Grade CF8M stainless steel body and disc, 17-4PH stainless steel shaft, with 17-4PH or 316 stainless steel spring, and Grade P Fluoroelastomer seat. Suitable for vertical or horizontal installation.

.5 Valves in stainless steel systems shall be of stainless steel body and disc. BFVs valves with rubber encapsulated discs or body shall not be used and will not be accepted in any application.

2.4 Drain Valves

.1 Refer to Part 2 of the mechanical work Section 20 05 10 Basic Mechanical Materials and Methods

2.5 Pressure Reducing Valves

.1 For piping to and including 50 mm (2") diameter, lead free, non-corrosive, non-ferrous direct spring acting pressure reducing valves to CAN/CSA B356, Water Pressure Reducing Valves for Domestic Water Supply Systems, each factory set at 345 kPa (50 psi) unless otherwise specified or required, each field adjustable from 175 kPa (25 psi) to 520 kPa (75 psi) and each complete with an integral inlet strainer. Acceptable products are:

.1 Bermad 935H Series
.2 Conbraco 36C Series
.3 Zurn/Wilkins 600XL Series
.4 Watts Industries (Canada) Inc. #LF25AUB Series
.5 Cash-Acme EB-25 Series
.6 Caleffi Hydronic Solutions

2.6 Chlorine

.1 Sodium hypochlorite to AWWA B-300, Hypochlorites.

3 EXECUTION

3.1 Demolition

.1 Do all required domestic water system demolition work. Refer to demolition requirements specified in the mechanical work Section 20 05 40 Demolition and Revision Work.

3.2 Piping Installation Requirements

.1 Provide all required domestic water piping.

.2 Piping, unless otherwise specified, is to be as follows:

.1 For pipe exposed in the service tunnel or adjoining rooms – Sch 10 Stainless Steel grooved or press joint pipe, couplings, valves and fittings. Provide at least two grooved flexible type couplings in all pipe runs longer than 50 meters.

.2 For 12 mm (½") diameter trap seal primer tubing located underground or in concrete or masonry construction - semi-rigid polyethylene

.3 Lay pipes true to line and grade with bells upgrade. Fit sections together so that, when complete, the pipe has a smooth and uniform invert. Keep pipe thoroughly clean so that jointed compound will adhere. Inspect the pipe for defects before being lowered into the trench.

.4 Slope all piping so that it can be completely drained.

.5 Provide proper dielectric unions or fittings in all connections between copper pipe and ferrous pipe or equipment.

.6 Secure trap seal primer tubing embedded in concrete to reinforcing steel in a secure manner and be present during the concrete pour to ensure that the tubing is not damaged or dislodged.

3.2.1 Installation of grooved mechanical components.

.1 Grooved joints shall be installed in accordance with the manufacturer’s latest published instructions.

.2 The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be blended, extruded, molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.

.3 Correct roll sets shall be used for pipe material grooved RX rolls MUST BE USED for Sched 10 Stainless Steel. Standard Steel Rolls on Sched 10 Stainless Steel will not be accepted.

.4 Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed. Provide a copy of the manufacturer's project kickoff checklist and confirmation letter of visit. Contractor shall remove and replace any improperly installed products. Manufacturer or Owner Rep/Engineer may request at their discretion any field grooved and installed joints be dissembled for verification of pipe groove dimensions.

3.3 Installation of Shut-Off Valves

.1 Refer to Part 3 of the mechanical work Section 20 05 10 Basic Mechanical Materials and Methods.

.2 Valves to and including 100 mm (2") diameter are to be ball type, valves larger than 50 mm (2") diameter are to be butterfly type. Except in grooved end systems. grooved end valves to be ball or butterfly type. Valves in grooved end system to be grooved end same manufacturer as grooved couplings, and fittings. All butterfly valves to have off-set disc for complete 360-degree circumferential engagement with seat.

3.4 Installation of Pressure Reducing Valves

.1 Provide domestic water pressure reducing valves in piping where shown and/or specified. Install so that each valve is readily accessible. Whenever possible, provide pressure reducing valves factory pre-set to required pressures.

.2 All pressure reducing valves used in domestic water applications must be listed (with contact temperature) and certified for domestic hot and cold water as applicable to NSF/ANSI/CAN 61 and NSF/ANSI 372

.3 Check and test operation and adjust as required.

3.5 Piping Expansion and Contraction Facilities

.1 Provide piping expansion fittings as noted in the pipe installation requirements section of this specification.

3.6 Flushing and Disinfecting Piping

.1 Flush and disinfect all new and/or reworked domestic water piping after leakage testing is complete.

.2 Isolate new piping from existing piping prior to flushing and disinfecting procedures.

.3 Flush piping until all foreign materials have been removed and the flushed water is clear. Provide connections and pumps as required. Open and close valves, faucets, hose outlets, and service connections to ensure thorough flushing.

.4 When disinfecting is complete, submit water samples to a certified laboratory for purity testing and, when testing indicates pure water in accordance with governing standards, submit a copy of the test results and fill the systems.

END OF SECTION

1 GENERAL

1.1 Scope

.1 This section applies to piping within the service tunnels, or underground piping servicing equipment within the service tunnels**. For underground piping beyond the service tunnels, refer to specification section 22 20 00 – Site Services.**

1.2 Related Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 20 05 05 (Mechanical Work General Instructions)

.3 Section 20 05 10 (Basic Mechanical Materials and Methods)

.4 Section 20 05 40 (Demolition and Revision Work)

1.3 References

.1 ASTM – American Society for Testing and Materials International Inc
  .1 ASTM B306

.2 CAN/CSA B181.2

.3 CAN/CSA-B70

.4 CAN/CSA-B602,

1.4 Submittals

.1 **Product Data**: Submit product data sheets for all products specified in this Section except pipe and fittings.

.2 **Plumbing Inspection Certificate:** Submit a copy of the plumbing inspection certificate prior to application for Substantial Performance.

2 PRODUCTS

2.1 Pipe, Fittings and Joints

.1 **Buried/Embedded PVC – DWV:** Schedule 40, flame spread rating not exceeding 25, IPS PVC drain, waste and vent pipe and fittings to CAN/CSA-B181.2, complete with solvent weld joints.

.2 **Copper- Solder Joint:** Type DWV hard temper to ASTM B306, with forged copper solder type drainage fittings and 50% lead - 50% tin solder joints.

.3 **Cast Iron:** Class 4000 cast iron pipe and fittings to CAN/CSA-B70, cast iron soil pipe, fittings, and means of joining, and mechanical coupling joints to CAN/CSA-B602, Mechanical couplings for drain, waste, and vent pipe and sewer pipe, 4-strap type for pipe to 100 mm (4”) and 6-strap type for piping larger than 100 mm (4”).

.4 **Copper-Victaulic Coupling Joint:** Type DWV hard temper to ASTM B306, with factory or site rolled grooved ends (with grooving rolls designed for copper) and wrought copper or cast bronze fittings with gasket type couplings.

.5 **Pumped sanitary mains inside service tunnel Stainless Steel – Grooved pipe Coupling Joint**: Schedule 40 stainless steel, factory or site rolled grooved, complete with stainless steel grooved end fittings.

2.2 Shut-Off and Check Valves (in drainage pump discharge piping)

.1 **Shut-off Valves**: Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass body, blowout-proof stem, chrome plated solid brass ball, solder or screwed ends as required, and removable lever handle. Acceptable products are:
- .1 Toyo Valve Co. Fig. 5049A or Fig. 5044A
- .2 Milwaukee Valve Co. #BA-155 or #BA -125
- .3 Kitz Corporation Code 58 or Code 59
- .4 Victaulic Co. of Canada Ltd. Series 722
- .5 Apollo Valves # 77-100 or # 77-200
- .6 Watts Industries (Canada) Inc. #FBV-3 or #FBVS-3

.2 **Check Valves**: Class 125, bronze, 1725 kPa (250 psi) WOG rated vertical lift check valve with solder or screwed ends as required, and, for horizontal piping, Class 125, bronze 1380 kPa (200 psi) WOG rated swing check valves with solder or screwed ends as follows:
- .1 Toyo Valve Co. Fig. 231 or Fig. 236 or Fig. 237
- .2 Milwaukee Valve Co. #1510 or #510
- .3 Kitz Corporation Code 36 or Code 22 or Code 23

3 EXECUTION

3.1 Demolition

.1 Do all required drainage and vent piping demolition work. Refer to demolition requirements specified in the mechanical work Section 20 05 40 Demolition and Revision Work.

.2 original copies of invoices issued by the municipality for street service connection work.

3.2 Drain and Vent Piping Installation Requirements

.1 Provide all required drainage and vent piping. Pipe, unless otherwise specified, is to be as follows:
- .1 For (buried in earth/backfill) gravity piping inside structures, unless otherwise specified - rigid DR35 PVC sewer pipe or rigid solvent weld IPS PVC drain, waste and vent pipe
- .2 For piping embedded in concrete, rigid solvent weld IPS PVC drain, waste and vent pipe

.3 For buried (in earth/backfill) drainage pump discharge piping – schedule 40 stainless steel Victaulic pipe and fitting.

.4 For pipe inside the building and above ground in sizes to and including 65 mm (2½") diameter - type DWV copper

.5 For pipe inside the building and above ground in sizes 75 mm (3") diameter and larger - Class 4000 cast iron with 4-strap couplings for pipe to and including 100 mm (4”) diameter, and 6-strap couplings for piping larger than 100 mm (4”) diameter, all with torque wrench tightened bolts, and, where pipe riser/building expansion will or may be a problem, cast iron pipe expansion joints

.6 For drainage pump discharge pipe connections inside the building and above ground from the pump(s) to the nearest gravity riser or buried main, including shut-off and check valve connections - schedule 40 stainless steel pipe and fitting.

.2 Unless otherwise specified, slope horizontal drainage piping above ground in sizes to and including 75 mm (3") diameter 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") diameter and larger 25 mm (1") in 2.4 m (8').

.3 Install and slope underground drainage piping to inverts or slopes indicated on the drawings to facilitate straight and true gradients between the points shown. Verify available slopes before installing the pipes.

.4 Unless otherwise specified, slope horizontal branches of vent piping down to the fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 m (4').

.5 Extend vent stacks up through the roof generally where shown but with exact locations to suit site conditions and in any case a minimum of 3 m (10') from fresh air intakes. Terminate sump vent stacks to 90 degree turn down elbows.

.6 Provide proper dielectric unions at connections between copper pipe and ferrous pipe or equipment.

3.3 Installation of Shut-Off and Check Valves

.1 Provide a shut-off valve and a check valve in the discharge piping of each drainage pump.

.2 Locate valves so that they are easily accessible without the use of ladders or other such devices.

END OF SECTION

1 GENERAL

1.1 Related Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 78 00 (Closeout Submittals)

.3 Section 01 91 13 (Commissioning Requirements)

.4 Section 20 05 05 (Mechanical Work General Instructions)

.5 Section 20 05 10 (Basic Mechanical Materials and Methods)

.6 Section 20 05 40 (Demolition and Revision Work)

.7 Section 20 05 55 (Testing, Adjusting and Balancing)

1.2 References

.1 ASTM A-48

.2 ASTM A479

.3 ASTM A53

.4 Canadian Standards Association CSA

1.3 Submittals

.1 **Shop Drawings/Product Data**: Submit shop drawings/product data sheets for all products specified in this Section. Include motor product data sheets, pump curves, and power and control wiring schematics, as well as product data for all accessories.

.2 **Start-Up and Test Data:** Submit, prior to Substantial Performance, start-up or test data specified in Part 3 of this Section.

.3 **Certification Letters**: Submit pump manufacturer/supplier start-up and installation certification letters as specified in Part 3 of this Section.

2 PRODUCTS

2.1 Access Chamber area drain Sump Pump

.1 Submersible sump pump as per the drawing schedule, complete with:
- .1 A cast iron pump casing, motor cover and pressure switch housing
- .2 An oil filled, 115 volt, 1-phase protected submersible motor
- .3 A non-clog impeller threaded to a corrosion protected steel shaft with mechanical shaft seal
- .4 An enclosed diaphragm type water level control pressure switch with Buna-N rubber diaphragm
- .5 A minimum of 3 m (20') of insulated copper conductor power cord with plug, prewired to the motor, with exact length of power cord sufficient to extend (unbroken) from the pump in the pit through conduit to a wall mounted receptacle adjacent the pit

.2 Acceptable manufacturers are:
- .1 Pentair Ltd. Hydromatic
- .2 Penberthy Injector Ltd.
- .3 F.E. Myers (Canada) Ltd.
- .4 ABS Pumps Corp.
- .5 ITT Flygt Canada
- .6 S.A. Armstrong Ltd.
- .7 Zoeller Canada Ltd.
- .8 Liberty Pumps Inc.

2.2 Submersible Centrifugal Drainage Pumps

.1 Pumps as per the drawing schedule, each complete with a mating cast iron discharge elbow terminating in a horizontal outlet flange permanently installed in the sump with pump discharge piping, and 2 guide bars supported by an upper and intermediate guide bar holder with sliding guide bracket fastened to the pump, all arranged such that the pump is automatically connected to the discharge elbow with a tight metal to metal seal when lowered down into the sump. The exterior of each pump is to be washed, primed, and finished with spray applied polyester-epoxy resin paint.

.2 **Pump Construction:** Major pump components are to be smooth grey cast iron to ASTM A-48, Class 30. Explosion proof. The single piece non-concentric design volute is to be complete with a smooth fluid passage large enough to pass 75mm size of solid entering through the impeller, and all exposed nuts and bolts are to be type 304 stainless steel. Each pump is also to be complete with:
- .1 **Motor:** non-overloading, housed in an oil filled enclosure which is water-tight to a depth of 20 m (65'), complete with a float switch to detect any leak in the stator chamber, stator thermal overload switches in series to monitor the temperature of each phase winding and stop the motor and activate an alarm, and a single ASTM A479 S43100-T stainless steel extended impeller/motor shaft designed to avoid contact with the pumped liquid
- .2 **Power cable:** CSA certified, multi-conductor SOW oil-resistant and water-tight cable with colour coded insulation on stranded copper conductors, and of a length to extend in a continuous length from the pump to the power and control panel, and equipped with water-tight cable entry seal with strain relief at the motor housing
- .3 **Bearings:** 2, shielded, permanently grease lubricated bearing sets, single deep groove ball type upper bearing, and double row angular contact lower ball bearings

.3 **Pump Removal Guide System:** Equal to Flygt part number 12-52 06 04 type 316 stainless steel bracket upper guide bar holder with expanding rubber grip for a 50 mm (2") NPS pipe, Equal to Flygt part number 13-52 06 06 type 316 stainless steel bracket intermediate guide bar holder with expanding rubber grip at the lower sleeve and tapered upper sleeve for 50 mm (2") NPS pipe, and the required length of 50 mm (2") NPS ASTM A53 Schedule 40 galvanized steel pipe guide bar.

.4 **Float Switches and Accessories: Equal to** Flygt Model ENM-10 tilt-type mechanical switch floats, intrinsically safe and suitable for hazardous environments, and complete with:

.1 Equal to A Flygt part number 13-52 01 08 stainless steel horizontal level regulator hanger for suspending up to 6 float switches, with squeeze cable connectors and mounting hardware

.2 Equal to A Flygt part number 13-50 70 06 type 304 stainless steel sway control ring with threaded rod insert

.3 Type SOW cable as specified for the pump power connection cable

.5 **Pump Lifting System:** Equal to Flygt-Lift system for each pump, consisting of 10 m (33') of nylon line, a short length of high tensile strength chain with a forged steel "Grip-Eye" for use with a mechanical lifting device, and all required hardware, all appropriately sized for the weight of the pump to be lifted.

.6 **Power and Control Panel:** Factory prewired and supplied with the pump set by the pump manufacturer, consisting of a CSA Type 4X stainless steel, weather proof, double-door, dead front cabinet complete with:

.1 A main disconnect circuit breaker

.2 A motor starter and a H-O-A selector switch for each pump

.3 A control and status monitoring unit(s) to connect pump motor housing water leakage float switches and winding thermal overload switches

.4 microprocessor based pump controller as described below

.5 A red flashing alarm light, and an audible alarm with silence pushbutton

.6 A fused 24 volt secondary control transformer

.7 An elapsed time meter for each pump

.8 Terminals for all field wiring connections

.7 **Power and Control Panel Controller:** The pump set controller is to be mounted on the front face of the power and control panel and is to contain a 16 bit 32 MHz processor with an application memory (flash) of 128 KBytes, system memory (flash) of 128 KBytes, a parameter memory (EEPROM) of 8 KBytes, battery backup for the real time clock function, and a watchdog circuit to enable backup operation in case of controller failure. The controller is to be programmed via an integral operator interface consisting of pushbuttons in combination with a 2-line LCD backlit display, and LED indicators for controller operation, communication status, pump operation status, and power supply status. Pump set operation is to be as follows:

.1 The controller is to facilitate continuous monitoring of the sump liquid level via a digital level signal from the float switches, and start and stop the pump(s) based on liquid levels(s) in the sump and operator programmed set-points

.2 The controller is to alternate the pumps every cycle, but is to also facilitate a selectable option to alternate pumps based on hours of run

.3 The controller is to monitor pump protection features to initiate alarms in the event of impending pump failure including over-temperature, seal failure, pump current, and tripped motor protector, and also signal a building automation system

.8 Acceptable Manufacturers are:
- .1 ITT Flygt Canada
- .2 F.E. Myers (Canada) Ltd.
- .3 Vaughan Inc.
- .4 Zoeller Canada Ltd.
- .5 Liberty Pumps Inc.

2.3 Sump Frames and Cover Plates

.1 Refer to structural drawings and specifications.

3 EXECUTION

3.1 Simplex Sump Pump

.1 Provide a submersible pump on a concrete base as shown on the drawings. Refer to the drawing detail.

.2 Provide all required sump piping, including a shut-off valve and a check valve for the pump. Ensure that piping is easily removable for pump withdrawal from the sump.

.3 Do not remove the plug from the pump power cord. Pull the power cord through empty PVC conduit extending from the sump to the receptacle and plug-in the pump.

.4 Provide sump pit accessories.

.5 Clean the sump prior to Substantial Performance.

3.2 Installation of Submersible Duplex Drainage Pumps

.1 Provide submersible drainage pumps in the sump. Refer to the drawing detail.

.2 Provide all required sump piping, including a shut-off valve and a check valve for each pump. Ensure that valves are readily accessible from floor level and that piping is easily removable for removal of pumps from the sump.

.3 Install the pump removal guide rail system with accessories in accordance with the manufacturer’s instructions.

.4 Install float switch(es) at the proper height in the sump and secure cable to a sump wall mounted bracket such that cables cannot twist around each other.

.5 Leave pump power and control cables outside the sump, neatly coiled, taped and identified for extension and connection to starting and control equipment.

.6 Hand the pump starter and control panel(s) and high water level alarm panel(s) to the electrical trade at the site for installation.

.7 Provide sump and pump accessories.

.8 Clean sump(s) prior to Substantial Performance.

3.3 Installation of Sump Frames and Coverplates

.1 Supply a frame and cover with access hatch(es) for each drainage sump. Carefully coordinate supply of frames and covers with the concrete trade forming and pouring the sumps. Hand frames to the concrete trade for incorporation into the formwork, and ensure that the frames are properly secured in place. Be present during the concrete pour to ensure that the frame is not damaged or dislodged.

.2 Install gaskets and cover plates and secure in place.

3.4 Equipment and System Start-Up

.1 Refer to requirements of the article entitled Equipment and System Start-Up in Section 20 05 05 Mechanical Work General Instructions Section.

3.5 Commissioning

.1 Refer to commissioning requirements specified in Section 20 05 05 Mechanical Work General Instructions Section.

3.6 Demonstration and Training

.1 Refer to the article entitled Equipment and System O & M Demonstration and Training in Section 20 05 05 Mechanical Work General Instructions Section. Include for 2 hours of on-site training for 2 groups of 2 people for submersible drainage pumps.

END OF SECTION

1 GENERAL

1.1 Related Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 78 00 (Closeout Submittals)

.3 Section 01 91 13 (Commissioning Requirements)

.4 Section 20 05 05 (Mechanical Work General Instructions)

.5 Section 20 05 10 (Basic Mechanical Materials and Methods)

.6 Section 20 05 40 (Demolition and Revision Work)

.7 Section 20 05 55 (Testing, Adjusting and Balancing)

.8 Section 21 11 16 (Fire Hydrants)

1.2 References

.1 ASTM C-478

.2 ASTM C32

.3 AWWA C509

.4 AWWA C601

.5 Canadian Standards Association CSA

1.3 Submittals

.1 **Product Data:** Submit product data sheets for all products specified in Part 2 of this Section except pipe and fittings.

.2 **Water Purity Data**: Submit water main laboratory water purity test results indicating chlorine residual prior to application for Substantial Performance.

1.4 Soils Test Report

.1 Carefully examine any soils test reports and include for all requirements applicable as a result of the report.

2 PRODUCTS

2.1 Pipe, Fittings and Joints

.1 **Sewer – (pressurized main) –** Pipe shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389 or CSA B137.11. The pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in an extrusion process. Piping shall contain a fiber layer to restrict thermal expansion and have a wall thickness of SDR 11. All pipe shall comply with the rated pressure

requirements of ASTM F 2389 or CSA B137.11. All pipe shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.

.2 **Compressed air:** Pipe shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389 or CSA B137.11. The pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in an extrusion process. Piping shall contain a fiber layer to restrict thermal expansion and have a wall thickness of SDR 11. All pipe shall comply with the rated pressure requirements of ASTM F 2389 or CSA B137.11. All pipe shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.11.

.3 **Water Service:** Pipe shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. The pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in an extrusion process. Domestic hot water shall contain a fiber layer to restrict thermal expansion and have a wall thickness of SDR 7.4. Domestic cold water pipes to have a wall thickness of SDR 11. All pipe shall comply with the rated pressure requirements of ASTM F 2389. All pipe shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11.

.4 **Fittings**: Fittings shall be manufactured from a PP-R resin (Fusiolen) meeting the short-term properties and long-term strength requirements of ASTM F 2389. The fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All fittings shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11. Fittings to be installed according to the manufacturer’s directions

.5 **Warranty**: Manufacturer shall warrant pipe and fittings for 10 years to be free of defects in materials or manufacturing. Warranty shall cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing. Warranty shall be in effect only upon submission by the contractor to the manufacturer of valid pressure/leak test documentation indicating that the system was tested and passed the manufacturer’s pressure/leak test.

2.2 Manholes

.1 Precast, water-tight reinforced concrete manholes manufactured to ASTM C-478 and Municipal standards, each sized and arranged to suit the drainage pipe size and arrangement, and complete with:

.1 A poured-in place or precast concrete base

.2 Cast-in place "Safety" type aluminum steps on 300 mm (12") centres, each step coated with 2 coats of static asphalt paint

.3 An water tight lid with lifting handle. See details on mechanical drawings for specifications of lid.

.4 All required masonry work to raise the top of manholes flush with finished grade

.2 Masonry work is to consist of cement mortar and clay or shale bricks to ASTM C32 grade M5, precast interlocking concrete members and accessories.

2.3 Fire Hydrants

.1 See fire hydrant spec section 21 11 16.

2.4 Shut-Off Valves (Water, Sanitary)

.1 Resilient seated, 1380 kPa (200 psi) rated, non-rising stem, FM approved and ULC listed wedge gate valves to AWWA C509, each with hub ends suitable for mechanical joint pipe connection, and an adjustable cast iron valve box (length to suit) with cover.

.2 Acceptable products are:

.1 Clow Canada #F6100 Series valve with box and cover

.2 Mueller #2360 Series with box and cover

.3 Terminal City

2.5 Shut-Off Valves (Compressed air)

.1 Resilient seated, 1380 kPa (200 psi) rated, non-rising stem, FM approved and ULC listed wedge gate valves to AWWA C509, each with hub ends suitable for mechanical joint pipe connection, and an adjustable cast iron valve box (length to suit) with cover.

.2 Acceptable products are:

.1 Clow Canada #F6100 Series valve with box and cover

.2 Mueller #2360 Series with box and cover

.3 Terminal City

3 EXECUTION

3.1 Demolition

.1 Do all required underground service piping demolition work. Refer to demolition requirements specified in the mechanical work Section entitled Demolition and Revision Work.

3.2 Excavation and Backfill

.1 Refer to requirements specified in the mechanical work Section entitled Basic Mechanical Materials and Methods and other relevant divisions of the Specifications.

.2 Locate all general reference points and take all necessary precautions to prevent damage or destruction to these points. Contractor is responsible for all site services work lines, elevations and measurements.

.3 Ensure that the locations of all existing underground services, mechanical and electrical, are properly and accurately located and marked. Contractor will be responsible for any damage to existing services caused as a result of site services work.

.4 Excavate to a minimum of 150 mm (6") below the bottom of the pipe. Support the pipe, unless otherwise specified, on a well compacted bed of dry, natural, undisturbed earth free from rocks or protrusions of any kind, or on compacted sand or granular B material as specified. See Section 33 11 16 (Water Utility Distribution Piping).

.5 Backfill: General Fill in accordance with Section 31 23 33.01 (Excavation, Trenching and Backfilling).

.6 Where unstable soil is present at the bottom of the trench, provide concrete saddles, pies, or other approved and suitable foundations.

3.3 Concrete Work

.1 Provide all poured concrete work, including reinforcing and formwork, required for site services work.

.2 Concrete is to be in accordance with Section 03 30 00 (Cast-in-place Concrete), Type D.

3.4 Drainage Service Piping Installation Requirements

.1 Provide all required underground drainage service piping.

.2 Install and slope underground drainage piping to inverts or slopes indicated on the drawings to facilitate straight and true gradients between the points shown. Verify available slopes before installing the pipes.

.3 Where water service piping occurs, install drainage pipe below water pipe.

.4 At the end of each working day temporarily plug and/or cap all open piping ends to prevent entry of debris or dirt.

3.5 Compressed Air Service Piping Installation Requirements

.1 Provide all required underground compressed air service piping.

.2 At the end of each working day temporarily plug and/or cap all open piping ends to prevent entry of debris or dirt.

3.6 Water Service Piping Installation Requirements

.1 Provide all required underground water service piping.

.2 Brace and secure underground water service pipe at bends, tees and similar fittings with restraint devices, and provide concrete thrust blocks in accordance with

Municipal or Provincial standards and details. Regardless of what is specified elsewhere in this Specification regarding provisions of concrete, provide thrust block concrete. Paint all restraint devices with 2 coats of corrosion resistant black asphalt base coating and allow time to dry prior to backfilling.

.3 Lay pipes true to line and grade with bells upgrade. Fit sections together so that, when complete, the pipe has a smooth and uniform invert. Keep pipe thoroughly clean so that jointed compound will adhere. Inspect the pipe for defects before being lowered into the trench.

.4 Where both water and drainage piping occurs, install water piping above drainage piping.

.5 Slope all piping so that it can be completely drained.

.6 At the end of each working day, temporarily plug and/or cap all open piping ends to prevent entry of debris or dirt.

3.7 Piping Applications

.1 Installers shall be trained and certified to install the pipe according to the manufacturer's guidelines.

3.8 Fusion Welding of Joints

.1 Install fittings and joints using socket-fusion, elecrofusion, or butt-fusion as applicable for the fitting or joint type. All fusion-weld joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.

.2 Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.

.3 Prior to joining, the pipe and fittings shall be prepared in accordance with ASTM F 2389 and the manufacturer's specifications.

.4 Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.

3.9 Installation of Manholes

.1 Provide precast concrete manholes where shown on the drawings. Properly bed each unit and set to the required invert.

.2 Provide a reinforced pre-cast concrete base slab and bottom section for each manhole, or provide a poured-in-place concrete base. Ensure that each manhole is sized to suit the pipe size and arrangement.

.3 Do all masonry work required to raise the top of each assembly flush with finished grade level.

.4 When work is substantially complete, clean out each manhole.

3.10 Installation of Fire Hydrants

.1 Provide fire hydrants where shown. Confirm exact locations and orientations prior to roughing-in.

.2 Equip each hydrant with a shut-off valve and connect with piping. Piping is to be rigid PVC.

.3 Conform to Municipal installation standards, including provision of concrete thrust blocks at piping elbows and similar fittings.

.4 Set each valve box cover flush with finished grade in a formed 300 mm x 300 mm x 100 mm (12" x 12" x 4") thick concrete pad with a sack rubbed finish.

.5 Regardless of what is specified elsewhere in this Specification regarding provision of concrete, provide thrust block and valve box pad concrete.

.6 When installation is complete, remove all hydrant nozzle caps and fully open to completely flush the assembly and to test operation.

.7 Touch-up paint any damaged hydrant finish.

3.11 Testing and Inspection of Services

.1 Prior to backfilling, test new service piping for leakage and flow in the presence of the Consultant and the Plumbing Inspector. Give a minimum of 72 hours notice for scheduled tests.

.2 **Water, Compressed air & Sanitary Main Leakage**: All new mains are to be leakage tested using clean water at 1400 kPa (200 psi) for a minimum period of 8 hours with no pressure drop.

3.12 Flushing and Disinfecting Water Service Piping

.1 Thoroughly flush domestic water service piping after leakage and flow testing is complete.

.2 Flush piping with clean water at a minimum velocity of 1.2 m/s (4'/s) at 205 kPa (30 psi) minimum pressure until all foreign materials have been removed and the flushed water is clear. Provide connections and pumps as required.

.3 When flushing is complete, disinfect the piping with a solution of chlorine in accordance with AWWA C601-68.

.4 When disinfecting is complete, submit water samples to a certified laboratory for purity testing and, when testing indicates pure water in accordance with governing standards, submit a copy of the test results and fill the systems.

END OF SECTION

1 GENERAL

1.1 Submittals

.1 **Product Data Sheets:** Submit product data sheets (fixture cuts) for all plumbing fixtures and fittings. Ensure that the product data sheets confirm that the products proposed meet all requirements of this Section of the Specification.

1.2 Quality Assurance

.1 Plumbing fixtures and fittings, where applicable, are to be in accordance with requirements of the following standards:
- .1 CAN/CSA B45 Series, General Requirements for Plumbing Fixtures, including supplements
- .2 ASME A112.18.1/CSA B125.1, Plumbing Supply Fittings
- .3 ASME A112.18.2/CSA B125.2, Plumbing Waste Fittings
- .4 ASME A112.18.6/CSA B125.6, Flexible Water Connections
- .5 CSA B125.3, Plumbing Fittings
- .6 CAN/CSA-B651, Accessible Design for Self-Service Interactive Devices
- .7 Local Building Code requirements

.2 All water supply fittings are to be lead-free in accordance with NSF/ANSI 61 requirements.

2 PRODUCTS

2.1 Plumbing Fixtures and Fittings

.1 Plumbing fixtures and fittings are to be in accordance with the drawing schedule.

3 EXECUTION

3.1 Installation of Plumbing Fixtures and Fittings

.1 Provide all required plumbing fixtures and fittings.

.2 Connect plumbing fixtures and fittings with piping sized in accordance with the drawing schedule.

.3 When installation is complete, check and test the operation of each fixture and fitting. Adjust or repair as required.

3.2 Commissioning

.1 Commission plumbing fixtures and fittings by proving proper operation.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.1 Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

.2 CAN3-C235-83, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.3 CSA B651-12 Accessible Design for the Built Environment.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.3 National Electrical Manufacturers Association (NEMA)

1.2 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.3 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates for control items in English.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data: submit WHMIS MSDS in accordance with Section 01 35 43 – Environmental Procedures and Sustainability and Section 01 35 33 – Health and Safety.

.3 Submit for review single line electrical diagrams in glazed frames and locate:

.1 Electrical distribution system in main electrical room.

.4 Submit for review fire alarm riser diagram, plan and zoning of building in glazed frames at fire alarm control panel and annunciator.

.5 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of BC, Canada.

.2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Indicate on drawings clearances for operation, maintenance, and replacement of operating equipment devices.

.5 Submit one copy of drawings and product data in PDF digital format to authority having jurisdiction.

.6 If changes are required, notify Departmental Representative of these changes before they are made.

.6 Quality Control: in accordance with Section 01 45 00 - Quality Control.

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for special approval before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

.6 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

.7 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

.8 Submit one copy of all manufacturer specific software packages, including license certifications/quantities required for adjusting the settings and configuration of electrical and communication systems components. Software shall include all required licencing, specialty port adapters and communication protocols. List all manufacturer specific software packages provided.

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentice’s program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings:

.1 In accordance with Section 01 32 16.06 - Construction Progress Schedule - Critical Path Method (CPM).

.2 Site Meetings: as part of Manufacturer's Field Services described in Section 01 91 13 - General Commissioning (CX) Requirements, schedule site visits, to review Work, at stages listed.

.1 After delivery and storage of products, and when preparatory Work is complete but before installation begins.

.2 Twice during progress of Work at 25% and 60% complete.

.3 Upon completion of Work, after cleaning is carried out.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 33 - Health and Safety.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Departmental Representative with schedule within 2 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling in accordance with Section 01 74 21 - Waste Management and Disposal.

1.7 SYSTEM STARTUP

.1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant will aspects of its care and operation.

1.8 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Section 01 35 43 – Environmental Procedures and Sustainability.

.2 Do verification requirements in accordance with Section 01 35 43 – Environmental Procedures and Sustainability.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Section 01 61 10 - Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval as described in PART 1 - SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

2.4 WARNING SIGNS

.1 Porcelain enamel signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Sizes as follows:

NAMEPLATE SIZES

Size 1 10 x 50 mm 1 line 3 mm high letters

Size 2 12 x 70 mm 1 line 5 mm high letters

Size 3 12 x 70 mm 2 lines 3 mm high letters

Size 4 20 x 90 mm 1 line 8 mm high letters

Size 5 20 x 90 mm 2 lines 5 mm high letters

Size 6 25 x 100 mm 1 line 12 mm high letters

Size 7 25 x 100 mm 2 lines 6 mm high letters

.2 Wording on nameplates to be approved by Departmental Representative prior to manufacture.

.3 Allow for minimum of twenty-five (25) letters per nameplate.

.4 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.5 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.6 Terminal cabinets and pull boxes: indicate system and voltage.

.7 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered and coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Conduit Prime	Auxiliary
0 to 250 V	Yellow
251 to 600 V	Yellow Green
601 to 5 kV	Yellow Blue
5 to 15 kV	Yellow Red
> 15kV	Yellow Purple
Telephone	Green
Other Communication Systems	Green Blue
Fire Alarm	Red
Emergency Voice	Red Blue
Other Security Systems	Red Yellow

2.9 CABLING AND WIRING IDENTIFICATION

.1 Identify all feeders with coloured tags having 4 slotted tie holes and secured with 2 plastic tag ties as follows:

.1 Minimum of 1 tag for each feeder in each manhole, pull box, or building.

.2 Minimum of one tag on each side of every connector, splice assembly, or junction box.

.3 Size 150 mm x 50 mm.

.4 Material: 3-ply lamicoid, minimum 5 mm thick.

.2 Identify all other cables with plastic tie-tags. Markings to be indelible and shall identify cable end destinations and service description.

.3 Identify the phasing by colour coding and phase designation letter ("A," "B," "C") at each and every set of 25 kV, 15 kV, and 208 V conductors at each termination (both Line and Load ends) and at both sides of each intermediate connector and splice point, with adhesive cable markers. Maintain phase sequence and colour coding throughout.

.4 Identify concrete duct banks, service ducts and conduits for communication and power and other spare raceways where they enter or leave structures, with engraved stainless steel marker plates indicating the type of raceway and buried depth. Install marker plates on the exterior wall immediately above point of entry. Obtain prior approval of the Departmental Representative for method of attachment to the surface.

.5 Colour code: to CSA C22.1.

.6 Where electrical conduits are encased in concrete in the apron and roadway, place bronze or stainless steel duct bank markers on 3 meter spacing for entire length of duct bank.

2.10 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.

.2 Paint indoor switchgear and distribution enclosures light gray to EEMAC 2Y-1.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

.2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

3.4 LOCATION OF OUTLETS

.1 Locate outlets in accordance with Section 26 05 32 - Outlet Boxes, Conduit Boxes and Fittings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: In accordance with CSA B651-12 Accessible design for built environment.

.2 Wall receptacles: In accordance with CSA B651-12 Accessible design for built environment.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: In accordance with CSA B651-12 Accessible design for built environment.

.5 Wall mounted telephone and interphone outlets: In accordance with CSA B651-12 Accessible design for built environment.

.6 Fire alarm stations: In accordance with CSA B651-12 Accessible design for built environment.

.7 Fire alarm bells: 2100 mm.

3.6 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.7 FIELD QUALITY CONTROL

.1 Load Balance:

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Provide upon completion of work, load balance report as directed in PART 1 - SUBMITTALS: phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.

.2 Conduct following tests in accordance with CSA C22.1, Canadian Electrical Code, Part 1

.1 Power distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm system communications.

.6 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Megger 600-2.4 kV circuits, feeders and equipment with a 5000 V instrument.

.4 Check resistance to ground before energizing.

.3 Carry out tests in presence of Departmental Representative.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

.6 Provide fault study, arc flash study, and protection & coordination study for all equipment installed in this contract. Study shall use values from existing protection and coordination study from SSSR to complete calculations. Studies to be signed and sealed by Professional Engineer registered in British Columbia.

3.8 CLEANING

.1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section specifies the materials and installation for wire and box connectors, rated to 1000V.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 26 05 00 (Common Work Results - Electrical)

.3 Section 26 05 21 (Wires and Cables (0-1000V))

.4 Section 26 05 31 (Splitters, Junction, Pull Boxes & Cabinets)

.5 Section 26 05 32 (Outlet Boxes, Conduit Boxes and Fittings)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under the relevant payment item in Section 26 05 21 (Wires and Cables 0-1000V).

1.4 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA-C22.2No.18 latest edition, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.

.2 CSA C22.2No.65 latest edition, Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)

.1 EEMAC 1Y-2, latest edition, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

.3 National Electrical Manufacturers Association (NEMA)

1.5 SUBMITTALS

.1 At least twenty-eight (28) days prior to commencing work, provide submittals to Departmental Representative in accordance with Section 01 33 00 (Submittal Procedures).

.2 Product Data:

.1 Submit manufacturer’s printed product literature, specifications and datasheets and include product characteristics, performance criteria, physical size, materials, finish and limitations.

.2 Manufacturer’s Instructions: submit manufacturer’s installation instructions and special handling criteria, installation sequence, cleaning procedures and maintenance instructions and manuals.

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2No.65, with current carrying parts of copper alloy sized to fit copper conductors 10 AWG or less.

.3 Clamps or connectors for armoured cable, flexible conduit, as required to: CAN/CSA-C22.2No.18.

Part 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

- .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
- .2 Install mechanical pressure type connectors and tighten screws. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
- .3 Install fixture type connectors and tighten. Replace insulating cap.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This section specifies copper conductors rated 0-1000 Volts and the most common electrical insulation and covering materials.

.2 This section does not include fire rated building wire to ULC S139 and CSA C83, marine, hazardous, mining, instrumentation, communication and fire alarm wiring.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 26 05 00 (Common Works Results - Electrical)

.3 Section 26 05 20 (Wire and Box Connectors)

.4 Section 26 05 31 (Splitters, Junction, Pull Boxes & Cabinets)

.5 Section 26 05 34 (Conduits, Conduit Fastenings and Conduit Fittings)

.6 Section 26 05 43.01 (Installation of Cables in Trenches and in Ducts)

.7 Section 27 05 13 (Communication Services)

.8 Section 33 71 73.02 (Underground Electrical Service)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Temporary and Permanent low voltage electrical system components will not be measured individually. Permanent low voltage electrical system will be paid for under the Lump Sum price tendered for LV ELECTRICAL SYSTEM. Payment shall be full compensation for supply, installation, connection and testing of temporary and permanent low voltage electrical system complete with conductors, cables, connectors, terminations, outlet/conduit/junction/pull boxes, splitters, cabinets, conduit (including fastenings and fittings), cable trays, hangers, supports, lighting, emergency lighting, fire alarm system, electrical ducts, underground electrical service, disconnections and reconnections, and all work as described in the Drawings and as specified.

.2 Communication services will be measured to Section 27 05 13 (Communication Services), and payment shall include all costs in connection with supply and installation of communication services.

.3 Grounding will be measured to Section 26 05 27 (Grounding), and payment shall include all costs in connection with supply and installation of a complete grounding system.

1.4 REFERENCES

.1 CSA C22.2 No .0.3 latest edition, Test Methods for Electrical Wires and Cables.

.2 CAN/CSA-C22.2 No. 131 latest edition, Type TECK 90 Cable.

1.5 SUBMITTALS

.1 At least twenty-eight (28) days prior to commencing work, provide submittals to Departmental Representative in accordance with Section 01 33 00 (Submittal Procedures).

.2 Product Data:

.1 Provide cable splice kit datasheets and installation instructions.

.2 Submit manufacturer's printed product literature, specifications and datasheets and include product characteristics, performance criteria, physical size, materials, finish and limitations.

.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures and maintenance instructions and manuals.

1.6 GENERAL REQUIREMENTS

.1 Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) conduit for the general wiring systems unless otherwise indicated.

.2 Teck cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, Teck wiring up to 750 system volts to be PVC jacketed armoured cable, multi-copper conductor type Teck90 1000 volt having a PVC jacket with FT-4 flame spread rating.

.3 Flexible AC90 armoured cabling (BX) shall not be used for the general wiring system other than final drops to recessed light fixtures in concealed locations.

.4 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.

.5 Refer to Equipment Schedule(s) for detailed responsibilities.

Part 2 Products

2.1 WIRE AND CABLE GENERAL

.1 Conductors: stranded for 10 AWG and larger. Minimum size #12 AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE for above-ground applications and RWU90 XLPE for underground duct applications, jacketted.

.3 Site services sub-circuits, including site lighting, to be minimum #10 AWG for power and #12 for controls. Increase wiring size for lengthy and/or loaded circuits so that system will not exceed the maximum voltage drop as recommended by the Canadian Electrical Code CSA 22.1, latest edition.

.4 Splice kits:

.1 Watertight, inline, cold shrinkable, suitable for the cable and cable support method as indicated on the Drawings.

.2 No junction boxes shall be used to enclose the splice.

.5 Main feeders to be conduit and copper insulated wiring unless otherwise noted on drawings. Provide ground wiring for all conduits in or below slabs. Increase conduit size as required.

.6 Conductors to be colour-coded. Conductors No.10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No.8 gauge and larger may be colour-coded

with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and conduit fittings. Conductors not to be painted.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131 latest edition.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking aluminum.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 One hole steel straps 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 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight approved for TECK cable. Dry type connectors not accepted.

.2 Stainless steel or corrosion resistant aluminum.

2.3 TRAY CABLE

.1 General description: CSA Type TC-ER. Industrial grade tray cable, CSA approved as suitable for usage in cable trays, underground ducts and for limited exposed run without mechanical protection.

.2 Conductors:

.1 Grounding conductor: single, finely stranded copper.

.2 Circuit conductors: three or four, finely stranded copper, size as indicated.

.3 Insulation:

.1 Type: PVC/Nylon, 600 or 1000V

.4 Overall covering: Oil Resistant black PVC material.

.5 Fastenings:

.1 One hole steel straps 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 Existing cable trays, cable tie fastening.

.4 Buried/concealed raceways or duct banks.

.5 Threaded rods: 6 mm dia. to support suspended channels.

.6 Connectors:

.1 Watertight, strain relief, gland type approved for TC cable. Dry type connectors not accepted.

.2 Stainless steel or corrosion resistant aluminum. Composite or plastic not acceptable.

2.4 CONTROL CABLES

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket.

.2 Low energy 300 V control cable: solid annealed copper conductors sized as indicated, with TWH over each conductor and overall covering of PVC jacket.

.3 600 V type: stranded copper conductors, sizes as indicated with R90 (x-link) ethylene-propylene rubber insulation type over each conductor and overall covering of PVC jacket.

Part 3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

.2 In underground ducts in accordance with Section 26 05 34.

.3 All wires are to be pulled in together in a common raceway, using liberal amounts of lubricant.

.4 No combining of circuits onto common neutral will be permitted. Use 2 pole or 3 pole breakers for combined circuits, no connector clips will be allowed.

.5 Ensure that all single phase loadings are reasonably closely balanced over the main feeders.

3.2 INSTALLATION OF TECK CABLE 0 -1000 V

.1 Install cables.

.1 Group cables wherever possible on channels or in cable trays.

.2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.3 INSTALLATION OF TRAY CABLES

.1 Group cables wherever possible with spacing and separation as noted.

.2 Draw cables in raceways in accordance with Section 26 05 43.01

.3 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

3.4 INSTALLATION OF CONTROL CABLES

.1 Control cable and conduit will be supplied and installed by Mechanical Contractor. Controls wiring must be installed in conformance with Electrical Specifications. Install control cables in conduit.

.2 Ground control cable shield.

3.5 REMOVAL OF TEMPORARY WORK AFTER USE

.1 Disconnect, remove and return to Departmental Representative the temporary low voltage electrical cables after their use in the Work.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply, installation, connection and testing of grounding and bonding equipment to items that include, but are not limited to, crane beams and crane rails, utility vault covers and embedded frames, duct bank reinforcing steel, metallic parts in the new service tunnel section, cable tray and supports, steel channel, metallic piping, ladder rungs, sump beam and grating, service tunnel access hatches and embedded frames, as indicated on the Drawings.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 26 05 00 (Common Work Results - Electrical)

.3 Section 26 05 21 (Wires and Cables (0-1000V))

.4 Section 26 05 34 (Conduits, Fastenings and Fittings)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 Grounding components will not be measured individually. Grounding will be paid for at the Lump Sum price tendered for GROUNDING. Payment shall be full compensation for supply, installation, connection and testing of grounding rods and conductors complete with extensions, grounding lugs and connectors, and all work as described on the Drawings and in this Section.

1.4 REFERENCES

.1 CAN/CSA-C22.1, Canadian Electrical Code, Part 1, Safety Standards for Electrical Installations.

.2 CAN/CSA-C22.2 No. 41-M, Grounding and Bonding Equipment.

.3 CAN/CSA-C22.3 No. 2, General Grounding Requirements and Grounding Requirements for Electrical Supply Stations.

.4 CAN/CSA-W47.l, Certification of Companies for Fusion Welding of Steel.

.5 CAN/CSA-W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).

.6 CAN/CSA-W59, Welded Steel Construction.

1.5 SUBMITTALS

.1 At least twenty-eight (28) days prior to commencing work, provide submittals to Departmental Representative in accordance with Section 01 33 00 (Submittal Procedures).

.2 Product Data:

.1 Submit manufacturer’s printed product literature, specifications and datasheets and include product characteristics, performance criteria, physical size, materials, finish and limitations.

.2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures and maintenance instructions and manuals.

Part 2 Products

2.1 GROUND CONDUCTORS AND CONNECTORS

.1 2/0 AWG bare stranded soft annealed copper bonding conductors.

.2 #2 AWG green PVC insulated stranded soft annealed copper bonding conductors.

.3 Ground lugs: Approved Products: Burndy YAL-2TC or T&B 54112.

.4 Ground studs: Approved Products: Burndy GSTUD series or T&B TBGS series.

.5 Ground conductor connectors: Approved Products: Burndy YGHC2-C2 or T&B CTP series.

.6 Ground conductor splices: Approved Products: Burndy YGS or T&B 53512.

.7 Rebar ground clamps: Approved Products: Burndy GAR3902-BU or T&B 54760.

.8 Pipe ground clamps: Approved Products: Burndy GAR-TC/3902 or T&B 3905/3906-TB.

.9 Flexible braided bare copper jumpers: Approved Products: Burndy Braid or T&B FB type to suit.

.10 Other grounding connector types and sizes as required and approved by the Departmental Representative.

Part 3 Execution

3.1 GENERAL

.1 The Contractor shall install a complete and continuous grounding system.

.2 Grounding conductors shall be installed as indicated on the Drawings.

.3 For the permanent installation, separate grounding conductors shall be run in the service tunnel cable tray and in duct banks around the east end of the dry dock, with each grounding conductor connected to ground rods on either side with compression connectors.

.4 All exposed grounding conductors in the service tunnel shall be green PVC insulated stranded copper size #2 AWG.

.5 All embedded grounding conductors underground and in duct banks shall be bare stranded copper size 2/0 AWG.

.6 All embedded grounding conductors shall be adequately held in position while the concrete is poured.

.7 Protect exposed grounding conductors from mechanical injury during and after construction.

.8 Use mechanical connectors for grounding connections to equipment provided with lugs.

.9 Sharp bends in the conductor shall be avoided.

.10 Soldered joints are not permitted unless otherwise noted.

.11 Threaded grounding studs are to be welded to crane rails to CSA W59-M.

.12 Flexible braided bonding jumpers shall connect utility vault covers and service tunnel access hatches to their respective embedded frames.

.13 Bond single conductor, metallic armoured cables to the cabinet at the supply end only. Break sheath continuity by inserting insulating sleeves in cables and by providing non-metallic entry plates at the load end.

.14 Install grounding connections for telephone, fire alarm, and intercommunication systems.

3.2 TESTING

.1 The Contractor shall test the installed grounding network prior to project completion to confirm the grounding integrity of the Work, as follows:

.1 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and the local authority having jurisdiction over the installation.

.2 Perform tests at all accessible grounding locations.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests and re-connect when tests are complete.

.5 Provide test results to Departmental Representative prior to burying ground conductors.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies U shape support channels either surface mounted. Suspended or set in poured concrete walls or ceilings.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 26 05 00 (Common Work Results - Electrical)

.3 Section 26 05 21 (Wires and Cables (0-1000V))

.4 Section 26 05 27 (Grounding)

.5 Section 26 05 34 (Conduits, Conduit Fastenings & Conduit Fitting)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under the relevant payment item in Section 26 05 21 (Wires and Cables 0-1000V).

1.4 REFERENCES

.1 CAN/CSA C22.1 No.126.1, Metal Cable Tray Systems.

.2 NEMA VE 1, Metal Cable Tray Systems.

.3 ASTM A36 Standard Specification for Carbon Structural Steel.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41mm, 2.5mm thick, surface mounted, suspended, or set in poured concrete walls and ceilings.

Part 3 Execution

3.1 INSTALLATION

.1 Secure equipment to surfaces with lead anchors or nylon shields as required.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.6 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at 1.5m on centre spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for splitters, junction boxes, pull boxes and cabinets.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 26 05 00 (Common Work Results - Electrical)

.3 Section 26 05 21 (Wires and Cables (0-1000V))

.4 Section 26 05 27 (Grounding)

.5 Section 26 05 34 (Conduits, Conduit Fastenings & Conduit Fitting)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under the relevant payment item in Section 26 05 21 (Wires and Cables 0-1000V).

1.4 REFERENCES

.1 Canadian Standards Association (CSA International)

.2 CSA C22.1, Canadian Electrical Code, Part 1.

.3 CSA C22.2 No. 40, Cutout, Junction, and Pull Boxes.

.4 CSA C22.2 No. 76, Splitters.

1.5 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Product Data: submit manufacturer's product data sheets indicating dimensions, materials, and finishes, including classifications and certifications.

.3 Shop Drawings: submit shop drawings for custom manufactured items showing materials, finish, dimensions, accessories, layout, and installation details.

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Corrosion resistant, metallic construction; Marine grade aluminum or stainless steel.

.3 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.4 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

.3 Corrosion resistant, metallic construction; Marine grade aluminum or stainless steel.

2.3 CABINETS

.1 Sheet steel cabinet, with full length hinged door, latch, lock, 2 keys, containing 19 mm G1S fir plywood backboard (if required) for surface or flush mounting as required.

.2 Include filtered vents and/or fan-cooling when enclosed equipment is heat producing.

.3 Corrosion resistant, metallic construction; Marine grade aluminum or stainless steel.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2 m above finished floor.

.3 Install terminal blocks as required.

.4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.

.2 Install size 2 identification labels indicating system name, voltage and phase, as appropriate to clearly indicate the enclosure use.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies rigid and flexible fasteners, fittings and installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 26 05 00 (Common Work Results - Electrical)

.3 Section 26 05 21 (Wires and Cables (0-1000V))

.4 Section 26 05 27 (Grounding)

.5 Section 26 05 34 (Conduits, Conduit Fastenings & Conduit Fitting)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under the relevant payment item in Section 26 05 21 (Wires and Cables 0-1000V).

1.4 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA C22.1, Canadian Electrical Code, Part 1.

.2 CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings.

Part 2 Products

2.1 OUTLET AND CONDUIT BOXES - GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.

.4 Blank cover plates for boxes without wiring devices.

.5 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 SURFACE CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

2.3 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.4 FITTINGS – GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of foreign materials.

.3 Conduit outlet bodies for conduit up to 35 mm. Use pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

Part 3 Execution

3.1 INSTALLATION

.1 Typical outlet box mounting heights are indicated in Section 26 05 00 or refer to wiring device and communication specification sections for particular mounting heights of outlet boxes where indicated.

.2 Support boxes independently of connecting conduits.

.3 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not to be used.

.4 All outlet boxes to be flush mounted in all areas.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies rigid and flexible conduits, fasteners, fittings and installation.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 26 05 00 (Common Work Results - Electrical)

.3 Section 26 05 21 (Wires and Cables (0-1000V))

.4 Section 26 05 27 (Grounding)

.5 Section 26 05 29 (Hangers and Supports for Electrical Systems)

.6 Section 26 05 32 (Outlet Boxes, Conduit Boxes and Fittings)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under the relevant payment item in Section 26 05 21 (Wires and Cables 0-1000V).

1.4 REFERENCES

.1 Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware: to CSA C22.2 No. 18.

.2 Rigid metal conduit (RMC): to CSA C22.2 No. 45.

.3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83.

.4 Rigid PVC conduit: to CSA C22.2 No. 211.2.

.5 Flexible metal conduit (FMC): to CSA C22.2 No. 56.

.6 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3.

1.5 BASIC WIRING METHODS

.1 Underground or in concrete exterior to building:

.1 All wiring shall be in Schedule 40 RPVC conduit.

.2 Concrete walls and slabs interior to building:

.1 All wiring shall be in Schedule 40 RPVC conduit.

.3 Motors, transformers and all vibrating equipment:

.1 Short (600mm to 1200mm) PVC jacketed flexible conduit with liquid tight connectors shall be used. Allow sufficient slack to avoid strain on connectors at extreme extension of equipment movement.

.4 Surface raceways - exterior:

.1 All surface raceways shall be UV compensated Schedule 40 RPVC conduit, protected from damage and excessive heating to the Departmental Representative's satisfaction.

1.6 LOCATION

.1 Electrical drawings are diagrammatic and do not show all conduits, wire, cable, etc. Electrical contractor to provide conduit, wire cable, etc., for a complete operating job to meet in all respects the intent of the drawings and specifications.

.2 Review the exact location criteria of each electrical outlet and device with the Departmental Representative prior to rough-in. Relocate any item installed without Departmental Representative confirmation as required by the Departmental Representative at no cost to the owner as long as the relocation is within 3m of the location originally shown on the electrical drawings.

.3 All junction boxes and other raceway access devices shall be mounted to avoid being visible from public areas. Obtain approval from Departmental Representative for any and all junction boxes that, due to the building design, cannot be concealed.

.4 All junction boxes mounted, out of necessity, on surface of solid walls shall be painted to match adjacent surface, with junction boxes painted to match designated systems.

Part 2 Products

2.1 RIGID PVC RACEWAY SYSTEM

.1 Rigid PVC fittings shall be of the same manufacturer as the conduit.

.2 All fittings with removable covers shall be complete with VC gaskets and brass securing screws and inserts. All metal components shall be brass or stainless steel.

2.2 RIGID METAL CONDUIT RACEWAY SYSTEM

.1 Rigid threaded metal conduits shall be installed as noted in drawings.

.2 All couplings and connection to enclosures shall used threaded fastening or locknuts; use of set screw type connections will not be accepted.

.3 Galvanized coating with easy pull internal treatment.

.4 All threads shall be tapered; Running threads will not be accepted.

.5 Factory formed threads shall be used where possible. When field threading is required, provide application of cold galvanizing paint or coating,

2.3 PVC JACKETTED FLEXIBLE CONDUIT

.1 PVC jacketed flexible conduit (liquid tight) shall be interlocking spiral aluminum conduit with continuous extruded PVC jacket.

.2 Conduit fittings shall be steel liquid tight type that fit over PVC jacket and seal uniformly all round.

2.4 FLEXIBLE ELECTRIC NON-METALLIC (ENT) TUBING

.1 Flexible electrical non-metallic tubing (ENT) **shall not** be used on this project.

2.5 OUTLET BOXES AND JUNCTION BOXES

.1 Except as noted for rigid PVC raceways, all outlet boxes and junction boxes shall be one piece formed or welded.

.2 Outlet boxes to be galvanized steel.

.3 Junction boxes to be galvanized steel or aluminum.

2.6 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1500mm oc.

.4 Threaded rods, 6 mm dia., to support suspended channels.

2.7 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

.3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.8 FISH CORD

.1 Polypropylene.

Part 3 Execution

3.1 INSTALLATION

.1 Use rigid PVC conduit underground, in corrosive areas, and surface mounted in wet areas not subject to damage.

.2 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.

.3 Minimum conduit size for lighting and power circuits: 19mm.

.4 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.5 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.6 Install fish cord in empty conduits.

.7 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.

.8 Dry conduits out before installing wire.

.9 Conduits shall be installed mechanically continuous from outlet to outlet and without pockets. All the necessary standard bushings, elbows and bends shall be provided. All conduit bends shall have a radius of not less than six (6) times the internal diameter of the conduit and in no case shall the equivalent of more than four quarter bends from outlet to outlet be made. For all conduit sizes to be used for low voltage raceway, the conduits shall have a minimum bending radius of 230mm.

.10 Conduit bends shall be made with no more than 10% flattening of the conduit. Bends shall be smooth throughout deformations.

.11 On surface wall runs, all conduit shall be installed in true vertical or horizontal direction and on ceilings in true 90 degree angles or parallel to the walls. Crossings of conduits shall also be made at 90 degree angles. Parallel running conduit shall be kept on equal spacing on the entire length of run including bends.

.12 All conduits shall be fastened to structure with steel straps (no cast type straps allowed).

.13 Raceways extending out concrete slabs shall be securely protected using rebar stubs or similar material. All duct stubs are to be kept sealed during construction

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Group conduits wherever possible on suspended or surface channels.

.3 Do not pass conduits through structural members except as indicated.

.4 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.3 CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines.

3.4 CONDUITS IN CAST-IN-PLACE OR PRECAST CONCRETE

.1 Locate to suit reinforcing steel. Install in centre one third of slab.

.2 Protect conduits from damage where they stub out of concrete.

.3 Install sleeves where conduits pass through slab or wall.

.4 Provide oversized sleeve for conduits passing through waterproof membrane, before membrane is installed. Use cold mastic between sleeve and conduit.

.5 Do not place conduits is slabs in which slab thickness is less than 4 times conduit diameter.

.6 Encase conduits completely in concrete with minimum 25 mm concrete cover.

.7 Organize conduits in slab to minimize cross-overs.

.8 Do not install conduits in slabs/concrete floors in lab areas.

3.5 CONDUITS IN CAST-IN-PLACE OR PRECAST SLABS ON GRADE

.1 Run conduits 25 mm encased in 75 mm concrete envelope.

3.6 CONDUITS UNDERGROUND

.1 Slope conduits to provide drainage.

.2 Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

3.7 EXPANSION COUPLINGS

.1 Provide expansion/deflection couplings in concrete ductbanks where noted in drawings. Coordinate with structural details for location of seismic joints and orientation. Conduit shall maintain full diameter throughout joint and shall not be reduced or increased.

.2 Install RPVC expansion joints where RPVC conduit emerges from ground and is secured to a building, wall or similar immovable object to ensure the RPVC conduits do not shear or break due to settlement.

.3 Install RPVC expansion joints where RPVC is surface mounted and subject to excessive expansion or contraction as determined by Canadian Electrical Code.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 00 (Common Work Results – Electrical)

.2 Section 26 05 21 (Wires and Cables (0-1000V))

1.2 MEASUREMENT AND PAYMENT PROCEDURES

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under the relevant payment item in Section 26 05 21 (Wires and Cables (0-1000V)).

.2 Concrete duct banks and vaults (pull pits) will be paid under Section 33 65 73 (Concrete Duct Banks and Vaults).

1.3 REFERENCES

.1 Insulated Cable Engineers Association, Inc. (ICEA)

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for cables and include product characteristics, performance criteria, physical size, finish and limitations.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 10 - Product Requirements with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off the ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.4 Store and protect cables from nicks, scratches, and blemishes.

.5 Replace defective or damaged materials with new.

Part 2 Products

2.1 MARKERS

.1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

.2 Stainless steel or bright bronze material. Cast in place or epoxied flush to final surface level.

2.2 CABLE PROTECTION

.1 Heavy duty mechanical protection and suitable warning signage for any temporary surface run cables over ground.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for cable installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension. Pulling tensions to cable manufacturer’s requirements and guidelines.

.5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.6 Install plugs and cap both ends of ducts to prevent entrance of foreign materials during and after construction.

.7 Pull through each duct wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign material.

.1 Pull stiff bristle brush through each duct immediately before pulling-in cables.

.8 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.9 After installation of cables, seal duct ends with duct sealing compound.

3.3 MARKERS

.1 Install markers into the concrete slab around the manhole, indicating the direction of the duct banks leaving each manhole.

.2 Coordinate with concrete installer to ensure anchor dowels are coordinated with any rebar installed in the slab.

3.4 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Perform tests using qualified personnel.

.1 Include necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds.

.1 Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Acceptance tests:

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

.7 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.6 PROTECTION

.1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.4 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include time-current characteristic curves for breakers with ampacity of 100A and over.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips as noted.

.5 Circuit breakers with interchangeable trips as indicated.

.6 Circuit breakers to have minimum 10kA symmetrical rms interrupting capacity rating or as noted in drawings or panel schedules.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 OPTIONAL FEATURES

.1 Refer to drawings, single lines and panel schedules for features to be included on moulded case breakers.

Part 3 Execution

3.1 INSTALLATION

.1 Install circuit breakers in switchboard or panel board assemblies as noted in drawings.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for fused and non-fused disconnect switches.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CAN/CSA C22.2 No.4-latest edition, Enclosed Switches.

.2 CSA C22.2 No.39-latest edition, Fuseholder Assemblies.

1.3 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 (Submittal Procedures).

Part 2 Products

2.1 DISCONNECT SWITCHES

.1 Fusible, non-fusible, horsepower rated disconnect switch in CSA Enclosure type 2 or as indicated.

.2 Provision for padlocking in off switch position by three locks.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated.

.5 Fuseholders: suitable without adaptors, for type and size of fuse indicated.

.6 Quick-make, quick-break action.

.7 ON OFF switch position indication on switch enclosure cover.

.8 Provide auxiliary Form-C contacts on switch operating mechanism where noted in drawings.

.9 Provide mechanical key interlocking scheme were noted in drawings.

.10 Exterior mounted disconnect switches shall be NEMA 4X rated.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 Common Work Results - Electrical.

Part 3 Execution

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses if applicable.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

1.2 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 UL61010B-1 Measuring, Testing and Signal Generation Equipment

.2 CAN3-C17- latest edition, Alternating - Current Electricity Metering

.2 National Electrical Manufacturers Association (NEMA)

.1 NEMA ICS 1-2000 (R2008), Industrial Control and Systems: General Requirements.

.3 International Electrical Standards (IEC)

.1 IEC62052-11: Electricity metering equipment (AC) – general requirements, tests and test conditions

.2 IEC61010-1 (EN61010-1): Safety requirements for electrical equipment for measurement, control, and laboratory use

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Shop Drawings:

.1 Include schematic, wiring, interconnection diagrams.

.2 Provide certificate of Revenue Canada Approval for devices requiring compliance and sealing.

1.4 QUALITY ASSURANCE

.1 Conduct tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

1.5 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

Part 2 Products

.1 REMOTE TERMINAL UNIT (RTU)

.1 Communications

.1 The remote terminal unit shall be capable of the following communications methods simultaneously and independently:

.1 Ethernet over copper media.

.2 Serial

.1 RS-232

.2 RS-485

.3 Serial

.1 RS-485

.2 The remote terminal unit shall support any one of the following communications protocols on any one port at any one time:

.1 ION

.2 Modbus

.1 Modbus RTU

.2 Modbus TCP

.3 Modbus Mastering of serial RS485 slaves

.2 Power Supply

.1 95 to 240VAC (±10%) @ 47 to 440Hz / 120 to 310 VDC

.3 I/O Options

.1 Digital Meter shall be capable of having 8 digital inputs capable of ½ cycle timing resolution, and shall be fitted with 8 inputs.

Part 3 Execution

3.1 INSTALLATION

.1 Install devices as noted in drawings. All installations shall be fully integrated to main assemblies and shall be completely tested for operation prior to shipping to site.

.2 Connect devices to communications means as noted in drawings, typically copper Ethernet. All patch cables shall be STP (shielded twisted pair), CAT 6 with positively engaging locking tabs. Where optical fibre is noted in contract, provide a suitable media converter at both ends to connect Digital Meters to SCADA Ethernet network.

.3 Connect RTU to 120VAC UPS Source.

.4 Provide power supply fusing protecting each RTU independently. Fuses shall be mounted in flip-open style fuse holder that will also provide isolation means for RTU. Fuse holders shall be rated for disconnecting power supply under load.

3.2 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.

.2 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at time and check out operation of section.

.3 Manufacturer shall coordinate to provide a complete factory demonstration of fully operational equipment prior to disassembly and sending to site.

3.3 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for copper communication services.

Part 2 Products

2.1 POLYETHYLENE INSULATED CABLES

.1 Conductors 24 AWG soft copper made into cables as follows:

- .1 Number of pairs: 50.
- .2 Polyethylene, electric grade insulation.
- .3 Non-hygroscopic coloured binders.
- .4 Sheath:
  - .1 Flat aluminum tape formed longitudinally and lapped with outer jacket of extruded polyethylene.
  - .2 Inner polyethylene jacket, flat aluminum tape and outer polyethylene jacket.
  - .3 Inner polyethylene jacket, corrugated aluminum tape not overlapped, and soldered, with covering of thermoplastic compound and jacket of polyethylene.
  - .4 Inner polyethylene jacket, layer of spirally wound paper tape and extruded lead sheath.
- .5 Protective covering:
  - .1 Aerial tape armour of galvanized steel tape.
  - .2 Buried tape armour of steel tape, asphaltic compound, and two layers of coal tar anthracene oil impregnated jute.
  - .3 Light wire armour of galvanized steel armour wire over cutched jute, covered by two successive layers of asphaltic compound and coal tar anthracene oil impregnated jute.
  - .4 Single wire armour of two successive layers of asphaltic compound and coal tar anthracene oil impregnated jute, heavy galvanized steel armour wire and outer covering of asphaltic compounds and two layers of coal tar anthracene oil impregnated jute, with overall layer of asphaltic compound.
  - .5 Double wire armour of two layers of asphaltic compound and coal tar anthracene oil impregnated jute, two layers of heavy galvanized steel armour wire separated by layer of asphaltic compound and overall covering of two successive layers of asphaltic compound and coal tar anthracene oil impregnated jute.
  - .6 Inner jacket of polyethylene covered by 1% lead antimony jacket designed for ducts.

Part 3 Execution

3.1 INSTALLATION

.1 Install armoured cables in ducts using [wire rope sockets to protect outer sheath.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies the materials and installation for communication cables including shielded and unshielded twisted pair (STP and UTP) copper cables.

1.2 SCOPE

.1 Supply and installation of a data/communication cabling system, complete with complete with provision of cables, connectors, and patch panels as indicated on the drawings and as required for a complete and fully functioning system.

.2 Fibre Optic System to be in accordance with Section 27 05 15.

.3 The complete data/communications system installation is to be in accordance with EIA/TIA-568 Standards.

1.3 REFERENCES

.1 Canadian Standards Association, (CSA International)

.1 CSA-T529-latest edition, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568a with modifications).

.2 CSA-C22.2 No. 214-latest edition, Communications Cables (Bi-national Standard, with UL 444).

.3 CAN/CSA-C22.2 No. 182.4-latest edition, Plugs, Receptacles, and Connectors for Communication Systems.

.2 Telecommunications Industry Association (TIA)

.1 TIA/EIA-568-latest edition, Commercial Building Telecommunications Cabling Standards Set.

1.4 SYSTEM DESCRIPTION

.1 Structured system of telecommunications cables (copper) for distributing voice and data, including video signals.

.2 Installed in physical star configuration with separate horizontal and backbone sub-systems. Horizontal cables link work areas to telecommunications closet located on same floor. Telecommunications rooms linked to central equipment room by backbone cables.

Part 2 Products

2.1 CABLE AND CONNECTORS

.1 Each UTP and STP cable shall meet the requirements and will consist of four unshielded twisted pairs of 24 AWG (0.5mm) 100-ohm nominal characteristic impedance, solid round annealed copper conductors insulated with flame retardant polymer.

.2 All cables will be certified/approved by CSA Standard PCC FT4 flammability test and UL CMR.

.3 Where cables are drawn through conduits below grade or encased in ductbank they shall also have an OSP rating, suitable for wet locations.

.4 UTP cables will meet or exceed the requirements in the proposed National Electrical Manufacturers Association (NEMA) Standard for Low-Loss Extended Frequency Premises Telecommunication Cable. The cable will meet the performance requirements of Category cable of the Underwriters Laboratories Inc. specifications and cable surface markings shall indicate this classification.

.5 STP and UTP cabling indicated for data communications shall be Cat 6 rated.

.6 Cat 6 cabling used for SCADA or metering shall be STP.

.7 UTP cabling indicated for telephone only shall be Cat 5e.

2.2 COMMUNICATION OUTLETS AND TERMINAL CONNECTIONS

.1 Data/communications outlets are to consist of an enclosure with flush mounted outlets. Outlets to be complete with quantity of modular RJ45 jacks as indicated on plans.

.2 Cable runs will have 300mm length of cable left coiled up inside outlet box for termination of RJ45 jacks.

.3 All cables shall have all pairs connected using the EIA.TIA standard pin configuration 568A. When combined, telephone jacks are to mount in the top position of outlets, and data jacks in the lower position.

2.3 COVERPLATES

.1 Coverplates are to be brushed stainless steel in accordance with Section 26 27 26 complete with provision for data/communication jacks as indicated on plans.

.2 Cover plates to have 2, 4 or 6 cutouts for jacks.

.3 Provide blank filler plugs for all unused ports.

.4 The wall plates shall be clearly and permanently marked with icon identification for both service types as well as with clear identification of cable/termination numbers.

2.4 PATCH PANELS AND PATCH CORDS

.1 Provide wall or rack mounted horizontal path panels as noted in drawings. Patch panels are to be loose loaded, but fully fitted out with all jacks for the full capacity of the panel. 48 port high density in 2 Rack units (RU).

.2 Provide cable management rings for wall mounted patch panels.

.3 Provide horizontal wire management for rack mounted patch panels (1U in height).

.4 Provide hinged wall mounted blades for wall mounted patch panels.

.5 Label patch panel ports, indicating room locations of all outlets.

.6 Cross-connect ports shall be labelled to correspond to work station address and riser cable number.

.7 Provide cable support bars for wall mounted patch panels.

.8 Based on the functionality, the patch panels will be clearly labeled

2.5 IDC MOUNTING BLOCKS

.1 Voice horizontal cables shall be terminated onto Category 5e "BIX: style mounting blocks complete with BIX distribution connectors in telecommunications room.

.2 Provide BIX mounting blocks complete with BIX distribution connectors for termination of telephone inter-building cable, each end, for cross-connect to telephone horizontal field equipment.

.3 Label BIX connectors, indicating room locations of all outlets.

.4 Label riser cables.

2.6 GROUND BAR

.1 Label bus bar connections.

.2 All patch panels, racks, and cable trays must be bonded to ground with #6 Cu. green insulated ground wire.

2.7 LABELLING

.1 Labels on wall plates and patch panels computer printed, black lettering on white tape. Labelling identification numbering to be as directed by Owner's representative.

.2 All raceways shall be clearly and permanently marked at both ends to indicate destination and function. The markings shall be clearly visible after construction is completed.

.3 All empty raceways shall be clearly and permanently marked at both ends to indicate destination and function. The markings shall be clearly visible after construction is completed.

.4 Each cable shall be clearly marked with a permanent sequential identifier at each end of the cable. All horizontal cable terminations will be labelled at patch panels and at data/comm. outlets. Label of wiring to be the same identifier as the label at the termination point.

2.8 PERFORMANCE REQUIREMENTS

.1 The complete end-to-end installation, including jacks, cables, patch panels, and patch cords shall meet the industry standard performance parameters for enhanced Category 6 as recommended by CAN/CSA-T529, latest revision. Test parameters shall include: Attenuation, Return Loss, NEXT, Power Sum NEXT, ELNEXT, Power Sum NEXT, ELFEXT, ACR, Power Sum ACR, Propagation Delay, and Delay Skew.

Part 3 Execution

3.1 INSTALLATION OF HORIZONTAL DISTRIBUTION CABLES

.1 Communications raceway shall be minimum 20mm EMT conduit stubbed into accessible ceiling space. All cables shall be installed in conduit or cable tray and as indicated on the drawings.

.2 Wires and cable shall be as short as practical except that sufficient slack shall be provided to:

.3 Prevent undue stress on cable forms, wires, and connections.

.4 Enable network components to be removed and replaced during servicing without disconnecting other parts.

.5 Facilitate movement of equipment for maintenance purposes.

.6 Wires and cables shall be placed and protected to avoid contact with rough surfaces or sharp edges. Where wires or cables run through holes in metal, they shall be protected by suitable grommets or bushings.

.7 Clearance between cables and heat emitting or interference generating devices shall be such as to avoid deterioration of these wires and cables due to heat dissipation from these devices, and to comply with industry standards. In particular cables shall have a minimum separation of 150mm from unshielded power lines and 600mm from fluorescent lighting.

.8 The horizontal wiring shall be continuous with no splice points. Bridged taps are not permitted and there will be no cross-connects between the outlet and the patch panel.

.9 The maximum cable length for each run is 90 metres and will allow for 3 extra metres at the work station/field end and 7 extra metres for the patch cord/cross-connect end.

.10 Each cable shall be clearly marked with a permanent sequential identifier at each end of the cable. All horizontal cable terminations will be labelled at cross-connects and at telecommunications outlets. Labelling will include room number or patch panel as per labelling requirements reference.

.11 Horizontal conduit fill must comply with the Canadian Electrical Code requirements.

3.2 INSTALLATION OF BACKBONE CABLES

.1 Install wiring and devices as indicated on plans

.2 The cabling components installed in the structured cabling system shall be warranted for a minimum of 25 years from the date of installation against defects in materials and workmanship.

.3 Leave a pullstring in each data/communications outlet conduit.

.4 Provide bushings on all conduit ends.

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results - Electrical.

.2 Test intra-building telephone cable for continuity.

.3 All data/communications cables shall be tested using testing equipment approved for Category 5e installations.

.4 Testing shall be conducted by authorized representative of cable and hardware manufacturer.

.5 Tests shall be performed from termination block to wall outlet jack on horizontal cables.

.6 Testing set-up shall be for a channel test, maximum length of 95m.

.7 Testing shall include verification of labelling integrity.

.8 Test results shall be documented and shall include the following information in addition to the cable parameters:

.1 Cable ID

.2 Transmit and Receive locations

.3 Test Equipment used to complete the test

.4 Contractor's name

.5 Technician's name and signature

.6 Date test was performed

.7 Relevant additional comments

.9 The complete end-to-end installation, including jacks, cables and patch panels shall meet or exceed industry standard performance requirements for Category 6. Cable test parameters are to include: Attenuation, Return Loss, NEXT, Power Sum NEXT, ELFEXT, Power Sum ELFEXT, ACR, Power Sum ACR, Propagation Delay, and Delay Skew. Permanent Link Test is required.

.10 Provide verification of the pin outs to CSA T529, ISDN (T568A) configuration.

.11 Test results must include the Telecommunication Room number from which the cables terminate and indicate the following information:

.1 Telecommunication Room

.2 Room number of outlet box location

.3 Communication jack number.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for fibre optic cable systems

1.2 SCOPE

.1 Installation of a complete fiber optic cabling system, complete with provision of cables, connectors, and patch panels as indicated on plans.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

- .1 CSA-T529-latest edition, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/EIA TIA 568a with modifications).
- .2 CAN/CSA-C22.2 No. 182.4-latest edition, Plugs, Receptacles, and Connectors for Communication Systems.

.2 Telecommunications Industry Association (TIA)

- .1 TIA/EIA-568-latest edition, Commercial Building Telecommunications Cabling Standards Set.

1.4 DESCRIPTION OF SYSTEM

.1 Install a complete fiber optic data cabling system as defined on the drawings and in these specifications.

.2 The contract includes the supply and installation of cabling for a complete system, including but not limited to:

- .1 Raceways and wireway systems as indicated on plans.
- .2 Supply of fiber optic interconnect patch panels and components.
- .3 Installation of connectors and terminations for all fibers.
- .4 Testing of all fibers.

1.5 WARRANTY

.1 There shall be a minimum one year vendor warranty on all cables, components and equipment including installation. The one year warranty period begins upon substantial performance or when the system is fully functional, whichever is later.

1.6 PRODUCT DATA AND SHOP DRAWINGS

.1 Submit product data and shop drawings in accordance with Section 01 33 00 – Submittal Procedures. This includes any test results provided by the cable manufacturer, and cable test results as specified herein.

.2 Shop drawings to include dimensions and performance characteristics of equipment and cable routing diagrams.

1.7 MAINTENANCE AND OPERATIONAL DATA

.1 Provide maintenance data for all fiber optic cables and equipment for insertion into the project Operations and Maintenance Manual.

.2 Contractor shall supply the Departmental Representative with a complete, up-dated, and accurate set of "As-built" drawings at job completion. These drawings will form part of the project Operations and Maintenance Manual.

Part 2 Products

2.1 CONNECTORS

.1 All fiber connectivity components are to be included in contract.

.2 All fibers will be terminated using LC style epoxy connectors for multimode, and SC style 8º angle polished pigtails fusion spliced for single mode fibers.

2.2 FIBER OPTIC CABLES

.1 Fiber optic cables will be provided and installed by the electrical contractor.

.2 Fibre optic cables shall be:

.1 Singlemode: (strands as noted in drawings) 9µm/125µm indoor/outdoor distribution fibre.

.2 Multimode: (strands as noted in drawings) multimode 50µm/125µm indoor/outdoor distribution fibre.

.3 Provide WHMIS sheets for fiber cable supplied, showing characteristics of cable construction, etc.

2.3 PATCH PANELS

.1 All fibers will be terminated onto patch panels wall or rack mounted as noted.

.2 Electrical contractor is responsible for the supply of all required equipment and components including but not limited to the following:

.1 Cabinets and patch panels

.2 Splice trays

.3 Adapters, connectors, and pigtails

.4 Cable guides as part of an integrated cable management system

.5 Heat shrink sleeves

.3 Fiber splice panels shall be wall mounted.

.4 Fiber patch panels and splice trays shall be rack mounted.

2.4 NETWORK SWITCHES AND MEDIA CONVERTERS

.1 Copper based 1 Gigabit, industrial Ethernet switch. Port count as noted in drawings. Complete with fiber uplink port. Provide all required patch cables.

.2 Fiber to copper Ethernet media converter. Suitable for fiber type and connector style as noted in this documents. Connect as required. Provide all required patch cables.

Part 3 Execution

3.1 FIBER OPTIC CABLING – OTDR TESTING

.1 Test all fibers prior to and after installation to ensure fiber integrity.

.2 Arrange to obtain all required fiber optic cabling. This contractor is to terminate as necessary, and to perform optical time-domain reflectometer (OTDR) tests on cables intended for use on this project, prior to proceeding with, and after completion of installation, to ensure that the fiber optic cables are free from faults. Submit all test results to Departmental Representative.

.3 Transmission testing performance parameters:

Wavelength (nm)	Maximum Attenuation (dB/km)	Min. Information Transmission Capacity (MHz-km)
Multimode 850	3.2	1500
Multimode 1300	1.5	500
Single Mode 1310	1.0	N/A
Single Mode 1550	1.0	N/A

3.2 FIBER OPTIC CABLING – INSTALLATION

.1 Install all runs, terminations and patch panels in strict accordance with industry standards, grouped together by type and in sequence; top down and/or left to right.

.2 All fiber optic cables are to be installed in conduit or cable trays, for protection of cables.

.3 Do not apply excessive tension to the cable. Pulling tension shall be less than the cable manufacturer's recommendation.

.4 The cable shall be installed such that it will not be crushed or damaged during or after installation.

.5 Any damaged cable, or cable installed with excessive force will be replaced by the electrical contractor at no cost to the project.

.6 Do not exceed the minimum bend radius of 20 times cable outer diameter for installation, and 10 times cable outer diameter upon completion of the installation.

.7 Vertical run cables will be supported using intermediate tension relief as recommended by the manufacturer. Use a split wire mesh grip and install the cable from the top down. Vertical cables should be installed using a pulling grip to ensure the stress is placed on the cable itself and not the fiber.

.8 Cabling shall not be installed in 90º elbows or junction boxes unless the minimum bend radius requirements for the cable are met.

.9 If lubricant is used, ensure it meets the manufacturer's recommendations.

.10 Bushings and grommets shall be used on all metal ends, edges, and openings where cables pass through to ensure the cable is not damaged.

.11 Leave a minimum of 1.5m service loop each end of each cable at each point of termination.

.12 Cables will be continuous with no splice points.

.13 Label all individual cables.

.14 Install all fibre runs in separate conduits for other systems cables. Do not install fibre optic cables in conduits with copper cables.

.15 Terminate vertical cabling fibre at the top of each communications rack using LC terminations in a front serviceable fibre patch panel.

.16 Building entry fibre to terminate at the main communications rack using LC terminations in a front serviceable fibre patch panel.

3.3 INSTALLATION INSPECTION

.1 The completed installation will be inspected visually by the Departmental Representative prior to the commencement of functional and electrical performance testing. The installation will be inspected for compliance with the industry standards referenced above, and particular attention will be given to the following criteria:

- .1 Neatness, clamping and harnessing of cables and wiring.
- .2 Wire and cable management, identification, and labeling.
- .3 Overall system completeness.
- .4 Nameplates, identification plates and markings.
- .5 Construction and finishes.
- .6 System grounding
- .7 Mechanical installation including compliance with seismic restraint requirements.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies empty telecommunications raceway systems with either overhead, cabletrough or cellular distribution system.

1.2 SYSTEM DESCRIPTION

.1 Empty telecommunications raceways system consists of outlet boxes, cover plates, conduits, cable trays, pull boxes, sleeves and caps, fish wires, concrete encased ducts.

Part 2 Products

2.1 MATERIAL

.1 Conduits: in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

.2 Underground cable ducts: in accordance with Section 33 65 73 - Concrete Encased Ductbanks and Manholes.

.3 Cable trays: in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.

.4 Junction boxes and cabinets: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.5 Outlet boxes, conduit boxes, and fittings: in accordance with Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.

.6 Fish wire: polypropylene type.

Part 3 Execution

3.1 INSTALLATION

.1 Install empty raceway system, including distribution system, fish wire, terminal cabinets, outlet boxes, floor boxes, pull boxes, cover plates, conduit, sleeves and caps, cabletroughs, service poles, miscellaneous and positioning material to constitute complete system.

.2 All conduits left as empty or space must be marked at each end with the termination location.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies materials and installation for fire detection and fire alarm systems.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 26 05 00 (Common Work Results - Electrical)

.3 Section 26 05 21 (Wires and Cables (0-1000V))

.4 Section 26 05 27 (Grounding)

.5 Section 26 05 31 (Splitters, Junction, Pull Boxes & Cabinets)

1.3 MEASUREMENT AND PAYMENT PROCEDURES

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under the relevant payment item in Section 26 05 21 (Wires and Cables (0-1000V)).

1.4 REFERENCES

.1 NBC-latest edition, National Building Code of Canada.

.2 Government of Canada

.1 TB OSH Chapter 3-03, latest edition, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire protection Electronic Data Processing Equipment.

.2 TB OSH Chapter 3-04, latest edition, Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC-S524-latest edition, Installation of Fire Alarm Systems.

.2 ULC-S525- latest edition, Audible Signal Appliances.

.3 CAN/ULC-S526- latest edition, Visual Signal Appliances, Fire Alarm.

.4 CAN/ULC-S527- latest edition, Control Units.

.5 CAN/ULC-S528- latest edition, Manual Pull Stations.

.6 CAN/ULC-S536- latest edition, Inspection and Testing of Fire Alarm Systems. .10 CAN/ULC-S537- latest edition, Verification of Fire Alarm Systems.

1.5 DESCRIPTION OF SYSTEM

.1 Existing fire alarm system is Edwards EST3 networked system with addressable zones and adequate capacity for the additional zones required.

.2 System is fully supervised, microprocessor-based, fire alarm system, utilizing digital techniques for data control and digital and multiplexing techniques for data transmission.

.3 System to carry out fire alarm and protection functions; including receiving alarm signals; initiating general alarm; supervising components and wiring; actuating annunciators and auxiliary functions; initiating trouble signals and signalling to fire department.

.4 The system is fully addressable, zoned, non-coded single stage.

.5 System to be modular in design to allow for future expansion.

.6 Operation of system shall not require personnel with special computer skills.

.7 Emergency Alarm pullstations and annunciation devices are connected to the fire alarm system. Under and Emergency event (blue pullstation) the appropriate strobe is illuminated, horns sound and an automatic call is made to first responders. This is a functionality of the existing system. New Emergency Alarm devices will tie to the existing system as a new zone with this functionality.

.8 Existing system includes:

.1 Central Control Unit in separate enclosure with power supply, stand-by batteries, central processor with microprocessor and logic interface, main system memory, input-output interfaces for alarm receiving, annunciation/display, and program control/signalling.

.2 Power supplies.

.3 Initiating/input circuits.

.4 Output circuits.

.5 Auxiliary circuits.

.6 Wiring.

.7 Manual and automatic initiating devices.

.8 Audible and visual signalling devices.

.9 End-of-line resistors.

.10 Local and Remote annunciators and displays.

1.6 SCOPE OF WORK

.1 Supply and install field wiring, isolation modules, end of line devices and all required hardware and accessories for a complete and operational system as described in these documents.

.2 Provide all programming and verification services to complete the installation as noted in these documents. Existing verification reports and address mapping can be provided for the integrator at the time of installation for further coordination.

.3 Demolition of existing fire alarm system located at the East End of the dry dock, and the splitting of the existing addressable loop into a South and North Side system, including reprogramming of the Fire Alarm system to account for these changes.

.4 Reconnection of the existing pull station located near the fuel storage area.

.5 Test and provide verification report to Departmental Representative.

1.7 REQUIREMENTS OF REGULATORY AGENCIES

.1 System:

.1 To TB OSH Chapter 3-04.

.2 Subject to PWGSC Fire Protection Engineering Services approval.

.3 Subject to PWGSC Fire Protection Engineering Services inspection for final acceptance.

.4 To Canadian Forces Fire Marshal approval.

1.8 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include:

.1 Layout of equipment.

.2 Zoning.

.3 Complete wiring diagram, including schematics of modules, splices, connections, isolation and booster devices.

1.9 CLOSEOUT SUBMITTALS

.1 Provide operation and maintenance data for Fire Alarm System for incorporation into manual.

.2 Include:

.1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.

.2 Technical data - illustrated parts lists with parts catalogue numbers.

.3 Copy of approved shop drawings.

.4 List of recommended spare parts for system.

1.10 EXTRA MATERIALS

.1 Include four (4) spare glass rods for manual pull box stations if applicable.

.2 Provide one spare device of each type used on site as part of this project.

1.11 MAINTENANCE

.1 Provide one year's free maintenance with two inspections by manufacturer during warranty period. Inspection tests to conform to CAN/ULC-S536. Submit inspection report to Departmental Representative.

Part 2 Products

2.1 MATERIALS

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer.

.2 In accordance with applicable CAN/ULC standards.

2.2 SYSTEM OPERATION

.1 Single stage operation. Operation of any alarm initiating device to:

.1 Cause audible signal devices to sound throughout building.

.2 Transmit signal to fire department via fire alarm transmitter.

.3 Cause zone of alarm device to be indicated on control panel and remote annunciator.

.4 Cause air conditioning and ventilating fans to shut down or to function so as to provide required control of smoke movement.

.5 Cause fire doors and smoke control doors if normally held open, to close automatically.

.2 Capability to program smoke detector status change confirmation on any or all zones in accordance with CAN/ULC-S527, Appendix C.

2.3 CONTROL PANEL

.1 Connect new zones to existing control panel.

2.4 END-OF-LINE DEVICES

.1 End-of-line devices to control supervisory current in alarm circuits and signalling circuits, sized to ensure correct supervisory current for each circuit. Open, short or ground fault in any circuit will alter supervisory current in that circuit, producing audible and visible alarm at main control panel and remotely as indicated.

2.5 GRAPHIC DISPLAY

.1 Update existing graphic display at the front entrance gate to support new zones and areas added. A CAD version of the existing graphic will be supplied to the fire alarm vendor for their use, but will require updates and verification work completed under this contract.

2.6 ISOLATION MODULES

.1 Addressable zone isolation modules.

.2 Edwards – “SIGA-IM”

2.7 RELAY MODULES

.1 Addressable relay modules.

.2 Edwards – “SIGA-CR”

2.8 WIRE AND CABLE

.1 Conductor Insulation: Minimum rating 300 volts. Single conductor RW90XLPE (X-link).

.2 Multi-conductor cables 105°C with outer PVC jacket, colour coded, FAS rated or similar suitable for installation in below grade raceways subject to expose to ocean water.

.3 Conductor sizes as follows:

.1 To initiating circuits: #18 AWG minimum, and in accordance with manufacturer's requirements.

.2 To signal circuits: #16 AWG minimum, and in accordance with manufacturer's requirements.

.3 To control circuits: #12 AWG minimum, and in accordance with manufacturer's requirements.

.4 Size all fire alarm wiring for maximum 3% voltage drop at maximum load at last device in run.

.4 All wiring to be copper.

.5 All wiring to be tag identified at the points of connection.

.6 Provide a ground conductor with all system wiring and bond all metal parts including device boxes.

.7 All fire alarm system wiring to be in conduit except short drops from ceiling junction box to detectors mounted in T-Bar ceiling may be rated fire alarm system cable.

Part 3 Execution

3.1 INSTALLATION

.1 Install systems in accordance with CAN/ULC-S524 and TB OSH Chapter 3-04.

.2 Locate and install manual alarm stations and connect to alarm circuit wiring.

.3 Locate and install detectors and connect to alarm circuit wiring. Do not mount detectors within 1 m of air outlets. Maintain at least 600 mm radius clear space on ceiling, below and around detectors.

.4 Connect alarm circuits to main control panel.

.5 Locate and install signal devices, bells, chimes, horns and visual signal devices and connect to signalling circuits.

.6 Connect signalling circuits to main control panel.

.7 Install end-of-line devices at end of alarm and signalling circuits.

.8 Install remote annunciator panels and connect to annunciator circuit wiring.

.9 Sprinkler system: wire alarm and supervisory switches and connect to control panel.

.10 Provide “SIGA-IM” isolation module at point where fire alarm cabling enters buildings.

.11 All initiating device wiring shall be Class ‘A’.

3.2 FIELD QUALITY CONTROL

.1 Perform tests as described herein and in accordance CAN/ULC-S537.

.2 Fire alarm system:

.1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors, and sprinkler system transmit alarm to control panel and actuate general alarm ancillary devices.

.2 Check annunciator panels to ensure zones are shown correctly.

.3 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of system.

.4 Manufacturer’s technician to verify all new devices and reconnected existing fire alarm system equipment and components in accordance with ULC Standard S537.

.5 Provide a Certification of Verification.

.6 After verification, demonstrate and spot test system as required by Departmental Representative and PWGSC Fire Protection Engineering Services.

.7 Class A circuits.

.1 Test each conductor on all circuits for capability of providing alarm signal on each side of single open-circuit fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

.2 Test each conductor on all circuits for capability of providing alarm signal during ground-fault condition imposed near midmost point of circuit. Reset control unit after each alarm function and correct imposed fault after completion of each test.

3.3 TRAINING

.1 Arrange and pay for on-site lectures and demonstrations by fire alarm equipment manufacturer to train operational personnel in use and maintenance of fire alarm system.

END OF SECTION

1. PART 1 – GENERAL

1.1 Description

.1 This Section covers the blasting, excavation, removal and disposal of rock to form excavations as described on the Drawings.

.2 In the event that the Contractor elects to use blasting as an alternate method for demolition of concrete structures, the provisions and requirements in this Section shall apply for Submittals, Definitions and Execution for blasting work.

1.2 Related Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 35 33 (Health and Safety Requirements)

.3 Section 01 74 19 (Waste Management and Disposal)

.4 Section 02 41 16.01 (Structure Demolition)

.5 Section 03 39 00 (In-situ Concrete Structures)

.6 Section 31 23 33.01 (Excavating, Trenching and Backfilling)

.7 Section 31 68 00 (Rock Anchors)

1.3 Measurement and Payment Procedures

.1 Controlled Blasting will be measured in square metres of the area of Minimum Lines of Excavation in rock (only for vertical or near-vertical faces that have been excavated by Controlled Blasting methods) as shown on the Drawings, below original rock horizon, but only where rock excavation **exceeds** 2.0 m in height. Controlled Blasting will not be measured where rock excavation is less than 2.0 m in height.

.2 Controlled Blasting will be paid for at the unit price tendered for ROCK EXCAVATION: CONTROLLED BLASTING. Payment for Controlled Blasting shall include for all costs in connection with Controlled Blasting.

.3 Controlled Excavation will be measured in square metres of the area of Minimum Lines of Excavation in rock (only for horizontal or near-horizontal faces that have been excavated by Controlled Excavation methods) as shown on the Drawings.

.4 Controlled Excavation will be paid for at the unit price tendered for ROCK EXCAVATION: CONTROLLED EXCAVATION. Payment for controlled Excavation shall include for all costs in connection with Controlled Excavation.

.5 Measurement of volume for excavation of rock shall be calculated from vertical cross-sections developed from field surveys of original rock horizon and rock/concrete interface behind existing concrete structures (after concrete

demolition), to Minimum Lines of Excavation shown on the Drawings, except where otherwise directed by Departmental Representative. Cross-sections shall be produced at spacings no greater than 5.0 m intervals along the excavated surface. Rock excavation volume will be measured in cubic metres of rock excavated, computed from the aforementioned cross-sections. The field surveys shall be performed so that:

.1 Surveyed points on the excavated rock surface are spaced no more than 2.5 m apart in each orthogonal direction across the excavated rock surface.

.2 Each surveyed point on the excavated rock surface is representative of the average rock surface within 1.0 m radius of that surveyed point.

.6 Rock excavation will be paid for at the unit price tendered for ROCK EXCAVATION: GENERAL. Payment for rock excavation shall include for all costs in connection with rock excavation (other than controlled blasting), including drilling, protection, blasting, excavation, shoring (including shotcrete and temporary anchors), scaling and hauling to designated disposal site. .No separate payment will be made for shoring support of excavations or for underpinning of structures.

.7 No measurement or payment will be made for rock excavation beyond the Minimum Lines of Excavation.

.8 No measurement or payment will be made for temporary anchors. Refer to Section 31 68 00 (Rock Anchors) for definition of “temporary anchors”.

.9 Overburden bulk excavation will be measured to Section 31 23 10 (Excavating, Trenching and Backfilling), and payment shall include all costs in connection with bulk excavation of overburden materials.

.10 Demolition of concrete structures will be measured to Section 02 41 16.01 (Structure Demolition), regardless of the Contractor’s chosen method of demolition.

.11 No measurement or payment will be made for Blasting Survey and Monitoring as described in Clause 1.8 of this Section. Blasting Survey and Monitoring shall be considered incidental to the work.

1.4 References

.1 British Columbia Ministry of Transportation and Infrastructure (MoT): Standard Specifications for Highway Construction, Section SS204 – Rock Cuts.

.2 WorkSafeBC Occupational Health and Safety Regulation, Part 21 (Blasting Operations), issued by the Workers Compensation Board of British Columbia.

.3 Explosives Act (Canada).

.4 Transportation of Dangerous Goods Act, 1992 (Canada).

1.5 Definitions

.1 Rock: Any solid natural material (not concrete) in excess of 0.25 m^3 and which cannot be removed by means of heavy duty mechanical excavating equipment with a 0.95 m^3 bucket. Frozen material will not be classified as rock.

.2 Overburden: Soil material that is not rock.

.3 PPV: Peak particle velocity.

.4 Minimum Line of Excavation: Line or plane, as indicated on the Contract Drawings, beyond which no soil or rock will be permitted to protrude into the structural concrete.

.5 Controlled Blasting: Controlled use of explosives and accessories in carefully spaced and aligned production and perimeter drill holes (e.g. by pre-shearing, cushion blasting or other smooth-wall drilling and blasting techniques) with light charges and close spacing, to produce the specified rock excavation within the Minimum Line of Excavation with minimal overbreak, to minimize damage to the rock remaining in place, to minimize flying rock (fly rock), and to minimize damage to nearby existing structures and facilities.

.6 Controlled Excavation: Use of Controlled Blasting method(s) and/or mechanical excavation method(s) to produce the specified rock excavation within the Minimum Line of Excavation with minimal overbreak at horizontal (or near-horizontal) bottom surfaces of excavation.

.7 For definitions of Temporary Anchors and Permanent Anchors, refer to Section 31 68 00 (Rock Anchors).

1.6 Submittals

.1 Blasting Consultant: Submit, in accordance with Section 01 33 00 (Submittal Procedures), the name and qualifications of proposed Blasting Consultant who is not an employee of Contractor or an explosives provider, having a minimum five (5) consecutive years of demonstrated experience in preparing successful blast designs, for at least three (3) similar projects. Include reference name and full contact information for each project. Do not proceed with blast designs until Blasting Consultant is accepted by Departmental Representative.

.2 Rock Excavation Crew: Submit, in accordance with Section 01 33 00 (Submittal Procedures), the names and qualifications of proposed personnel for drilling and blasting activities. Written qualifications for the Blaster of Record (as defined by WorkSafeBC Part 21) shall include, at a minimum, a current blaster's certificate issued by the Workers Compensation Board (WorkSafeBC). Proposed drillers and blasters shall have a minimum of five (5) consecutive years of demonstrated experience in rock excavation and blasting work for at least three (3) projects. Include reference name and full contact information for each project. Do not proceed with rock excavation or blasting work until drillers and blasters are

accepted by Departmental Representative.

.3 Blasting Operation: Submit to Departmental Representative and local authorities having jurisdiction for approval, written proposal of operations for removal of rock by blasting and by other methods, in accordance with Section 01 33 00 (Submittal Procedures):

.1 Indicate proposed method of carrying out work, types and quantities of explosives to be used, loading charts and drill hole patterns, type of caps, blasting techniques, Controlled Blasting methods (e.g. light charges and close spacing), Controlled Excavation methods (e.g. mechanical excavation), and blast protection measures for items such as fly rock, vibration, dust and noise control. Include details of protective measures, blast blankets, personnel access restrictions, time of blasting, and other pertinent details.

.2 Submit complete records of each blast to Departmental Representative by noon of the day following each blast. Maintain complete and accurate record of drilling and blasting operations and vibration monitoring.

.3 Submit recommendations and reports prepared by Blasting Consultant for design and revision of blasts, within twenty-four (24) hours of each site visit by the Blasting Consultant.

1.7 Qualifications

.1 Retain Blasting Consultant to design, program and supervise blasting work, to revise blasting design based upon results of blasts, and to determine precautions, preparation and operational techniques.

.2 Retain experienced Rock Excavation Crew.

1.8 Blasting Survey and Monitoring

.1 Departmental Representative, Contractor and Blasting Consultant will jointly visit property holders of buildings and structures adjacent to (and within) the Esquimalt Graving Dock, to describe blasting and seismic recording operations and obtain their permission for setting up seismographs.

.2 Contractor shall perform pre-blast and post-blast surveys of all buildings and structures within 100 m of the work site perimeter. The pre-blast survey shall indicate the pre-blast condition of the buildings and structures, and shall include an assessment of possible damage due to blasting. Contractor shall submit the pre-blast survey to Departmental Representative at least twenty-eight (28) days prior to start of blasting work, and Contractor shall ensure that the Blasting Consultant takes the pre-blast survey assessment into account in blasting design. Contractor shall submit the post-blast survey to Departmental Representative within fourteen (14) days of completion of blasting work.

.3 Conduct seismographic (vibration) monitoring continually during entire progress of blasting operations.

.4 Monitor the existing East End Retaining Wall (and the existing adjacent "mural" retaining wall), including monitoring of vibration and movements, on a continual basis to ensure satisfactory performance and safety during the blasting work. If any adverse effects from the blasting work are recorded or observed, the Contractor shall stop blasting work immediately, notify Departmental Representative, and modify the blasting method as corrective action to the satisfaction of Departmental Representative. Refer to Section 31 23 33.01 (Excavation, Trenching and Backfilling) for design of temporary shoring at soil excavations.

1.9 Blasting and Vibration Control

.1 Reduce ground vibrations to avoid damage to structures and remaining rock mass. Control blasting so that at least 50% of perimeter hole traces are visible after each blast. Revise blast plan as necessary to achieve this requirement.

.2 Blasting is not permitted within a distance of 25 m from fresh concrete, shotcrete or grout poured within twenty-four (24) hours. Maximum PPV not to exceed 25 mm/s measured at face of fresh concrete, shotcrete or grout after twenty-four (24) hours and less than seven (7) days from concrete placement.

.3 Maximum PPV from blasting is not to exceed 50 mm/s at nearest building.

.4 Maximum PPV from blasting is not to exceed 100 mm/s at nearest unreinforced concrete wall and floor of existing dry dock.

.5 Maximum PPV from blasting is not to exceed 100 mm/s at nearest reinforced concrete structure.

.6 Maximum air-blast overpressure is not to exceed 0.34 kPa (140 dB) at nearest building.

.7 Complete blasting before any structural element including unreinforced and reinforced concrete is installed within 50 m of blast holes.

.8 Contractor's Blasting Consultant shall be on site for every blast to observe performance of the work. Subject to satisfactory performance of the blasting work, Departmental Representative may, at their sole discretion, allow this requirement to be relaxed after the first five (5) blasts.

2. PART 2 – PRODUCTS – NOT USED

3. PART 3 – EXECUTION

3.1 Warning and Protection

.1 Inform occupants of adjacent buildings (within 100 m of the blasting work) of upcoming blasting work at least four (4) hours ahead of time. Post guards, sound warnings and display signs when blasting is to take place.

.2 Prevent damage to surroundings and prevent injury to persons.

.3 Maintain minimum safe distance for all personnel during blasting operations. Design blasts to take into account potential impacts on all parties, such as: public safety; adjacent private residences and public buildings; PWGSC and DND personnel, equipment and buildings; other dock users and contractors.

.4 For all blasts, utilize blast mats or approved alternative protection.

.5 Install blast mats (with edge seals) to prevent dust from entering the dock services tunnel. Note that the existing dock services tunnel is the source of clean dust-free air for the EGD electrical substations, and it is imperative that this air source not become contaminated with air-borne dust particles.

.6 Maintain the permanent and temporary services in safe and fully functional condition throughout the duration of construction.

1. Protect services from damage caused by rock excavation (blasting). Visually inspect services once every working day during rock blasting operations, and weekly when no rock blasting is taking place. Repair all damage within twenty-four (24) hours of its occurrence, or as soon thereafter as possible.
2. All costs associated with maintenance, protection, inspection and repairs to the temporary and services shall be borne by Contractor, at no extra cost to the Owner.

3.2 Excavation and Rock Removal

.1 Co-ordinate the work of this Section with Section 01 35 33 (Health and Safety Requirements).

.2 Excavate rock to the Minimum Lines of Excavation as shown on the Drawings.

.3 Do blasting operations in accordance with local and provincial codes, health and safety regulations, and to WorkSafeBC Part 21 “Blasting Operations”. Comply with the requirements of the “*Explosives Act (Canada)*” and the “*Transportation of Dangerous Goods Act, 1992 (Canada)*”.

.4 Perform all operations in general accordance with MoT SS204. However, in case of conflict between this Section and MoT SS204, this Section shall take precedence.

.5 Use rock excavation and removal procedures appropriate to the rock conditions to produce uniform and stable excavation surfaces, to minimize overbreak beyond the Minimum Lines of Excavation, to minimize fracture of rock mass outside the Minimum Lines of Excavation, and to avoid damage to adjacent structures.

.6 Controlled Blasting: At perimeter vertical (or near vertical) faces of rock excavation use Controlled Blasting method(s). Depth of perimeter holes shall be maximum 8.0 m below working surface, with depth of production holes adjusted to suit this limit. Refer to Clause 1.5.5 for definition and scope of Controlled Blasting.

.7 Controlled Excavation: At horizontal (or near horizontal) bottom surfaces of rock excavation use Controlled Excavation method(s). Refer to Clause 1.5.6 for definition and scope of Controlled Excavation.

.8 Prepare rock surfaces which are to bond to concrete, by scaling, pressure washing and broom cleaning surfaces to remove all loose material.

.9 Remove boulders and fragments which may slide or roll into excavated areas.

.10 Immediately after each blast, install temporary anchors for rock support as required to comply with the Contractor's responsibility for safety under WorkSafeBC regulations, and in accordance with Section 01 35 33 (Health and Safety Requirements). For requirements related to temporary anchors, refer to Section 31 68 00 (Rock Anchors).

.11 Correct unauthorized rock excavation or accidental removal of rock, at no extra cost, by placing unreinforced concrete in the space between the Minimum Lines of Excavation and the excavated rock surface, of the same concrete Type as for the structural concrete pour and integral with the structural concrete pour, in accordance with Sections 03 30 00 (Cast-in Place Concrete) and Section 03 39 00 (In-situ Concrete Structures).

.12 Correct unauthorized or accidental removal of existing concrete, at no extra cost, by placing unreinforced concrete in the space between the Minimum Lines of Excavation and the excavated concrete/rock surface, of the same concrete Type as for the structural concrete pour and integral with the structural concrete pour, in accordance with Sections 03 30 00 (Cast-in Place Concrete) and Section 03 39 00 (In-situ Concrete Structures).

3.3 Rock Disposal

.1 Dispose of excavated rock off site, except where otherwise approved in writing by Departmental Representative.

.2 Dispose of excavated rock only at approved disposal site(s). Do not dispose of excavated rock into landfill. Excavated rock to be disposed off site shall be transported to appropriate disposal location, as approved by Departmental Representative.

.3 All transportation manifests for rock leaving the work site shall be collected and submitted to Department Representative on a daily basis.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This is a general Section applicable to Sections 22 20 00 (Site Services), 33 05 13 (Manholes and Catch Basins), 33 11 16 (Water Utility Distribution Piping), 33 41 00 (Storm Utility Drainage Piping), and Section 33 65 73 (Concrete Duct banks and Vaults).

.2 This Section also covers bulk excavation of overburden materials and is applicable to Section 01 35 103.43 (Special Procedures for Contaminated Sites), as required for the work and as shown on the Drawings.

.3 This Section describes details regarding bulk excavation from the Contractor's Work Site. Excavation includes completion of Required Excavation work to remove contaminated material from the work area (as shown on the Drawings). The excavation area limits are shown on the Drawings and Contractor shall take care to note offset areas from existing structures to prevent potential undermining of those structures.

.4 The Contractor is responsible for reviewing the information provided in the Specifications, the EMP, the EGD Environmental Best Management Practices (EBMPs) and other Contract Documents regarding nature of material, structural conditions and site access to be encountered at the Contractor's Work Site, and selecting appropriate land based excavation equipment that will allow for removal of this material.

.5 Specialized excavation techniques may be required to protect existing structures adjacent to the work.

.6 During Required Excavation activities, the Contractor shall implement best management practices (BMPs) to minimize potential for contamination to areas outside of the work area. The Contractor shall include details and descriptions of the BMPs that will be implemented to prevent contamination as part of the Construction Work Plan.

.7 The Contractor shall load excavated overburden materials directly into haul trucks that are lined to prevent leakage/spillage during transport. No temporary stockpiling of excavated materials is allowed.

.8 Descriptions of material to be excavated are provided in the Appendices and Reference Documents attached to the Specifications. The Contractor shall review this information and use it to inform the Contractor's work.

.9 The Contractor becomes the owner of, and is responsible for, any soil, sediment, excavated material, debris, waste, or other material once it is removed or excavated to be loaded onto a vehicle or vessel for transport to a Contractor provided Disposal Facility.

.10 The Contractor is responsible for selecting the appropriate excavation equipment and excavation means and methods that considers the site conditions (including equipment reach, and loading restrictions of the area adjacent to the excavation area), character of materials, facility usage, and existing structures adjacent to the excavation areas that may be encountered during excavation operations. By submitting its Tender, the Contractor acknowledges that it has carefully considered these conditions and other project considerations and included appropriate means and methods for excavation activities.

.11 Contractor shall conduct excavation activities in a manner that minimizes the generation of excavation residuals and potential for accumulation of excavation residuals within the excavation area.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 11 55 (General Instructions)

.3 Section 01 35 103.43 (Special Procedures for Contaminated Sites)

.4 Section 01 74 21 (Waste Management and Disposal)

.5 Section 22 20 00 (Site Services)

.6 Section 31 24 15 (General Fill)

.7 Section 32 11 16.01 (Granular Sub-Base)

.8 Section 32 11 23 (Aggregate Base Courses)

.9 Section 33 05 13 (Manholes and Catch Basins)

.10 Section 33 11 16 (Water Utility Distribution Piping)

.11 Section 33 41 00 (Storm Utility Drainage Piping)

.12 Section 33 65 73 (Concrete Duct banks and Vaults)

1.3 MEASUREMENT AND PAYMENT

.1 Payment for excavation shall be made on a Cubic Meter basis, as a part of the price tendered for overburden excavation and disposal, once all required excavation and certified disposal has been accepted (upon comparison of Contractor's pre-and post-construction surveys and excavation plan) by the Departmental Representative.

.2 The actual in-situ volume of excavated material the Contractor removes to achieve the required excavation elevation is dependent upon the Contractor's excavation means and methods. The Overexcavation Allowance is the maximum extent of excavation below the Required Excavation Elevation that the Contractor is allowed to remove to; excavation below the Overexcavation Allowance is Excessive Excavation. The Contractor shall select its means and methods to

conduct its excavation work to stay within the Overexcavation Allowance limits to the extent practicable. Should the Contractor's excavation means and methods result in Excessive Excavation, the Contractor shall account for potential Excessive Excavation volume in its pricing consideration and may be required to backfill Excessive Overexcavation at no cost to PSPC.

.3 For Tendering purposes, all excavated soil shall be considered to be classified as per the project specific Soil Classification Report contained in Appendix C.

.4 All costs associated with removal, handling and disposal of any encountered debris shall be considered incidental to the work and shall be included in the tender price for TYPE 1 OVERBURDEN BULK EXCAVATION AND DISPOSAL and TYPE 2 OVERBURDEN BULK EXCAVATION AND DISPOSAL.

.5 The method to be used to determine the measurement volume for overburden materials that are contaminated i.e. TYPE 1 OVERBURDEN BULK EXCAVATION, shall be to the approval of Departmental Representative.

.6 The measurement volume for overburden materials that are not contaminated, i.e. TYPE 2 OVERBURDEN BULK EXCAVATION, shall be calculated as the difference between the total bulk excavation measurement volume and the Type 1 volume

.7 No separate measurement or payment will be made for excavation associated with the work of Sections 22 20 00 (Site Services), 33 05 13 (Manholes and Catch Basins), 33 11 16 (Water Utility Distribution Piping), 33 41 00 (Storm Utility Drainage Piping), and 33 65 73 (Concrete Duct Banks and Vaults). Measurement or payment for bulk excavation of overburden materials will be made under this Section.

.8 No separate payment will be made for shoring support of excavations or for underpinning of structures.

.9 Measurement and payment for granular fills is covered under Section 31 24 15 (General Fill), Section 32 11 16.01 (Granular Sub-Base) and Section 32 11 23 (Aggregate Base Courses).

.10 Measurement and payment for Rock excavation is covered under Section 31 23 16.26 (Rock Excavation).

1.4 REFERENCES

.1 ASTM Cl17, Test Method for Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soils Using Modified Effort (56,000 ft-lb/ft3 (2,700 kN-m/m3))

.4 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.5 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.6 Canadian Transportation of Hazardous Goods Act – Transportation of Hazardous Goods Regulation.

.7 British Columbia Environmental Management Act (SBC 2003, Chapter 53).

1.5 DEFINITIONS

.1 Excavation classes: two classes of excavation will be recognized; common excavation and rock excavation.

.1 Rock: any sound or solid mass material in excess of 1.0 cubic metre, of such hardness and texture that can only be effectively loosened or broken down by mechanical ripping equipment and/or by means of heavy duty excavation equipment. Frozen material is not classified as rock.

.2 Rock: Any solid natural material (not concrete) in excess of 0.25 m^3 and which cannot be removed by means of heavy duty mechanical excavating equipment with a 0.95 m^3 bucket. Frozen material will not be classified as rock.

.3 Common excavation: excavation of materials of whatever nature, which are not included under definitions of rock excavation, also known as "Soil".

.2 Minimum Line of Excavation: Line or plane, beyond which no soil or rock will be permitted to protrude.

1.6 SUBMITTALS

.1 Soil Management Plan: At least twenty-eight (14) days prior to commencing bulk excavation work, and in accordance with Section 01 33 00 (Submittal Procedures), submit for review by Departmental Representative design, drawings and supporting data prepared by qualified professional engineer registered or licensed in the Province of British Columbia, showing proposed method and sequencing of work and product data for excavation, shoring and underpinning for excavations. Soil Management Plan shall address removal of any surface vegetation, excavation of contaminated and non-contaminated overburden materials, and disposal off-site to an approved location suitable for Type 1 and Type 2 overburden material. The Soil Management Plan shall also contain the following information:

.1 Equipment Layout

.2 Reference to the construction work schedule that identifies timing and sequencing for completion of excavation, upland transportation and disposal activities, as they relate to other major elements of the work.

.3 Number, types, and capacity of equipment to be used.

.4 Upland transportation route to the Contractor provided Disposal Facility.

.5 Means and methods for excavation, upland transportation, and off-site disposal activities:

.6 BMPs proposed by the Contractor and/or as required the EGD Facility during excavation, upland transportation of excavated materials to the Contractor provided Disposal Facility.

.2 Daily Reporting: As part of the Daily Construction Report, as described in Section 01 33 00 (Submittal Procedures), the Contractor shall keep a daily record of the area(s) excavated, the estimated volume removed, Progress Surveys, and a summary of other details of the work. The Daily Construction Report shall be signed by the Contractor's site superintendent and quality control manager.

.3 Waste Reduction Work Plan: At least twenty-eight (14) days prior to start of bulk excavation work, submit detailed Waste Reduction Work Plan in accordance with Section 01 74 21 (Waste Management and Disposal) and indicate:

.1 Descriptions of types and anticipated quantities of materials to be salvaged, reused, recycled and land-filled.

.2 Schedule of excavation, shoring and underpinning.

.3 Number and location of dumpsters.

.4 Anticipated frequency of tippage.

.5 Names and addresses of hauliers, waste facilities and waste receiving organizations.

1.7 SITE INFORMATION

.1 Character of Materials:

.1 Subsurface investigations were performed to characterize the physical and chemical quality of the excavated material. Detailed results from geotechnical and chemical testing of the overburden and rock are provided in the attached Appendices and Reference Documents.

.2 The Contractor shall satisfy itself regarding the nature of materials present at the site prior to Tender. The type of materials encountered at the Contractor's Work Site may vary from the conditions described in the attached Appendices and reference drawings. Variations in the type of materials encountered may occur that do not differ materially from those indicated in the Specifications, and if encountered, will not be considered as basis for claims due to differing Work Site conditions.

.3 Hard material in its natural state is defined as material requiring blasting, and includes boulders or fragments too large to be removed in one piece by the excavation equipment, as well as till-like material that may be present within the Excavation Area. The Contractor shall anticipate that within the Required Excavation area, that there will be significant quantities of boulders and debris, which can potentially be removed in one piece by appropriately sized excavation equipment.

.2 Debris:

.1 Debris, such as rebar, cables, chains, straps, wood, and other man-made items, may be encountered during excavation operations. Some of this debris material may not be suitable for disposal at the authorized Disposal Facility(ies) with sediment, as the authorized Disposal Facility(ies) may require that waste slated for disposal as daily cover be free of rebar, cables, and other debris. The Contractor shall coordinate with the Disposal Facility(ies) to determine whether debris needs to be screened out of the sediment prior to upland transport and disposal. The Contractor shall provide all necessary debris removal screening, transport, and disposal, and the costs for this work shall be considered incidental to the work.

.2 Debris shall be disposed of at an authorized Disposal Facility and in accordance with Laws and Regulations.

.3 The Contractor shall immediately notify the Departmental Representative if any debris is encountered that is considered Hazardous Waste and the Departmental Representative will determine its disposition.

Part 2 Products

2.1 MATERIALS

.1 Bedding and surround of underground services: Granular material as specified in Sections 33 41 00 (Storm Utility Drainage Piping), 33 11 16 (Water Utility Distribution Piping).

.2 Other backfill material below subgrade level: General Fill to Section 31 24 15, or selected material from excavation on site, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

.3 During backfilling, Contractor shall, at his own cost, conduct ongoing quality control sampling and testing to confirm that the gradations, physical and chemical properties, and compaction of the specified backfill materials conform to the relevant Sections of the specification. All quality control test reports shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.4 During placement, Departmental Representative may, at his discretion, inspect the backfilled materials for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to Contractor, unless material does not conform, whereon the testing shall be at Contractor's expense.

.5 Failure of a sample to meet any one of the specified gradation and physical and chemical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative.

Part 3 Execution

3.1 SITE PREPARATION

.1 Prior to start of excavation work, remove obstructions, ice, snow, trees, shrubs and all organic matter from surfaces to be excavated.

3.2 PROTECTION OF EXISTING FEATURES

.1 Comply with Section 01 11 55 (General Instructions) and applicable local regulations to protect existing features.

.2 Existing buried/overhead utilities, retaining walls and buried structures:

.1 Several utilities exist within the work area, such as: electrical power, control and telecommunication lines; electrical duct banks; potable water lines; high mast lighting; fire protection mains; compressed air lines; sanitary sewers and storm water drains.

.2 Many utilities and structures exist within the adjacent areas of the Esquimalt Graving Dock facility.

.3 Protect existing buried/overhead utilities, retaining walls and buried structures from damage while work is in progress and repair damage resulting from work.

.4 Where excavations cross or run adjacent to existing utilities, hand excavate in the vicinity of the existing utilities to determine actual location.

.3 Existing buildings and surface features:

.1 Protect existing buildings, structures, fences, bench marks and monuments from damage while work is in progress and repair damage resulting from work.

3.3 SHORING, BRACING AND UNDERPINNING

.1 Engage services of a qualified Professional Engineer who is registered in B.C. to design and inspect shoring, bracing and underpinning required for work.

.2 Construct temporary works to depths, heights and locations as required for the Works, and as required by the relevant Authorities and Codes.

.3 Shotcrete, if used by Contractor as temporary shoring for excavations, may be left in place permanently, except in the top 0.5 m below final grade. Soil nails, if used by Contractor as temporary shoring for excavations, may be left in place permanently, provided any soil nails are at a minimum depth of 1.0 m below final grade at the shored face and for the full length of the soil nails behind the shored face.

.4 Sheet- piling, if used by Contractor as temporary shoring for excavations, shall not be left in place permanently

.5 During backfill operations:

.1 Remove sheeting and shoring from excavations, except as allowed otherwise in this Section.

.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.

3.4 DEWATERING AND HEAVE PROTECTION

.1 Keep excavations free of water while work is in progress.

.2 Protect open excavations against flooding and damage due to surface run-off.

.3 Dispose of water in a manner not detrimental to any portion of work completed or under construction. Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other contaminants prior to treatment and disposal in accordance with the Contractor's EPP and either Section 02 60 00.01 (Contaminated Sites Water Treatment – Onsite) or Section 02 60 00.08 (Contaminated Sites Water Treatment – Offsite).

3.5 UPLAND EXCAVATION

.1 Do all work in accordance with approved Soil Management Plan and Waste Reduction Work Plan (as described in Clause 1.6 of this Section).

.2 Excavate overburden soils to the minimum lines of excavation as shown on the Drawings, or if minimum lines of excavation are not shown excavate to lines, grades, elevations and dimensions as indicated.

.3 Transportation and disposal of bulk excavation of overburden materials is to be disposed off-site. Stockpiling of excavated soils is not permitted on-site. Contractor shall assume responsibility and include all costs for excavation, testing (as necessary), transport and disposal of all excavated soils as part of the project. For bidding purposes, all excavated soil shall be considered to be classified as per the project specific Soil Classification Report contained in Appendix C. The Contractor shall be responsible for all testing of soils as necessary for health and

safety, transport, disposal, and compliance with Laws and Regulations. In-situ testing or test-pitting prior to excavation will be permitted.

.4 Excavation must not interfere with the foundation bearing support area at existing adjacent footings, defined as being within lines extending downwards from bottom edges of the footing at 45° outward splay from the vertical plane.

.5 Soil at inverts of excavations to be undisturbed soil or fill, level, free from loose, soft or organic matter.

.6 Notify Departmental Representative when bottom of excavation is reached.

.7 Obtain Departmental Representative approval of completed excavation.

.8 Remove unsuitable material from trench bottom to extent and depth as directed by Departmental Representative.

.9 Where required due to unauthorized over-excavation, correct by backfilling with general fill compacted as specified in Section 31 24 15 (General Fill), or to the specified compaction density for the backfill material for which the excavation was being prepared, as appropriate to the situation.

.10 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.

3.6 BEDDING AND SURROUNDING OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated and as specified in Sections 33 41 00 (Storm Utility Drainage Piping), 33 11 16 (Water Utility Distribution Piping).

3.7 GENERAL BACKFILLING AND COMPACTION AT UPLAND EXCAVATIONS

.1 Do not proceed with backfilling operations at upland excavations until Departmental Representative has inspected and approved installations.

.2 Areas to be backfilled to be free from organic material, 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.

.5 Backfilling around installations.

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within twenty-four (24) hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 300 mm.

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

.1 Permit concrete to cure for minimum fourteen (14) days or until it has sufficient strength to withstand earth and compaction pressure, and approval has been obtained from Departmental Representative.

.2 If approved by Departmental Representative, erect bracing or shoring to counteract unbalanced loads, and leave in place until removal is approved by Departmental Representative.

.7 Compact general backfill as specified in Section 31 24 15 (General Fill).

3.8 RESTORATION

.1 Upon completion of work, remove surplus materials and debris, trim slopes, and correct defects as directed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section describes the supply and placement of otherwise unspecified fills in the Work, including trench backfill (between pipe surround and subgrade), and general backfill in excavations at the east end retaining wall and at other locations indicated on the Drawings.

.2 This Section also describes the supply and placement of general fill for the crane beam foundations.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 02 55 10 (Dust Control)

.3 Section 22 20 00 (Site Services)

.4 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.5 Section 32 11 16.01 (Granular Sub-Base)

.6 Section 33 05 13 (Manholes and Catch Basins)

.7 Section 33 11 16 (Water Utility Distribution Piping)

.8 Section 33 41 00 (Storm Utility Drainage Piping)

.9 Section 33 65 73 (Concrete Duct Banks and Vaults)

1.3 MEASUREMENT AND PAYMENT

.1 General fill for manholes, catch basins, water utility distribution piping, storm utility drainage piping, concrete duct banks and vaults will not be measured separately, but considered incidental to the work. All costs in connection with such general fill shall be included in the relevant unit price tendered under Section 33 05 13 (Manholes and Catch Basins), Section 33 11 16 (Water Utility Distribution Piping), Section 33 41 00 (Storm Utility Drainage Piping), and Section 33 65 73 (Concrete Duct Banks and Vaults), respectively.

.2 Except as described in Clause 1.3.1, general fill shall be measured after compaction in cubic metres of material actually incorporated into work at the various thicknesses shown to neat lines within the areas defined on the Drawings. No measurement will be made for material which is placed on a temporary basis or materials which are subsequently removed.

.3 Except as described in Clause 1.3.1, general fill will be paid for at the unit price tendered for GENERAL FILL. This payment shall be full compensation for supply, sampling and testing, processing, transporting, placing, re-handling,

grading, moisture conditioning, trimming and compacting of general fill materials and all related activity necessary to complete the work as specified.

.4 Survey and other quality control activities will not be measured separately, but considered incidental to the work.

1.4 REFERENCES

.1 ASTM C117, Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Refer to Clauses 2.1.2 and 2.2.3 of this Section.

Part 2 Products

2.1 GENERAL FILL

.1 General fill shall consist of durable, natural granular material, free of organics, with no more than 8 % by weight passing the 75 μm (No. 200) sieve. Recycled materials from offsite sources, including but not limited to concrete, asphalt pavement, and glass, shall not be used as fill. The maximum particle size shall not exceed 150 mm.

.2 At least twenty-eight (28) days prior to commencing the placement of general fill material, the Contractor shall at his cost identify the proposed off site source(s) and, in accordance with Section 01 33 00 (Submittal Procedures), submit to Departmental Representative for review:

.1 Qualification test data, including material gradation curves, physical and chemical properties for each source, confirming that the proposed material(s) meet or exceed the requirements of this specification. Contractor shall also provide access for qualification sampling by Departmental Representative. Departmental Representative may, at his discretion, collect qualification samples from the proposed source(s) and carry out independent tests, all at no cost to Contractor;

.2 Details of the processing required, if any, to meet the gradation requirements; and,

.3 Details of the ongoing quality control procedures during production.

.3 Departmental Representative will, within fourteen (14) days of receiving the above submission, advise Contractor of the acceptability of the proposed materials and procedures.

.4 During general fill material production, Contractor shall, at his own cost, conduct ongoing quality control sampling and testing at the loading conveyor to confirm that the general fill materials conform to the specification. The material gradation testing rate for general fill shall be not less than one test for every 100 m3 placed in the work. The testing rate for in-situ compacted density of general fill shall be not less than one test for every **50 m^3** placed in the work; the testing rate for reference dry density (ASTM D1557) shall be not less than one test for every 100 **m^3** placed in the work. All quality control test reports shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.5 During placement, Departmental Representative may at his discretion inspect the general fill materials for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to Contractor, unless material does not conform, whereon the testing shall be at Contractor's expense.

.6 Failure of a general fill sample to meet any one of the specified gradation and physical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative.

Part 3 Execution

3.1 GENERAL

.1 All general fill shall be imported by road transport, unloaded directly within the Work site.

.2 Contractor shall provide adequate flag-persons and/or traffic signal devices to prevent interference with emergency vehicles or traffic of other dock users and contractors.

.3 Priority shall be given to all other traffic over Contractor's construction traffic.

.4 At the end of each working day, sweep roadway and clean up all fallen soil, dust and debris arising from fill deliveries, to Departmental Representative's satisfaction.

.5 Select appropriate fill material and placing methods, provide suitable equipment and sequence the work so that the specified quality of fill is produced.

.6 Fill above water level shall not be placed at temperatures which, in the opinion of Departmental Representative, will cause freezing of the materials before they are adequately compacted.

.7 Ensure no organic material, snow, ice, silt pockets, or other deleterious material is incorporated within the general fill.

.8 Cover or wet down general fill material to prevent blowing dust and sand, in accordance with Section 02 55 10 (Dust Control).

.9 Maintain and protect the general fill against erosion and other damage.

3.2 COMPACTION OF GENERAL FILL

.1 Contractor shall submit his proposed methodology for the compaction of the general fill, not less than twenty-eight (28) days prior to commencing the placing of the general fill. This submittal shall contain:

.1 List and specifications for compaction equipment;

.2 Name(s) and outline of relevant experience of shift superintendent(s);

.3 Proposed methods and sequence of work; and,

.4 A detailed schedule for the work.

.2 Place all general fill in maximum 300 mm lifts and compact to a minimum of 95 % modified Proctor maximum dry density per ASTM D1557 and corrected for oversize materials in accordance with ASTM D4718.

.3 Modify the moisture content of the material as necessary, or as directed by Departmental Representative, to obtain the specified density. If the material becomes excessively moist and cannot be properly compacted, it shall be removed and replaced with a suitable material.

.4 During the work, only hand-operated compaction equipment shall be used within a distance of 0.6 m from any concrete structure.

.5 Ensure that the compaction does not impact or damage any structures.

.6 Repair any damage to structures arising from compaction.

.7 Fill densities and moisture contents shall be measured by nuclear methods in accordance with ASTM D2922 and ASTM D3017. All moisture contents measured using nuclear methods shall be confirmed by oven dry method in accordance with ASTM D2216 or microwave method in accordance with ASTM D4643. In the event of a discrepancy between moisture content determinations, the moisture content determined by oven dry method shall apply. Oversize materials shall be determined for each density test and the measured density corrected for oversize materials. Departmental Representative may, at his sole discretion, approve corrections to densities measured with a nuclear gauge for a material type, if Contractor provides site specific and material-specific correlation tests between nuclear density test methods and volumetric test methods approved by Departmental Representative.

.8 If an area of general fill compaction fails to meet the acceptance criteria, conduct additional tests, as directed by Departmental Representative, to delineate the extent of the area. Remediate the area and conduct additional tests, as directed by Departmental Representative, to confirm that the area meets the acceptance criteria. No additional payment will be made for these tests or remediation work.

.9 After compaction, the final surface of the general fill shall be graded to within a tolerance of +/- 25 mm, but not uniformly high or low. For final grade elevations, refer to the Drawings.

END OF SECTION

1. PART 1 – GENERAL

1.1 Description

.1 This Section covers the supply, installation and testing of permanent rock anchors utilizing high strength prestressing steel.

1.2 Related Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 39 00 (In-situ Concrete Structures)

.3 Section 04 05 12 (Grout)

.4 Section 31 23 16.26 (Rock Excavation)

1.3 Measurement and Payment Procedures

.1 Permanent rock anchors will be measured in lineal metres incorporated into the work, measured as the actual anchor bar (tendon) length installed, determined by the details shown on the Drawings, or as directed by Departmental Representative.

.2 Permanent rock anchors will be paid for at the relevant unit prices tendered, as listed below. Payment for permanent rock anchors shall include for all costs in connection with the supply, installation, grouting, stressing and testing of permanent rock anchors.

.1 ROCK ANCHORS: DRY DOCK WALLS

.2 ROCK ANCHORS: DRY DOCK FLOOR

.3 No measurement or payment will be made for temporary anchors.

.4 Anchors that do not meet test criteria will be remedied or replaced at Contractor's cost.

.5 Anchor pockets and anchor encapsulation within in-situ concrete structures will not be measured separately, but considered incidental to the work. All costs in connection with the construction of anchor pockets and anchor encapsulation, including grout where indicated, shall be included in the unit prices tendered for concrete to Section 03 39 00 (In-situ Concrete Structures).

1.4 References

.1 All methods and materials shall conform to the following standards unless noted otherwise:

.1 CSA CAN3-A23.1, Concrete Materials and Methods of Concrete Construction.

.2 CSA CAN3-A23.2, Methods of Test for Concrete.

.3 CSA CAN3-A3001, Portland Cement.

.4 Post Tensioning Institute (PTI), Recommendations for Prestressed Rock and Soil Anchors.

.5 ASTM A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

1.5 Definitions

.1 Rock Anchor:

.1 A rock anchor is a high strength steel tendon, fitted with a stressing anchorage at one end and a means of permitting force transfer to grout and rock on the other end. The rock anchor tendon is inserted into a prepared hole of suitable length and diameter, fixed to the rock and stressed to a specified force. The total length of a rock anchor comprises two parts:

.1 Bond length (socket) is the portion of the anchor that transmits the force to the surrounding rock.

.2 Free length (stressing length) is the portion of the anchor which is free to elongate elastically during stressing.

.2 The stressing anchorage is a device that permits the stressing and anchoring of the prestressing steel under load.

.3 The fixed anchorage is at the opposite end of the tendon from the stressing anchorage and is a mechanism that permits the transfer of the induced force to the surrounding grout or rock. Deformed bar does not normally require a fixed anchorage, since the anchor load is transferred to the grout by bond.

.4 Grout pipes, vent pipes and miscellaneous appurtenances are required for injecting the anchor grout or corrosion protective filler.

.2 Anchor: A system used to transfer tensile loads to soil or rock. It includes all prestressing steel, anchorages, grout, coatings, sheathings and couplers if used. An anchor may be locked off with or without prestress, to suit the design requirements as indicated on the Drawings and in the Specification.

.3 Permanent Anchor (or Permanent Rock Anchor): Any anchor for permanent use having a service life equal to the design life of the Work. Permanent anchors are shown on the Contract Drawings.

.4 Temporary Anchor (or Temporary Rock/Soil Anchor): Any anchor for temporary use, generally with a design service life of less than 18 months. Temporary anchors are to be designed and provided by the Contractor (at no extra cost to the Owner) as required to ensure rock/soil stability and safety during excavation and subsequently until the permanent anchors are installed and accepted by Departmental Representative.

.5 Tendon: The complete anchor assembly (excluding grout) consisting of anchorage and prestressing steel with sheathing and coating when required.

.6 Anchor Grout: Portland cement grout that is injected into the anchor hole to provide anchorage at the bond length of the tendon.

.7 Secondary Grout: Material that is injected into the anchor hole to cover the stressing length of the anchor, providing corrosion protection for the high strength steel. This material may be grout or other approved materials.

.8 Consolidation Grout: Portland cement grout that is injected into the hole prior to inserting the tendon to waterproof or otherwise improve the rock surrounding the hole.

.9 Design Load: Anticipated final maximum effective load in the anchor after allowance for time dependent losses or gains.

.10 Proof Load: Temporary prestressing load in an anchor, at a force level greater than its design load, for testing purposes.

.11 Transfer (Lock-Off) Load: Prestressing force in an anchor after proof loading immediately after the force has been transferred from the jack to the stressing anchorage.

.12 Alignment Load: A nominal load, usually between 2 % and 10 % of the design load, maintained on a performance tested anchor when the anchor is unloaded. This load is left in the anchor to keep the testing equipment positioned.

1.6 Submittals

.1 Temporary Anchors: At least fourteen (14) days before the start of rock excavation work submit, to Departmental Representative for his review and in accordance with Section 01 33 00 (Submittal Procedures), a Method Statement and drawings prepared, sealed and signed by a Professional Engineer registered to practice in the Province of British Columbia (the temporary anchor designer) indicating materials and installation details for the Contractor's temporary anchors.

.2 Permanent Anchors: At least twenty-eight (28) days before the start of each type of concrete work submit, to Departmental Representative for his review and in accordance with Section 01 33 00 (Submittal Procedures), the following items for permanent anchors:

.1 Drawings prepared, sealed and signed by a Professional Engineer registered to practice in the Province of British Columbia (the anchor designer), and shall include the following information:

.1 Tendon type;

.2 Anchor layout;

.3 Grade and properties of the anchor materials;

.4 Design load, the anticipated load and the factor of safety for each anchor;

.5 Method and details of anchor fabrication;

.6 Details of corrosion protection;

.7 Proposed method and details for grouting;

.8 Grout mix, including cement type, additives, strength and mixing and placing equipment;

.9 Anchor bond length;

.10 Proposed drilling method and equipment;

.11 Proposed installation method;

.12 Proposed stressing method and equipment; and

.13 Proposed provisions for stressing and de-stressing.

.2 Certified mill test reports and typical stress-strain curves for each heat or lot of prestressing material used to fabricate the anchors showing the ultimate load, the yield, the percentage elongation at yield load and the modulus of elasticity. All prestressing material shall be tagged so that the heat or lot from which it was fabricated can be easily identified.

.3 Description of equipment to be used, and calibration charts prepared by a certified testing laboratory, for all tensioning equipment.

.3 After anchor installation, the Contractor shall prepare and submit to Departmental Representative a written description of all equipment used and detailed reports of all installation, testing and stressing operations. These reports shall be provided for temporary anchors and permanent anchors and shall include:

.1 A drawing identifying the anchors and showing their as-installed locations;

.2 Anchor types and installation dates;

.3 Drill reports including reports on testing and consolidation grouting if performed;

.4 Pull-out test results; and,

.5 Acceptance test loads and procedures including all creep and displacement readings.

1.7 Anchor Design

.1 Rock anchor systems and drawings shall conform to the following parameters:

.1 Permanent anchors shall have double corrosion protection;

.2 Permanent anchors shall be bonded into the rock at the locations shown on the Drawings;

.3 The anchor head detail for permanent anchors shall allow for both re-tensioning and de-stressing of anchors;

.4 The stressing anchorage for permanent anchors shall be capable of developing 95 % of the guaranteed minimum ultimate tensile strength of the anchor material when tested in an unbonded state.

2. PART 2 – PRODUCTS

2.1 Materials for Permanent Anchors

.1 Prestressing Steel:

.1 Bars used in permanent anchors shall conform to ASTM A615, grade 80, 57mm diameter.

.2 Anchorages:

.1 The anchorage shall develop, in the unbonded state, at least 95 % of the minimum specified ultimate strength of the prestressing steel, and at least 2 % elongation when measured in a minimum gauge length of 3.0 m.

.2 The stressing anchorages shall be capable of lift-off during the period of installation, in order to check the anchor load.

.3 Couplers:

.1 Couplers for tendon sections shall be capable of developing 100 % of the guaranteed minimum ultimate tensile strength of the tendon.

.2 The corrosion protection of the couplers shall be equal to or better than that of the remainder of the tendon.

.4 Centralizers and Spacers:

.1 Centralizers shall be capable of positioning the tendon in the drill hole such that the specified minimum grout cover is achieved around the tendon.

.2 Centralizers shall be provided at a maximum of 3.0 metres centre to centre throughout the grouted length. The first centralizer shall be a maximum of 1.5 m from the bottom of the anchor.

.3 Centralizers and spacers shall be made from steel, plastic or any material non-detrimental to the high strength prestressing steel. Wood spacers shall not be used.

.5 Sheathing and Corrosion Protection:

.1 The sheathing material shall be steel, plastic or any other material non-detrimental to the high strength prestressing steel.

.2 Material used for grout vents or drain holes shall be either plastic or non-ferrous metal.

.3 The properties of any corrosion protection material shall not be detrimental to the prestressing steel and should prevent the intrusion of corrosive environments. Coating materials shall also have the following properties:

.1 Free from cracks and not brittle or fluid over the entire anticipated range of temperatures;

.2 Chemically stable for the life of the tendon;

.3 Non-reactive with the surrounding materials such as concrete, tendons or sheathing;

.4 Corrosion-inhibiting; and,

.5 Impervious to moisture.

.4 Plastic corrugated sheathing used for multiple corrosion protection schemes shall have a minimum wall thickness of 0.5 mm.

.5 Sheathing shall have sufficient tensile strength and water-resistance to resist unrepairable damage and deterioration during transport, storage at job site and installation.

.6 Grout:

.1 For grout products and grouting equipment, refer to Section 04 05 12 (Grout), except as stipulated by this Section.

.2 Portland cement shall be Type MS (was Type 20) or Type HE (was Type 30) to CAN/CSA-A3001. Type GU (was Type 10) cement may be used if tricalcium aluminate content is between 4.0 % and 7.5 %.

.3 Grout shall be in accordance with Section 6.8.4 “Cement Grout for Bonded Tendons” of CAN/CSA-A23.1-09, except that the minimum grout strength shall be 30 MPa at 7 days and 45 MPa at 28 days when tested in accordance with CAN/CSA-A23.2-lB.

.4 Admixtures containing chlorides (as Cl in excess of 0.5 % by weight of admixture, assuming 1 part of admixture per 90 parts of cement), fluorides, sulphites and nitrates shall not be used.

2.2 Equipment

.1 All equipment used for fabrication, handling and placing shall be such that it will not damage the anchor tendons.

.2 The grouting equipment shall be capable of continuous mechanical mixing to produce a grout free of lumps and undispersed cement. A manifold system with a series of valves and calibrated pressure gauge shall permit continuous circulation and pumping of grout with accurate control of grout pressure.

.3 Stressing equipment shall be capable of applying at least the specified test load to the anchor tendon. The calibrated pressure gauge indicating the hydraulic jack pressure shall read to within 3 % accuracy of the true value.

.4 All stressing equipment shall be used in accordance with the specifications of the manufacturer and shall, at all times, be maintained in good condition.

.5 Accurately calibrated load cells shall be employed to measure load. The pumps, jacks and all tensioning equipment shall be calibrated in order to verify the load cell readings. All calibrations shall be conducted by an approved laboratory with the necessary equipment and shall be certified. If any incident occurs during transportation, handling or tensioning which may have caused damage, the equipment shall be recalibrated.

2.3 Fabrication of Permanent Anchors

.1 Tendons shall be either shop fabricated or field fabricated in accordance with approved Drawings, using personnel trained and qualified in this type of work.

.2 Tendons shall be free of dirt, detrimental rust or any other deleterious substance.

.3 Tendons shall be handled and protected prior to installation in such a manner as to avoid corrosion and physical damage thereto.

.4 All field joints of the corrosion protection shall be made watertight by an epoxy bonding compound or equivalent.

.5 Tendons for anchors shall be sheathed in the free stressing length.

.6 For sheathed tendons, the sheathing may consist of a tube surrounding the tendon bar.

.7 The tendon components shall be stored, fabricated and handled to avoid prolonged exposure to the elements.

.8 The area immediately behind the stressing anchorage shall be adequately protected from climatic elements, aggressive water, pollutants, or other corrosion inducing agents. Pipes or trumpets may be welded to the bearing plate, a seal provided between the anchor and the sheath, and the entire void pumped full of corrosion inhibiting grease, mastic or grout.

3. PART 3 – EXECUTION

3.1 Quality Control

.1 Perform all work in accordance with the approved Quality Control plan. The procedures, personnel, products, methods, and submittals noted in this section shall be considered a minimum requirement of that plan. Additional submittals, checklists, procedures and methods may be required to meet the requirements of the Contract and fulfill the obligations of the Quality Control plan.

.2 Contractor to retain the services of a Professional Engineer, the Engineer of record for anchor installation, who is experienced in work of this type. This Engineer shall inspect the installation of anchors and monitor anchor stressing acceptance tests.

.3 Failure of any anchor to meet acceptance test criteria will result in rejection of the anchor in question. Consistent failure of a given anchor type will require reassessment of the anchor design and installation practices. Contractor to propose strategy to remediate a failed anchor.

3.2 Delivery, Storage and Handling

.1 Handle and protect anchors prior to installation to prevent physical damage to the anchors and their corrosion protection system, and to ensure that, before installation, all materials are free from loose scale, rust, dirt, oil, paint or other deleterious materials.

.2 Store anchors on racks or sills with identifying tags or markings to permit easy access and identification and to prevent the occurrence of physical damage and corrosion, and store all other installation materials until required for use in unbroken packages or containers in a weather-tight and dry place.

3.3 Drilling for Permanent Anchors

.1 Holes for anchors shall be started within an angular tolerance of +/- 3 degrees from their planned orientation and within a location tolerance of 25 mm from the position shown on the Construction Drawings.

.2 Holes for anchors shall deviate no more than 50 mm in 1500 mm, from the theoretical centreline.

.3 Holes for anchors which exceed the above tolerances shall be grouted and re-drilled.

.4 Keep a record of all drilling procedures and times, which shall be made available to the Departmental Representative.

.5 The size of the anchor hole shall exceed the maximum diameter of the anchor by a minimum of 10 mm. The size of the anchor hole shall also exceed the diameter of the anchor corrosion protection (sheathing) by a minimum of 38 mm. The size of the anchor hole shall also be a minimum of 146 mm.

.6 Where anchors penetrate through overburden materials before reaching rock, drilling may be by any method the Contractor chooses for the particular conditions. The overburden shall be cased when there is a danger of hole collapse or subsidence around existing structures.

3.4 Installation of Permanent Anchors

.1 Tendons shall be placed in accordance with the tendon manufacturer's recommendations and the Drawings, under the inspection of the manufacturer.

.2 All equipment used for handling and inserting the tendon shall be such that it will not damage the anchor bar and corrosion protection.

.3 Grout tubes shall be flushed with water or compressed air to ensure that they are clear.

.4 Centralizers shall be provided at 3.0 m centre to centre throughout the grouted length to ensure that the tendon is located centrally in the hole.

.5 All anchors shall be installed through the casing to avoid damage to the corrosion protection.

.6 Maintain a record showing the anchor type and installation date for each anchor.

.7 Tendons shall not be used for grounding electrical equipment.

.8 When acidic water can enter the bore hole during the period subsequent to the drilling and flushing operation and prior to tendon insertion and grouting, chemical additives shall be introduced for neutralizing purposes.

.9 Temporary protection of the exposed stressing end of the tendon shall be provided during the period between installation of the tendon and final protection of the stressing end.

.10 Upon completion of all Work on the tendon, the anchorage shall be encased in concrete or fitted with a watertight steel or plastic housing filled with grout, grease, bitumen, or other comparable permanent protection. The final protection must be applied on uncorroded components.

3.5 Grouting of Permanent Anchors

.1 The grout shall be a cementitious grout with a water/cement ratio of less than 0.45.

.2 Additives to the grout, if used, shall be mixed and added in accordance with the manufacturer's recommendations.

.3 Collodial or shear mixers (high energy) shall be used to minimize water separation and grout bleed.

.4 Grouting for anchors sheathed on their free length may be undertaken in one operation. The grout shall be pumped into the anchor hole through a grout pipe provided for that purpose until the hole is filled. The grout shall be injected at the lowest point on the bond length and injected only after installation of the anchor in the hole.

.5 After primary grouting, the anchors shall remain in an undisturbed condition until the necessary grout strengths have been achieved.

.6 Any void at the top end of the anchor beyond the designated free length shall be filled with grout if the anchor is to be used for a permanent application.

.7 Grout shall be tested in accordance with Quality Assurance plan and as specified in Section 04 05 12.

3.6 Pre-Production Anchors

.1 Provide three pre-production test anchors in both the dock wall and dock floor (6 total) prior to permanent anchor installation.

.2 Test pre-production anchors in accordance with Sections 3.7 and 3.8 of this Specification.

3.7 Testing and Stressing of Permanent Anchors

.1 Each anchor shall be tested. The maximum test load shall not exceed 80 % of the guaranteed ultimate tensile strength of the tendon.

.2 Anchor testing shall be carried out no earlier than seven (7) days after grouting for Type GU (was Type 10) cement or Type MS (was Type 20) cement, and no earlier than three (3) days after grouting for Type HE (was Type 30) cement.

.3 For the anchors installed at the Dry Dock Floor and Dry Dock Walls, the first two anchors and at least 5 % of the remaining anchors shall be performance tested. The remaining anchors (i.e. those not performance tested) at the Dry Dock Floor and Dry Dock Walls shall be proof tested.

.4 No testing or stressing shall be performed except in the presence of Departmental Representative.

3.8 Performance Tests and Proof Tests on Permanent Anchors

.1 Carry out performance tests and report results in accordance with PTI DC35.1-14 to the design and lock-off loads indicated on the drawings.

.2 Transfer Load: No transfer load shall be to the anchors at the Dry Dock Floor and Dry Dock Walls.

3.9 Further Checks and Completion for Permanent Anchors

.1 Cutting of Tendon Protrusions for all Anchors:

.1 After an anchor has been accepted by Departmental Representative, the portion of the anchor tendon protruding over the anchor may be cut, if not otherwise required. Cutting shall be done according to the tendon manufacturer's recommendations. Care shall be taken not to damage the tendon anchorage.

.2 Acceptance Criteria for all Anchors:

.1 Departmental Representative will review the anchor test results, both performance and proof, and determine whether the anchor is acceptable. An anchor shall be acceptable if:

.1 The total elastic movement obtained from a performance test exceeds 80 % of the theoretical elastic elongation of the stressing length, and is less than the theoretical elastic elongation of the stressing length plus 50 % of the bond length; and,

.2 The creep movement does not exceed 2.0 mm per log cycle during the final log cycle time increment of the performance test regardless of tendon length and load.

.2 If the first anchors installed fail during testing, it will be necessary to modify the design or construction procedures. The Contractor shall assist Departmental Representative in determining the most suitable modifications.

.3 Departmental Representative, at his sole discretion, shall determine whether an anchor which fails to meet the above minimum acceptance criteria may be incorporated in the Work.

.3 After performance testing and proof testing is complete and accepted by Departmental Representative, cast anchors into the Dry Dock Floor and Dry Dock Wall structures as indicated on the Drawings.

.5 Ensure each bearing plate is aligned, positioned and held firmly in conformance with the requirements of Section 03 30 00 (Cast-in-Place Concrete) so that full bearing condition is achieved against anchor nut/washer during concrete and/or grout placement.

3.10 Records

.1 On completion of the Work, the Contractor shall submit to Departmental Representative record drawing(s) showing the final anchor locations for temporary anchors and for permanent anchors.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply, placement and compaction of the granular sub-base underlying granular base where shown on the Drawings.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 31 24 15 (General Fill)

.3 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.4 Section 32 11 23 (Aggregate Base Courses)

1.3 MEASUREMENT AND PAYMENT

.1 Granular sub-base shall be measured after compaction, in cubic metres of material actually incorporated into work at the various thicknesses shown to neat lines within the areas defined on the Drawings. No measurement will be made for material which is placed on a temporary basis or materials which are subsequently removed.

.2 Granular sub-base will be paid for at the unit price tendered for GRANULAR SUB-BASE. This payment shall be full compensation for supply of material, sampling and testing, placing, grading, moisture conditioning, compacting, trimming and all related activity necessary to complete the work as specified.

1.4 REFERENCES

.1 ASTM C117, Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

.4 ASTM D4718, Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Refer to Clause 2.1.3 of this Section.

Part 2 Products

2.1 GRANULAR SUBBASE

.1 Granular sub-base shall be hard, durable, crushed or pit run sand and gravel free of organic and any deleterious matter, and capable of forming a competent surface for the granular base.

TABLE 1 – SUB-BASE GRADATION

Sieve Size (U.S. Standard)	Gradation Limits (% Passing by Dry Weight)
75 mm (3 in)	100
19 mm (3/4 in)	65 – 100
4.75 mm (No. 4)	30 – 100
2.00 mm (No.10)	15 – 100
0.40 mm (No.40)	5 – 50
0.075 mm (No.200)	0 – 5

.2 Material shall comply with the gradation limits given in Table 1, when tested in accordance with ASTM C117 and ASTM C136, and have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

.3 At least twenty-eight (28) days prior to commencing granular sub -base placement, and in accordance with Section 01 33 00 (Submittal Procedures), Contractor shall submit to Departmental Representative for review the proposed material source(s) and placement procedures and provide, at Contractor's cost, qualification test results confirming that the proposed material from each source (gradation curves, physical and chemical properties) meets or exceeds the requirements of this specification.

.4 Departmental Representative will, within fourteen (14) days of receiving the above submission, advise Contractor of the acceptability of the proposed materials and procedures.

.5 During granular sub-base production, Contractor shall, at his own cost, conduct ongoing quality control sampling and testing at the loading conveyor to confirm that the granular sub -base material conforms to the specification. The material gradation testing rate for granular sub-base shall be not less than one test for every **200 m^3** placed in the work. The testing rate for in -situ compacted density of granular sub-base shall be not less than one test for every **50 m^3** placed in the work; the testing rate for reference dry density (ASTM D1557) shall be not less than one test for every **200 m^3** placed in the work. All quality control test reports

shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.6 During placement, Departmental Representative may, at his discretion, inspect the granular sub-base material for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to Contractor, unless material does not conform, whereon the testing shall be at Contractor's own expense.

.7 Failure of a sample to meet any one of the specified gradation and physical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative. Subject to Departmental Representative's agreement, rejected granular sub-base material may be used instead as general fill material.

Part 3 Execution

3.1 GENERAL

.1 All granular sub-base shall be imported by road transport, unloaded directly within the Work site.

.2 Contractor shall provide adequate flag-persons and/or traffic signal devices to prevent interference with emergency vehicles or traffic of other dock users and contractors.

.3 Priority shall be given to all other traffic over Contractor's construction traffic.

.4 At the end of each working day, sweep roadway and clean up all fallen rock, dust and debris arising from rock deliveries, to Departmental Representative's satisfaction.

3.2 PLACING

.1 Placing of granular sub-base material shall commence only after approval by Departmental Representative of the finished grade of excavations or finished grade of general fill, as appropriate to the location. Refer to Section 31 24 15 (General Fill) and Section 31 23 33.01 (Excavation, Trenching and Backfilling) for requirements.

.2 Surfaces shall at all times be kept free of snow, ice or any other deleterious material.

.3 Placement shall be conducted using methods that avoid segregation or degradation of the material. Any areas where segregation occurs shall be over-excavated, reworked, and replaced to the satisfaction of Departmental Representative.

.4 Material lift thickness shall not exceed 200 mm after compaction unless otherwise approved by Departmental Representative.

.5 Placing of subsequent lifts shall proceed only after acceptance by Departmental Representative of the compacted surface to be covered.

3.3 COMPACTING

.1 Granular sub-base material shall be compacted to a minimum of 95 % modified Proctor maximum dry density (ASTM D1557) corrected for oversize materials in accordance with ASTM D4718, and as shown on the Drawings.

.2 Modify the moisture content of the material as necessary, or as directed by Departmental Representative, to obtain the specified density. If the material becomes excessively moist and cannot be properly compacted, it shall be removed and replaced with a suitable material.

.3 During the work only hand-operated compaction equipment shall be used within a distance of 0.6 m from any concrete structure.

.4 Ensure that the compaction does not impact or damage any structures.

.5 Repair any damage to structures arising from compaction.

.6 Fill densities and moisture contents shall be measured by nuclear methods in accordance with ASTM D2922 and ASTM D3017. All moisture contents measured using nuclear methods shall be confirmed by oven dry method in accordance with ASTM D2216 or microwave method in accordance with ASTM D4643. In the event of a discrepancy between moisture content determinations, the moisture content determined by oven dry method shall apply. Oversize materials shall be determined for each density test and the measured density corrected for oversize materials. Departmental Representative may, at his sole discretion, approve corrections to densities measured with a nuclear gauge for a material type, if the Contractor provides site specific and material-specific correlation tests between nuclear density test methods and volumetric test methods approved by Departmental Representative.

.7 If an area of granular sub- base compaction fails to meet the acceptance criteria, conduct additional tests, as directed by Departmental Representative, to delineate the extent of the area. Remediate the area and conduct additional tests, as directed by Departmental Representative, to confirm that the area meets the acceptance criteria. No additional payment will be made for these tests or remediation work.

.8 Contractor shall make available compacted areas for density testing for quality assurance purposes, as required by Departmental Representative.

3.4 FINAL TOLERANCES

.1 Final compacted and graded surface shall be within ± 25 mm of the specified grade, but not uniformly high or low.

3.5 MAINTENANCE

.1 Maintain finished granular sub-base in same condition as that upon acceptance until granular base is placed.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply, placement and compaction of the granular base underlying asphalt paving and underlying certain concrete structures as shown on the Drawings.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 39 00 (In-Situ Concrete Structures)

.3 Section 31 24 15 (General Fill)

.4 Section 32 12 16 (Asphalt Paving)

.5 Section 32 11 16.01 (Granular Sub-Base)

1.3 MEASUREMENT AND PAYMENT

.1 Granular base shall be measured after compaction, in cubic metres of material actually incorporated into work at the various thicknesses shown to neat lines within the areas defined on the Drawings. No measurement will be made for material which is placed on a temporary basis or materials which are subsequently removed.

.2 Granular base will be paid for at the unit price tendered for GRANULAR BASE. This payment shall be full compensation for supply of material, sampling and testing, placing, grading, moisture conditioning, compacting, proof rolling, trimming and all related activity necessary to complete the work as specified.

1.4 REFERENCES

.1 ASTM C136, Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.2 ASTM C117, Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing.

.3 ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))

.4 ASTM D4718, Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles.

.5 ASTM D5821, Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 Refer to Clause 2.1.3 of this Section.

Part 2 Products

2.1 GRANULAR BASE

.1 Granular base shall be hard, durable crushed sand and gravel free of organic and any deleterious matter, and capable of forming a smooth, competent surface for placement of asphalt paving or for use as foundation for miscellaneous concrete structures. Coarse aggregate to have a minimum of 50% fractured faces when tested in accordance with ASTM D5821.

TABLE 1 – GRANULAR BASE GRADATION

Sieve Size (U.S. Standard)	Gradation Limits % Passing by Dry Weight
25 mm (1 in)	100
19 mm (3/4 in)	85 – 100
9.5 mm (3/8 in)	60 – 85
4.75 mm (No. 4)	40 – 70
2.0 mm (No. 10)	25 – 50
0.40 mm (No.40)	5 – 25
0.075 mm (No.200)	0 – 5

.2 Material shall comply with the gradation limits given in Table 1, when tested in accordance with ASTM C136 and ASTM C117, and have a smooth curve without sharp breaks when plotted on a semi-log grading chart.

.3 At least twenty-eight (28) days prior to commencing granular base placement, and in accordance with Section 01 33 00 (Submittal Procedures), Contractor shall submit to Departmental Representative for review the proposed material source(s) and placement procedures and provide, at Contractor's own cost, qualification test results confirming that the proposed material from each source (gradation curves, physical and chemical properties) meets or exceeds the requirements of this specification.

.4 Departmental Representative will, within fourteen (14) days of receiving the above submission, advise Contractor of the acceptability of the proposed materials and procedures.

.5 During granular base production, Contractor shall, at his own cost, conduct ongoing quality control sampling and testing at the loading conveyor to confirm that the gradation of the granular base material conforms to the specification. The material gradation testing rate for granular base shall be not less than one test for every **200 m3** placed in the work. The testing rate for in-situ compacted density of granular base shall be not less than one test for every **50 m3** placed in the work; the testing rate for reference dry density (ASTM D1557) shall be not less than one test for every **200 m3** placed in the work. All quality control test reports shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.6 During placement, Departmental Representative may, at his discretion, inspect the granular base material for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to Contractor, unless material does not conform, whereon the testing shall be at Contractor's expense.

.7 Failure of a sample to meet any one of the specified gradation and physical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative. Subject to Departmental Representative's agreement, rejected granular base material may be used instead as general fill material.

Part 3 Execution

3.1 GENERAL

.1 All granular base shall be imported by road transport, unloaded directly within the Work site.

.2 Contractor shall provide adequate flag-persons and/or traffic signal devices to prevent interference with emergency vehicles or traffic of other dock users and contractors.

.3 Priority shall be given to all other traffic over Contractor's construction traffic.

.4 At the end of each working day, sweep roadway and clean up all fallen rock, dust and debris arising from rock deliveries, to Departmental Representative's satisfaction.

3.2 PLACING

.1 Placing of granular base material shall commence only after approval of the granular sub-base by Departmental Representative. Refer to Section 32 11 16.01 (Granular Sub-Base) for granular sub-base requirements.

.2 Surfaces shall at all times be kept free of snow, ice or any other deleterious material.

.3 Placement shall be conducted using methods that avoid segregation or degradation of the material. Any areas where segregation occurs shall be over-excavated, reworked, and replaced to the satisfaction of Departmental Representative.

.4 Material lift thickness shall not exceed 200 mm after compaction unless otherwise approved by Departmental Representative.

.5 Placing of subsequent lifts shall proceed only after acceptance by Departmental Representative of the compacted surface to be covered.

3.3 COMPACTING

.1 Granular base material shall be compacted to a minimum of 95 % modified Proctor maximum dry density (ASTM D1557) corrected for oversize materials in accordance with ASTM D4718, and as shown on the Drawings.

.2 Modify the moisture content of the material as necessary, or as directed by Departmental Representative, to obtain the specified density. If the material becomes excessively moist and cannot be properly compacted, it shall be removed and replaced with a suitable material.

.3 During the work only hand-operated compaction equipment shall be used within a distance of 0.6 m from any concrete structure.

.4 Ensure that the compaction does not impact or damage any structures.

.5 Repair any damage to structures arising from compaction.

.6 Fill densities and moisture contents shall be measured by nuclear methods in accordance with ASTM D2922 and ASTM D3017. All moisture contents measured using nuclear methods shall be confirmed by oven dry method in accordance with ASTM D2216 or microwave method in accordance with ASTM D4643. In the event of a discrepancy between moisture content determinations, the moisture content determined by oven dry method shall apply. Oversize materials shall be determined for each density test and the measured density corrected for oversize materials. Departmental Representative may, at his sole discretion, approve corrections to densities measured with a nuclear gauge for a material type, if Contractor provides site specific and material-specific correlation tests between nuclear density test methods and volumetric test methods approved by Departmental Representative.

.7 If an area of granular base compaction fails to meet the acceptance criteria, conduct additional tests, as directed by Departmental Representative, to delineate the extent of the area. Remediate the area and conduct additional tests, as directed by Departmental Representative, to confirm that the area meets the acceptance criteria. No additional payment will be made for these tests or remediation work.

.8 Contractor shall make available compacted areas for density testing for quality assurance purposes, as required by Departmental Representative.

3.4 FINAL TOLLERANCES

.1 Final compacted and graded surface shall be within ± 10 mm of the specified grade, but not uniformly high or low.

3.5 PROOF ROLLING

.1 Proof roll top of granular base upon completion of fine grading and compaction.

.2 For proof rolling use a 50 tonne pneumatic roller, or a 20 tonne unballasted static mass vibratory roller operated at normal walking speed.

.3 Make sufficient passes with proof roller to subject every point on surface to two separate passes under the maximum load.

.4 Where proof rolling reveals areas of inadequate compaction, compact the granular base course and proof roll again.

.5 Where proof rolling reveals areas of defective or fines-contaminated general fill:

.1 Remove granular base, sub-base and general fill materials to depth and extent directed by Departmental Representative.

.2 Backfill excavated area with approved general fill and compact in accordance with Section 31 24 15 (General Fill).

.3 Replace granular sub-base material and compact in accordance with Section 32 11 16.01 (Granular Sub-Base); and,

.4 Replace granular base material and compact in accordance with this section.

3.6 MAINTENANCE

.1 Maintain finished granular base in same condition as that upon acceptance until asphalt or concrete is placed.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply and placement of an asphalt tack coat on the vertical saw cut edge of the existing asphalt and on contact surfaces at existing concrete and asphalt features prior to application of a lift of asphalt paving.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 32 11 23 (Aggregate Base Courses)

.3 Section 32 12 13.23 (Asphalt Prime Coat)

.4 Section 32 12 16 (Asphalt Paving)

1.3 MEASUREMENT AND PAYMENT

.1 Asphalt tack coat will not be measured separately, but considered incidental to the work. All costs in connection with asphalt tack coat shall be included in the unit price tendered for asphalt paving under Section 32 12 16 (Asphalt Paving).

.2 No separate measurement or payment will be made for asphalt tack coat at overlapping areas, overspray or asphalt tack coat which must be re-applied due to weather conditions, contamination, disruption or other causes.

.3 No separate measurement or payment will be made for asphalt tack coat on contact surfaces at concrete structures.

1.4 REFERENCES

.1 ASTM D140, Practice for Sampling Bituminous Materials.

.2 ASTM D977 (2003), Standard Specification for Emulsified Asphalt.

.3 CAN/CGSB 16.1 M, Cutback Asphalts for Road Purposes.

.4 CAN/CGSB 16.2 M, Emulsified Asphalts, Anionic Type, for Road Purposes.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS, SAMPLES AND MATERIAL CERTIFICATION

.1 Make all submittals in accordance with Section 01 33 00 (Submittal Procedures).

.2 Submit, in plastic containers, to Departmental Representative two 4.0 L samples of asphalt tack coat proposed for use at least fourteen (14) days prior to commencing work, if requested. Samples may be omitted if source and material is

identical to that for asphalt prime and samples of asphalt prime have previously been provided.

.3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into work, in accordance with ASTM D140.

.4 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt tack coat material meets requirements of this Section.

Part 2 Products

2.1 MATERIAL

.1 Anionic emulsified asphalt material: To ASTM D977 grade SS 1 or SS-1h.

Part 3 Execution

3.1 EQUIPMENT

.1 Pressure distributor to be:

.1 Designed, equipped, maintained and operated so that the asphalt material:

.1 Is maintained at even temperature.

.2 May be applied uniformly on variable widths of surface up to 5 m.

.3 May be applied at readily determined and controlled rates from 0.2 to 5.4 L/m^2 with uniform pressure, and with an allowable variation from any specified rate not exceeding 0.1 L/m^2.

.2 Capable of distributing asphalt material in uniform spray without atomization at temperature required.

.3 Equipped with meter registering metres of travel per minute visibly located to enable truck driver to maintain constant speed required for application at specified rate.

.4 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.

.5 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.6 Equipped with accurate volume measuring device or calibrated tank.

.7 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.

3.2 APPLICATION

.1 Apply tack coat only on clean and dry surface. Obtain Departmental Representative's approval of surface before applying asphalt tack coat.

.2 Anionic emulsified asphalt:

.1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Departmental Representative.

.2 Apply tack coat evenly to pavement surface at a minimum rate of 0.25 L/m^2, but do not exceed 0.7 L/m^2.

.3 Paint contact surfaces of concrete structures with thin, uniform coat of asphalt tack coat material.

.4 Do not apply tack coat when air temperature is less than 5 C or when rain is forecast within two (2) hours.

.5 Apply tack coat only to surfaces that are expected to be overlayed on same day.

.6 Where traffic is to be maintained, treat no more than one half width of surface in one application.

.7 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.

.8 Re-tack contaminated or disturbed areas as directed by Departmental Representative.

.9 Apply additional material to areas not sufficiently covered as directed by Departmental Representative.

.10 Keep traffic off tacked areas until tack coat has set.

.11 Permit tack coat to set before placing asphalt paving.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply and placement of asphalt prime coat to the granular base surface prior to asphalt paving operations.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 32 11 23 (Aggregate Base Courses)

.3 Section 32 12 13.16 (Asphalt Tack Coat)

.4 Section 32 12 16 (Asphalt Paving)

1.3 MEASUREMENT AND PAYMENT

.1 Asphalt prime will not be measured separately, but considered incidental to the work. All costs in connection with asphalt prime shall be included in the unit price tendered for asphalt paving under Section 32 12 16 (Asphalt Paving).

.2 No separate measurement or payment will be made for asphalt prime at overlapping areas, overspray or asphalt prime which must be re-applied due to weather conditions, contamination, disruption or other causes.

.3 No separate measurement or payment will be made for supply and application of sand blotter and sweeping of excess.

.4 No separate measurement or payment will be made for asphalt prime on contact surfaces at concrete structures.

1.4 REFERENCES

.1 ASTM D140, Practice for Sampling Bituminous Materials.

.2 ASTM D977 (2003), Standard Specification for Emulsified Asphalt.

.3 CAN/CGSB 16.1 M, Cutback Asphalts for Road Purposes.

.4 CAN/CGSB 16.2 M, Emulsified Asphalts, Anionic Type, for Road Purposes.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS, SAMPLES AND MATERIAL CERTIFICATION

.1 Make all submittals in accordance with Section 01 33 00 (Submittal Procedures).

.2 Submit, in plastic containers, to Departmental Representative two 4.0 L samples of asphalt prime proposed for use at least fourteen (14) days prior to commencing work, if requested.

.3 Provide access on tank truck for Departmental Representative to sample asphalt material to be incorporated into work, in accordance with ASTM D140.

.4 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.

Part 2 Products

2.1 MATERIAL

.1 Asphalt material: To ASTM D977 grade SS 1 or SS-1h.

.2 Sand blotter: clean granular material passing 4.75 mm sieve and free from organic matter or other deleterious materials.

Part 3 Execution

3.1 EQUIPMENT

.1 Pressure distributor to be:

.1 Designed, equipped, maintained and operated so that asphalt material:

.1 Is maintained at even temperature.

.2 May be applied uniformly on variable widths of surface up to 5 m.

.3 May be applied at readily determined and controlled rates from 0.2 to 5.4 L/m^2 with uniform pressure, and with an allowable variation from any specified rate not exceeding 0.1 L/m^2.

.2 Capable of distributing asphalt material in uniform spray without atomization at temperature required.

.3 Equipped with meter registering metres of travel per minute visibly located to enable truck driver to maintain constant speed required for application at specified rate.

.4 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.

.5 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.

.6 Equipped with accurate volume measuring device or calibrated tank.

.7 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.

3.2 APPLICATION

.1 Obtain Departmental Representative's approval of surface before applying asphalt prime.

.2 Anionic emulsified asphalt:

.1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Departmental Representative.

.2 Apply diluted asphalt emulsion at a minimum rate of 0.9 L/m^2 but not to exceed 3.0 L/m^2.

.3 Apply diluted asphalt emulsion on damp surface unless otherwise directed by Departmental Representative.

.3 Paint contact surfaces of concrete structures with thin, uniform coat of asphalt prime material.

.4 Do not apply prime when air temperature is less than 5 C or when rain is forecast within two (2) hours.

.5 Where traffic is to be maintained, treat no more than one half width of surface in one application.

.6 Prevent overlap at junction of spreads.

.7 Do not prime surfaces that will be visible when paving is complete.

.8 Apply additional material to areas not sufficiently covered as directed by Departmental Representative.

.9 Keep traffic off primed areas until asphalt prime has set.

.10 Permit prime to set before placing asphalt paving.

3.3 USE OF SAND BLOTTER

.1 If asphalt prime fails to penetrate within twenty-four (24) hours, spread sand blotter material in amounts required to absorb excess material.

.2 Sweep and remove excess blotter material.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply, placement and compaction of hot mix asphalt concrete pavement to lines, grades and typical sections as shown on the Drawings for the apron roadway.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 02 41 13.14 (Asphalt Paving Removal)

.3 Section 32 11 23 (Aggregate Base Courses)

.4 Section 32 12 13.23 (Asphalt Prime Coat)

.5 Section 32 12 13.16 (Asphalt Tack Coat)

1.3 MEASUREMENT AND PAYMENT

.1 Asphalt concrete paving shall be measured in square metres of asphalt concrete paving actually incorporated into work for the various courses and thicknesses shown within the areas defined on the Drawings. No measurement will be made for material which is placed on a temporary basis or materials which are subsequently removed.

.2 Asphalt concrete paving will be paid for at the unit price tendered for ASPHALT PAVING. This payment shall be full compensation for supplying, placing and compacting the asphalt mix, adjustments to levels of catch basin gratings, quality control and all other work necessary and incidental thereto for which separate payment is not elsewhere provided. This payment shall include for all costs in connection with supplying and installing asphalt prime and asphalt tack coat.

.3 Removal of existing asphalt paving will be measured to Section 02 41 13.14 (Asphalt Paving Removal), and payment shall include all costs in connection with asphalt paving removal and disposal.

1.4 REFERENCES

.1 ASTM C88, Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.

.2 ASTM C117, Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.3 ASTM C123, Test Method for Lightweight Pieces in Aggregate.

.4 ASTM C127, Test Method for Specific Gravity and Absorption of Coarse Aggregate.

.5 ASTM C128, Test Method for Specific Gravity and Absorption of Fine Aggregate.

.6 ASTM C131, Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.7 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates.

.8 ASTM C1252, Standard Test Method for Uncompacted Void Content for Fine Aggregate.

.9 ASTM D995, Specification for Requirements for Mixing Plants for Hot Mixed, Hot Laid Bituminous Paving Mixtures.

.10 ASTM D1559, Test Method for Resistance to Plastic flow of Bituminous Mixtures Using Marshall Apparatus.

.11 ASTM D2419, Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

.12 ASTM D2726, Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.

.13 ASTM D2950, Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.

.14 ASTM D3203, Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.

.15 ASTM D4791, Test Method for Flat and Elongated Particles in Coarse Aggregate.

.16 ASTM D5821, Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.

.17 CAN/CGSB 8.1, Sieves Testing, Woven Wire.

.18 CAN/CGSB 8.2 M, Sieves Testing, Woven Wire, Metric.

.19 BC MoT 2006 Standard Specification for Highway Construction: Section 951, Asphalt and Paving Materials for Highway Use; and Section 952, Asphalt Supply.

.20 Asphalt Institute MS-2, Sixth Edition 1993, Mix Design Method for Asphalt Concrete.

.21 AASHTO M320-5, Asphalt Cement.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS, SAMPLES AND MATERIAL CERTIFICATION

.1 Make all submittals in accordance with Section 01 33 00 (Submittal Procedures).

.2 Submit aggregate gradation, asphalt concrete mix design and trial mix test results to Departmental Representative for approval at least twenty-eight (28) days prior to commencing work.

.3 At least twenty-eight (28) days prior to commencing work, inform Departmental Representative of proposed source of aggregates and provide access for sampling. Allow continual sampling by Departmental Representative during production. Install sampling facilities at discharge end of production conveyor, to allow Departmental Representative to obtain representative samples of items being produced. Stop conveyor belt when requested by Departmental Representative to permit full cross section sampling.

.4 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 twenty-eight (28) days prior to commencing work.

.5 Upon request, submit manufacturer's test data and certification that asphalt cement meets requirements of this Section.

Part 2 Products

2.1 ASPHALT CEMENT

.1 Asphalt cement: AASHTO PG 64-11 Grade or BC MoT Standard, Table 951-C, Penetration Grade 80-100 asphalt cement.

2.2 AGGREGATES

.1 Crushed stone or gravel consisting of sound, hard, durable, angular particles, free from soft, thin, elongated or laminated particles, clay lumps, cementation, minerals, organic material, frozen material and other substances that would act in a deleterious manner for the use intended.

.2 Material shall comply with the gradation limits given in Table 1 when tested in accordance with ASTM C136 and ASTM C117, sieve sizes to CAN/CGSB 8.1, and have a smooth curve without sharp breaks when plotted on a semi-log grading chart:

TABLE 1 – AGGREGATE GRADATION LIMITS

Sieve Size	Gradation Limits% Passing by Dry Weight	
	Fine Mix (Surface Course)	**Medium Mix (Lower Course)**
37.5 mm	-	-
25 mm	-	-
19 mm	-	100
12.5 mm	100	84-95
9.5 mm	90-100	73-90
4.75 mm	55-80	50-75
2.36 mm	32-64	35-57
1.18 mm	24-51	26-45
0.600 mm	17-40	18-34
0.300 mm	13-29	10-26
0.150 mm	8-18	6-17
0.075 mm	3-7	3-7

.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 When dryer drum plant or plant without hot screening is used, process fine aggregate through 4.75 mm sieve and stockpile separately from coarse aggregate.

.5 Do not use aggregates having known polishing characteristics in mixes for surface courses

.6 Sand equivalent: to ASTM D2419. Min: 50.

.7 Magnesium Sulphate soundness: to ASTM C88. Max % loss by mass:

.1 Coarse aggregate: 12.

.2 Fine aggregate: 16.

.8 Los Angeles degradation: Grading B, to ASTM C131. Max % loss by mass:

.1 Coarse aggregate: 25.

.9 Absorption: to ASTM C127. Max % by mass:

.1 Coarse aggregate: 1.75.

.10 Loss by washing: to ASTM C117. Max % passing 0.075 mm sieve:

.1 Coarse aggregate: 1.20.

.11 Lightweight particles: to ASTM C123. Max % by mass less than 1.95 relative density: 1.50.

.12 Flat and elongated particles: to ASTM D4791, (with length to thickness ratio greater than 5). Max % by mass:

.1 Coarse aggregate: 10.

.13 Crushed fragments: 100% of particles by mass retained on the 4.75 mm sieve. Minimum 100% one fractured face, 95% two fractured faces. Material to be divided into ranges, using methods of ASTM C136.

.14 Uncompacted voids by ASTM C1252: minimum 45%.

.15 Regardless of compliance with specified physical requirements, fine aggregates may be accepted or rejected on basis of past field performance.

2.3 MINERAL FILLER

.1 Mineral filler is 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 by Departmental Representative to improve mix properties.

.3 Mineral filler to be dry and free flowing when added to aggregate.

2.4 MIX DESIGN

.1 Job mix formula to be approved by Departmental Representative.

.2 Mix shall not contain Recycled Asphalt Pavement (RAP).

.3 Design of mix: by Marshall method to requirements below.

.1 Compaction blows on each face of test specimens: 75.

.2 Mix physical requirements shall conform to the values given in Table 2.

.4 Measure physical requirements as follows:

.1 Marshall stability 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 Voids in mineral aggregates: to Asphalt Institute MS-2, chapter 4.

TABLE 2 – MIX DESIGN

Test Property	**Value or Range for Fine Mix (Surface Course)**	**Value or Range for Medium Mix (Lower Course)**
Marshall Stability at 60 C (kN), Minimum	10.0	10.0
Flow Value (mm), Range	2 - 4	2 - 4
Air Voids in Mixture (%), Range	3 - 5	3 - 5
Voids in Mineral Aggregate (%),Minimum	14	12
Index of Retained Stability (%),Minimum	85	85

.5 Do not change job mix without prior approval of Departmental Representative. Should change in material source be proposed, new job mix formula to be approved by Departmental Representative.

.6 Add dust to effective asphalt cement ratio of 0.6 to 1.2.

Part 3 Execution

3.1 PLANT AND MIXING REQUIREMENTS

.1 Batch and continuous mixing plants:

.1 To ASTM D995.

.2 Feed aggregates from individual stockpiles through separate bins to cold elevator feeders. Do not load frozen materials into bins.

.3 Feed cold aggregates to plant in proportions that will ensure continuous operations.

.4 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved.

.5 Before mixing, dry aggregates to a moisture content not greater than 1% by mass or to a lesser moisture content if required to meet mix design requirements. Heat to temperature required to meet mixing temperature.

.6 Immediately after drying, screen aggregates into hot storage bins in sizes to permit recombining into gradation meeting job mix requirements.

.7 Store hot screened aggregates in a manner to minimize segregation and temperature loss.

.8 Heat asphalt cement and aggregate to mixing temperature appropriate for the approved mix design. Do not heat asphalt cement above 160 C.

.9 Make available current asphalt cement viscosity data at plant. With information relative to viscosity of asphalt being used, control the temperature of completed mix at plant and at paver after considering hauling and placing conditions.

.10 Maintain temperature of materials within plus or minus 5 C of specified mix temperature during mixing.

.11 Mixing time:

.1 In batch plants, both dry and wet mixing times shall be as required for the approved mix design. Continue wet mixing as long as necessary to obtain a thoroughly blended mix but not less than 30 s or more than 75 s.

.2 In continuous mixing plants, mixing time shall be as required for the approved mix design, but not less than 45 s.

.3 Do not alter mixing time unless allowed by Departmental Representative.

.2 Dryer drum mixing plant:

.1 Load aggregates from individual stockpiles to separate cold feed bins. Do not load frozen materials into bins.

.2 Feed aggregates to burner end of dryer drum by means of a multi bin cold feed unit and blend to meet job mix requirements by adjustments of variable speed feed belts and gates on each bin.

.3 Meter total flow of aggregate by an electronic weigh belt system with an indicator that can be monitored by plant operator and which is interlocked with asphalt pump so that proportions of aggregate and asphalt entering mixer remain constant.

.4 Provide for easy calibration of weighing systems for aggregates without having material enter mixer.

.5 Calibrate bin gate openings and conveyor speeds to ensure mix proportions are achieved. Calibrate weigh bridge on charging conveyor by weighing amount of aggregate passing over weigh bridge in set amount of time. Difference between this value and amount shown by plant computer system to differ by not more than plus or minus 2 %.

.6 Make provision for conveniently sampling the full flow of materials from the cold feed.

.7 Provide screens or other suitable devices to reject oversize particles or lumps of aggregate from cold feed prior to entering drum.

.8 Provide a system interlock which will stop all feed components if either asphalt or aggregate from any bin stops flowing.

.9 Accomplish heating and mixing of asphalt mix in an approved parallel flow dryer mixer in which aggregate enters drum at burner end and travels parallel to flame and exhaust gas stream. Control heating to prevent fracture of aggregate or excessive oxidation of asphalt. Equip system with automatic burner controls and provide for continuous temperature sensing of asphalt mixture at discharge, with a printing recorder that can be monitored by the plant operator. Submit printed record of mix temperatures at end of each day.

.10 Mixing period and temperature to produce a uniform mixture in which particles are thoroughly coated, and moisture content of material as it leaves mixer to be less than 2 %.

.3 Temporary storage of hot mix:

.1 Provide mix storage of sufficient capacity to permit continuous operation and designed to prevent segregation.

.2 Do not store asphalt mix in storage bins in excess of 3 hours.

.4 While producing asphalt mix for this project, do not produce mix for other users unless separate storage and pumping facilities are provided for materials supplied to this project.

.5 Mixing tolerances:

.1 Permissible variation in aggregate gradation from job mix (percent of total mass) shall conform to the values given in Table 3.

TABLE 3 – VARIATION IN AGGREGATE GRADATION

Sieve Size	Maximum Variation in Aggregate Gradation (as % of total mass)
4.75 mm sieve and larger	5.0
2.36 mm sieve	4.0
0.600 mm sieve	3.0
0.180 mm sieve	2.0
0.075 mm sieve	1.0

.2 Permissible variation of asphalt cement from job mix: 0.25%.

.3 Permissible variation of mix temperature at discharge from plant: 5 C.

.6 Temperature Monitoring: Monitor temperature of completed mix at plant and/or paver after considering hauling and placing conditions.

3.2 EQUIPMENT

.1 Pavers: mechanical grade controlled self powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.

.2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.

.3 Vibratory rollers:

.1 Minimum drum diameter: 1,200 mm.

.2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.

.4 Haul trucks: 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 a 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 a bearing area not exceeding 310 cm^2 for compacting material along curbs, gutters and other structures inaccessible to roller. Mechanical compaction equipment, when approved by Departmental Representative, may be used instead of tamping irons.

.3 Straight edges, 4.5 m in length, to test finished surface.

3.3 PREPARATION

.1 Reshape granular roadbed if required and obtain approval of Departmental Representative prior to paving.

.2 When paving over existing asphalt surface, clean pavement surface. When levelling course is not required, patch and correct depressions and other irregularities to approval of Departmental Representative before beginning paving operations.

.3 When matching new pavement with existing pavement, make a vertical saw cut in the existing pavement at the junction with the new pavement.

.4 Apply prime coat and tack coat in accordance with Section 32 12 13.23 (Asphalt Prime Coat) and 32 12 13.16 (Asphalt Tack Coat) prior to paving.

.5 Prior to laying mix, clean surfaces of loose and foreign material.

3.4 TRANSPORTATION OF MIX

.1 Transport mix to job site in vehicles cleaned of foreign material.

.2 Paint or spray truck beds with limewater, soap or detergent solution, or non petroleum based commercial product, at least once a day or as required. Elevate truck bed and thoroughly drain. No excess solution will be permitted.

.3 Schedule delivery of material for placing in daylight, unless Departmental Representative approves 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 a 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 appropriate for the approved mix design, but not less than 135 C.

3.5 PROTECTION OF EXISTING FEATURES

.1 The existing dock apron pavement shall be fully preserved, except as indicated for pavement removal on the Drawings.

.2 Contractor shall, within 24 hours, repair any damage made to the dock pavement surface caused by Contractor.

3.6 PLACING

.1 Obtain Departmental Representative's approval of base, existing surface, tack coat and prime coat prior to placing asphalt.

.2 Place asphalt concrete to thicknesses, grades and lines as indicated or as directed by Departmental Representative.

.3 Placing conditions:

.1 Place asphalt mixtures only when air temperature is above 5 C;

.2 When temperature of surface on which material is to be placed falls below 10 C, provide extra rollers as necessary to obtain required compaction before cooling; and,

.3 Do not place hot mix asphalt when pools of standing water exist on surface to be paved, during rain, or when surface is damp.

.4 Place asphalt concrete in compacted lifts of thickness not to exceed:

.1 **Surface Course: 40 mm** thickness of Fine Mix material; and,

.2 **Lower Course: 50 mm** thickness of Medium Mix material.

.5 Where possible do tapering and levelling where required in lower lifts. Overlap joints by not less than 300 mm.

.6 Commence spreading at high side of pavement or at crown and span crowned centerlines with initial strip.

.7 Spread and strike off mixture with self propelled mechanical finisher.

.1 Construct longitudinal joints and edges true to line markings on roadways. Contractor to establish lines for paver to follow, parallel to centerline of proposed pavement. Position and operate paver to follow established line.

.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 screened surfaces.

.8 When hand spreading is used:

.1 Approved wood or steel forms, rigidly supported to assure correct grade and cross section, may be used. 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. Avoid high temperatures which may burn material. Do not use tools at a higher temperature than temperature of mix being placed.

3.7 COMPACTING

.1 Roll asphalt continuously using a uniform rolling pattern.

.2 Do not change rolling pattern unless mix changes or lift thickness changes.

.3 Roll asphalt continuously to density not less than 98 % of 75 blow density in accordance with ASTM D1559, except as noted otherwise. At pavement joints, and at constricted areas where asphalt is placed using small hand-operated compaction equipment, the acceptance criteria is 95 % of 75 blow density in accordance with ASTM D1559. Average in-situ air void content shall be between 6 % and 7 % with no result higher than 8 %. In-situ air void content shall be based on Maximum Theoretical Specific Gravity of the Marshall samples.

.4 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 undue displacement of material or cracking of surface.

.3 Operate roller slowly initially to avoid displacement of material. Do not exceed 5 km/h for breakdown and intermediate rolling for static steel wheeled and pneumatic tired rollers. Do not exceed 9 km/h for finish rolling.

.4 Use static compaction for levelling course 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 30 to 40 impacts per metre of travel. For lifts less than 50 mm thick, impact spacing should not 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.

.5 Breakdown rolling:

.1 Commence breakdown rolling with static steel wheeled roller immediately following rolling of transverse and longitudinal joints 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. Exceptions may be made when working on steep slopes or super-elevated sections.

.4 Use only experienced roller operators for this work.

.6 Intermediate rolling:

.1 Use pneumatic tired, steel wheel or vibratory rollers and follow breakdown rolling as closely as possible and while paving mix temperature allows maximum density from this operation.

.2 Rolling to be continuous after initial rolling until mix placed has been thoroughly compacted.

.7 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, Departmental Representative may specify use of pneumatic tired rollers.

.2 Conduct rolling operations in close sequence.

3.8 JOINTS

.1 General:

.1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.

.2 Paint contact surfaces of existing structures such as manholes, curbs or gutters or cold asphaltic concrete joints 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 a 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. If cold joint cannot 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 35 to 38 mm.

.4 Before rolling, carefully remove and discard coarse aggregate in material overlapping joint with a 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. Feather joints may not be constructed without the approval of Departmental Representative. If Departmental Representative does not approve feather joint, construct full depth butt joint.

.5 Construct butt joints at locations and to details shown on the Drawings.

3.9 FINISH TOLLERANCES

.1 Finished asphalt surface to be within ± 5 mm of specified grade, but not uniformly high or low.

.2 Finished asphalt surface not to have irregularities exceeding 5 mm when checked with a 4.5 m straight edge placed in any direction.

.3 Water ponding is not permitted.

.4 Surface drainage: slopes to gutters, catch basins, etc. to conform with existing contours, in accordance with Drawings and eliminating puddles and ponds.

.5 Paving shall be placed with a slight fall (2% min.) away from buildings.

3.10 TEST PROGRAM

.1 Contractor shall undertake a Quality Control program at his cost to ensure the material supplied and the placement of the paving complies with the specification.

.2 The following test program shall form part of Contractor's Quality Control program.

.1 Aggregate Gradation: Regular sieve analysis to determine aggregate gradation during the crushing operation in accordance with ASTM C136. One (1) test will be carried out for each 300 to 500 tonnes of production, or a minimum of once per day.

.2 Mix Quality:

.1 Marshall Stability: One (1) test of three (3) briquettes for each asphalt mix per production day.

.2 Specific Gravity: as above.

.3 Air Voids and VMA: as above.

.4 Flow Index: as above.

.5 Asphalt Content Extraction: as above.

.6 Maximum Theoretical Specific Gravity: as above.

.3 Density Testing: In-place density testing shall be carried out for Quality Control at representative areas of the asphalt pavement placed, including at joints, areas near shoulders and areas near the centre of the mat. The acceptance criteria for compaction of asphalt pavement shall be the density as specified herein, measured to ASTM D2726 (bulk specific gravity method). Density testing program shall be as follows:

.1 Carry out Quality Control field density testing on a continuous basis (i.e. while the product is still warm and compactable) throughout the paving production work, to ASTM D2950 (nuclear method). These initial test results may be used as a general guide to the level of compaction achieved, but are not the acceptance criteria for pavement compaction. The Contractor shall be aware

that compaction test results to ASTM D2950 (nuclear method) often overestimate the actual compaction achieved as measured by pavement cores to ASTM D2726 (bulk specific gravity method), and he shall interpret the initial ASTM D2950 (nuclear method) compaction results accordingly.

.2 Carry out Quality Control testing for pavement acceptance purposes as follows:

.1 Field Density: After asphaltic concrete has been laid and compacted, extract pavement core(s) for determining the compacted (in-place) density of the pavement. Determine the compacted density to ASTM D2726 (bulk specific gravity method). Obtain one (1) core for every 50 m of pavement strip placed. In addition, for joint density testing, obtain one (1) core for every 50 m of joints. Locations of pavement cores shall be determined in consultation with Departmental Representative.

.2 Pavement Thickness: Measure pavement cores that are extracted for field density as described above to determine the compacted thickness of the pavement in place.

.3 Should any core sample fail to meet the specified field density and thickness requirements, additional sampling/testing of cores and remedial action may be required as directed by Departmental Representative, at Contractor's own expense, to correct such deficiencies.

.4 Contractor shall backfill core holes.

.5 Contractor shall pay all costs in connection with sampling and testing of aggregates and finished paving which fail to meet specified requirements.

.6 A testing agency retained and paid for by Departmental Representative will undertake such tests as Departmental Representative may carry out, at his sole discretion, for Quality Assurance purposes.

3.11 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 a 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.

3.12 MAINTENANCE

.1 Contractor shall be responsible for maintaining the condition of, and cleaning of the asphalt pavement throughout the entire duration of the Contract. Unless Contractor can prove otherwise, defects shall be attributed to Contractor's construction activities, and Contractor shall correct any such defects or irregularities (i.e. cracking, rutting, depression) prior to final acceptance.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section is a reference section for storm utility drainage piping.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 20 00 (Concrete Reinforcing)

.3 Section 03 30 00 (Cast-in-Place Concrete)

.4 Section 03 39 00 (In-Situ Concrete Structures)

.5 Section 05 50 00 (Metal Fabrications)

.6 Section 22 20 00 (Site Services)

.7 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.8 Section 32 11 23 (Aggregate Base Courses)

.9 Section 33 41 00 (Storm Utility Drainage Piping)

1.3 MEASUREMENT AND PAYMENT

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid for under the following Sections:

.1 Covers, frames and miscellaneous metalwork for storm utility drainage manholes and catch basins will not be measured individually, but considered incidental to the work of this Section. These covers, frames and miscellaneous metalwork shall be paid for within the lump sum price tendered for storm utility drainage under Section 33 41 00 (Storm Utility Drainage Piping), and payment shall include for all costs in connection with supplying and installing these items.

.2 All other work in this Section will not be measured individually. All other work in this Section shall be paid for within the lump sum price tendered for storm utility drainage under Section 33 41 00 (Storm Utility Drainage Piping).

1.4 REFERENCES

.1 ASTM A536, Ductile Iron Castings.

.2 ASTM C139, Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.

.3 ASTM C478M, Specification for Precast Reinforced Concrete Manhole Sections.

.4 ASTM C990, Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

.5 ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))

.6 CAN/CSA-A5-M, Portland Cement.

.7 CAN/CSA-A85-M, Masonry Cement.

.8 CAN/CSA-A23.1-M, Concrete Materials and Methods for Concrete Construction.

.9 CAN/CSA A82.56-M, Aggregate for Masonry Mortar.

.10 CAN3-A165 Series-M, CSA Standards on Concrete Masonry Units.

.11 CAN/CSA G30.18-M, Billet Steel Bars for Concrete Reinforcement.

.12 CAN/CSA G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS AND MATERIAL CERTIFICATION

.1 At least twenty-eight (14) days prior to commencing work, submit manufacturer's test data and certification that materials meet requirements of this Section. Include manufacturer's drawings, information and shop drawings where pertinent.

.2 These submissions are to comply with Section 01 33 00 (Submittal Procedures).

Part 2 Products

2.1 MATERIAL

.1 Concrete: to Section 03 30 00 (Cast-in-Place Concrete).

.2 Concrete reinforcement: to Section 03 20 00 (Concrete Reinforcing).

.3 Precast round manhole and catch basin sections: to ASTM C478M, to size(s) indicated on the Drawings. Top sections flat slab top type with opening offset for vertical ladder installation. Monolithic bases to be approved by Departmental Representative and set on concrete slabs cast in place. Manhole and catch basin sections and lids shall be designed to withstand loads specified on the Drawings.

.4 Joints: to be made watertight using rubber rings, bituminous compound, epoxy resin cement or cement mortar.

.5 Mortar:

.1 Aggregate: to CAN/CSA-A82.56.

.2 Cement: to CAN/CSA-A85.

.3 Ladder rungs: to CAN/CSA-G30.18, 20M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164. Rungs to be safety pattern (drop step type) or Cast-in place "Safety" type aluminum steps on 300 mm (12") centres, each step coated with 2 coats of static asphalt paint.

.6 Adjusting rings: to ASTM C478M.

.7 Frames, covers and gratings, to dimensions as indicated and following requirements:

.1 Metal covers and gratings to bear evenly on frames. A frame with cover or grating to constitute one unit. Assemble and mark unit components before shipment.

.2 Manhole and catch basin frames, covers and gratings to ASTM A536 Grade 65-45-12.

.3 Castings to be sand blasted or cleaned, and ground to eliminate surface imperfections, and then coated with two applications of asphalt varnish.

.4 Manhole and catch basin frames, covers and gratings: The model numbers shown on the. All manhole and catch basin frames, covers and gratings shall be designed to withstand loads specified on the Drawings. Stormwater manhole covers shall be marked “STORM” in the casting.

.8 Granular base foundation at manholes and catch basins: to Section 32 11 23 (Aggregate Base Courses). During granular base production, Contractor shall, at his own cost, conduct ongoing quality control sampling and testing at the loading conveyor to confirm that the gradation of the granular base material conforms to the specification. The testing rate for in-situ compacted density of Granular Base shall be not less than one test for every manhole and catch basin structure installed in the work; the testing rate for reference dry density (ASTM D1557) shall be not less than two tests for the work. All quality control test reports shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.9 During placement, Departmental Representative may, at his discretion, inspect the granular base material at manholes and catch basins for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to Contractor, unless material does not conform, whereon the testing shall be at Contractor’s own expense.

.10 Failure of a sample to meet any one of the specified gradation and physical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative. Subject to Departmental Representative’s agreement, rejected granular base material may be used instead as general fill material.

Part 3 Execution

3.1 EXCAVATION AND BACKFILLING

.1 Excavate and backfill in accordance with Section 31 23 33.01 (Excavation, Trenching and Backfilling).

.2 Obtain approval of Departmental Representative before commencing installation of catch basins.

3.2 CONCRETE WORK

.1 Do concrete work in accordance with Section03 30 00 (Cast-In-Place Concrete).

.2 Place concrete reinforcement in accordance with Section 03 20 00 (Concrete Reinforcing).

.3 Position metal inserts in accordance with dimensions and details as indicated.

3.3 INSTALLATION

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.

.3 Dewater excavation and remove soft and foreign material before placing concrete base.

.4 Cast bottom slabs directly on undisturbed fill or, when use of precast concrete bases are permitted by Departmental Representative, set precast concrete base on 150 mm minimum of granular base compacted to a minimum of 95 % of modified Proctor corrected maximum dry density (ASTM D1557).

.5 Precast units:

.1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight with Departmental Representative approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination thereof.

.2 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

.3 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.

.6 For sewers:

.1 Place stub outlets and bulkheads at elevations and in positions indicated.

.2 Connect concrete, PVC, and HDPE pipe into manhole and catch basin using manhole adaptor ring and fill hole with shrinkage compensating grout. Roughen PVC prior to applying grout.

.3 Bench to provide a smooth U-shaped channel. Side height of channel to be level with the crown of the highest sewer inlet. Slope adjacent floor at 8 %. Curve channels smoothly. Slope invert to establish sewer grade.

.7 Set frame and grating or cover to required elevation on no more than six (6) concrete rings. Join rings to frame with cement mortar. Parge and make smooth and watertight.

.8 Place frame and grating or cover on top section to elevation as indicated. If adjustment is required use concrete ring.

.9 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply and installation of the temporary and permanent fire water mains, hydrants, valves, and valve boxes in the service tunnel and apron adjacent to the Dry Dock Extension as shown on the Drawings. Section to be read in conjunction with Section 22 11 16 (Domestic Water Piping and Valves) and Section 22 20 00 (Site Services).

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 78 00 (Closeout Submittals)

.3 Section 20 05 10 (Basic Mechanical Materials and Methods)

.4 Section 21 11 16 (Fire Hydrants)

.5 Section 22 11 16 (Domestic Water Piping and Valves)

.6 Section 22 20 00 (Site Services)

.7 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.8 Section 03 30 00 (Cast-in-Place Concrete)

.9 Section 03 39 00 (In Situ Concrete Structures)

1.3 MEASUREMENT AND PAYMENT

.1 Fire water mains will not be measured individually. Fire water mains will be paid for at the Lump Sum price tendered for FIRE WATER MAINS. Includes cross over pipe replacement at Graving Dock Section 3. Payment shall be full compensation for trenching, laying, jointing, installation, flushing, testing, backfill, supply and delivery of materials including pipe, fittings, valves, hangers, supports, heat tracing and insulation, thrust blocks and disposal offsite of temporary services after use in the Work, and all work necessary or incidental thereto for which separate measurement is not provided elsewhere.

1.4 REFERENCES

.1 ANSI/AWWA B300, Hypochlorites.

.2 ANSI/AAW B301, Liquid Chlorine.

.3 ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.

.4 ANSI/AWWA C207, Steel Pipe Flanges for Waterworks Service, 4 in. – 44 in.

.5 ANSI/AWWA C208, Dimensions for Fabricated Steel Water Pipe Fittings.

.6 ANSI/AWWA C509, Resilient-Seated Gate Valves for Water-Supply Service.

.7 ANSI/AWWA C502, Standard for Dry-Barrel Fire Hydrants.

.8 ANSI/AWWA C601, Flushing and Disinfecting.

.9 ANSI/AWWA C110/A21.10, Ductile-Iron and Gray Iron Fittings, 3 inch through 48 inch (75 mm through 1200 mm), for Water.

.10 ANSI/AWWA C150/A21.50, Thickness Design of Ductile-Iron Pipe.

.11 ANSI/AWWA C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast, for Water.

.12 ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.

.13 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

.14 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates.

.15 ASTM C117, Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing.

.16 ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

.17 ASTM D3139, Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

.18 ASTM F477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

.19 AWWA C605, Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

.20 AWWA M23, PVC Pipe – Design and Installation.

.21 CAN/CGSB-8.1, Sieves Testing, Woven Wire.

.22 CAN/CGSB-8.2, Sieves Testing, Woven Wire, Metric.

.23 CGSB 1-GP-12c, Standard Paint Colours.

.24 CSA 137.3, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

.25 CGSB 1-GP-59M, Enamel, Exterior Gloss Alkyd Type.

.26 IEEE 515.1, Recommended Practice for the Testing, Design, Installation, and Maintenance of Electrical Resistance Heat Tracing for Commercial Applications.

1.5 DEFINITIONS

.1 NOT USED

1.6 SHOP DRAWINGS

.1 Submit shop drawings and product data in accordance with Section 01 33 00 (Submittal Procedures).

1.7 MATERIAL CERTIFICATION

.1 At least twenty-eight (14) days prior to commencing work, submit manufacturer's test data and certification that pipe materials meet the requirements of this section. Include manufacturer's drawings, information and shop drawings where pertinent.

1.8 CLOSE OUT SUBMITTALS

.1 Provide record drawings, including directions for operation valves, details of pipe material, location of air and vacuum release valves, hydrant details, heat tracing and insulation, maintenance and operating instructions in accordance with Section 01 78 00 (Closeout Submittals).

.2 Include on the record drawings top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

1.9 SCHEDULING OF WORK

.1 Schedule Work to minimize interruptions to existing services.

.2 Fire water main to remain in service throughout construction, except as allowed in 1.9.6 and 1.9.7 of this Section 33 11 16.

.3 Temporary fire water main to be installed prior to disconnecting existing fire water main.

.4 Temporary fire water main to be installed and connected to existing fire water main prior to demolition of east end section of existing fire water main.

.5 Permanent fire water main to be installed prior to disconnecting temporary fire water main.

.6 Change over between existing fire water main and temporary fire water main shall be coordinated with Departmental Representative, and shall be performed in a manner to minimize impact on dry dock operations. Change over shall take no longer than 12 hours and shall be scheduled to take place at night between 6:00 pm and 6:00 am.

.7 Change over between temporary fire water main and permanent fire water main shall be coordinated with Departmental Representative, and shall be performed in a manner to minimize impact on dry dock operations. Change over shall take no longer than 12 hours and shall be scheduled to take place at night between 6:00 pm and 6:00 am.

.8 Schedule work to minimize variations in sub-grade quality. All fire water mains are to be installed and backfilled prior to placing granular sub-base.

.9 Notify fire department and Departmental Representative a minimum of fourteen (14) days prior to any planned interruption of water supply to hydrants. Notify fire department and Departmental Representative immediately of any accidental interruption of water supply to hydrants.

.10 Provide “Out of Service” sign on hydrant not in use.

Part 2 Products

2.1 PIPE, JOINTS AND FITTINGS

.1 Pipe shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389. The pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in an extrusion process. All pipe shall comply with the rated pressure requirements of ASTM F 2389. All pipe shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11

.1 Joints for HDPE pipe to be heat butt fusion to ASTM D2657 and in accordance with manufacturer’s recommendations.

.2 Fittings:

.1 Fittings shall be manufactured from a PP-R resin (Fusiolen) meeting the short-term properties and long-term strength requirements of ASTM F 2389. The fittings shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All fittings shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11.

.3 Bolts, carbon steel ASTM A-193, Grade B-7, with heavy hexagon nuts to ASTM A-194, CL-2H, heavy hex style zinc plated to ASTM B633. Provide suitable washers between each bolt head and the flange and between each nut and the flange.

.4 Flange gaskets:

.1 EDPM gasket materials to suit the application, and bolts and nuts.

.5 Nuts and washers to be carbon steel, Grade A to ASTM 563. Washers to be flat hardened steel to ASTM f436. Nuts and washers to be zinc plated to ASTM B633.

.6 Tie rods to be continuous threaded, quenched and tempered alloyed steel to ASTM A3454Grade BC and to be zince plated to ASM B633. Tie rods to be minimum 19mm diameter or greater.

2.2 VALVES AND VALVE BOXES

.1 Gate valves: to ANSI/AWWA C509, standard iron Class 125 body, resilient wedge valves with non-rising stems, minimum 1380 kPa working pressure with flanged joints to ANSI/AWWA C110/A21.10. Valves to open counter clockwise. FM approved and ULC listed wedge gate valves to AWWA C509, each with hub ends suitable for mechanical joint pipe connection, and an adjustable cast iron valve box (length to suit) with cover.

.2 Ball valves: Class 150, stainless steel body, three piece.

.3 Valve Boxes: three piece sliding type adjustable over minimum of 450 mm complete with valve operating key of such length that when set on valve operating nut top of rod will not be more than 150 mm below cover.

.1 Base to be large round type with minimum diameter of 300 mm.

.2 Top of box to be marked "WATER".

.4 Automatic Breach Containment Valves: to ANSI/AWWA B16.42, Ductile Iron grade ASTM A536 body material.

.1 Install Automatic Breach Containment Valves

2.3 HYDRANTS

.1 Hydrants to Section 21 11 16 (Fire Hydrants)

2.4 SERVICE CONNECTIONS

.1 Underground service line valve fittings 19 to 50MM to AWWA C800 suitable for 1035 kPa working pressure.

.2 HDPE pressure pipe to CSA-B137.1 and AWWA C901, mimimum pressure rating 200 psi.

.3 Corporation stops bronze to ASTM B62, AWWA thread inlet, compression type outlet.

.4 Curb stops to be bronze to ASTM B62, compression type, inverted key, ball or cylinder type construction utilizing rubber O-ring seals.

.1 All fitting and valve connections on polyethylene to have solid fluted stiffening liners manufactured from stainless steel to ANSI T304 designed for the appropriate type and ID of pipe.

.5 Service valve boxes:

.1 Curb stop valve boxes on 25mm diameter and smaller services to be telescoping assembly comprised of threaded cast iron top with bronze pentagon centre plug, 25 NPS iron pipe, cast iron base slowing threaded insertion of 25 NPS pipe accommodation for curb stop valve and 14mm diameter steel operating rod attached to curb stop valve with bronze cotter pin.

.6 Service connections PVC pipe:

.1 Service connections less than 100mm, corporation stop, tapped to main using AWWA threads, complete with stainless service saddle. Service saddle to consist of circumferential band type complete with side bars and fingers, keeper bar, stud bolts, nuts, washers and gaskets.

.2 Service connections 100mm and over use tee fitting or tapping valve and sleeve.

.7 Tee connections above 100mm to be fabricated of same material and to same standards as specified pipe fittings and to have ends matching pipe to which they are joined.

2.5 HANGERS AND SUPPORTS

.1 Pipe hangers and supports as shown on the Drawings.

.2 Pipe hangers and supports to Section 20 05 10 Basic Mechanical Materials and Methods.

.3 Pipe hanger and support to manufacturer's standard production components, parts and assemblies.

2.6 PIPE BEDDING AND SURROUND MATERIAL

.1 Granular material shall be crushed or screened stone, gravel or sand consisting of hard, durable particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials with gradation within the limits given in Table 1, when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

2.7

TABLE 1 – PIPE BEDDING AND SURROUND

Sieve Size (U.S. Standard)	Gradation Limits (% Passing by Dry Weight)
19 mm (3/4 in.)	100
12.5 mm (1/2 in.)	70 - 100
9.5 mm (3/8 in.)	50 - 85
4.75 mm (# 4)	30 - 60
2.0 mm (# 10)	15 - 40
0.40 mm (#40)	10 - 30
0.075 mm (#200)	0 - 5

.1 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00 (Cast-in-place Concrete), Type D.

.2 At least twenty-eight (28) days prior to commencing pipe bedding/surround placement, the Contractor shall notify Departmental Representative of the proposed material source(s) and placement procedures and provide, at Contractor's cost, qualification test results confirming that the proposed material from each source meets or exceeds the requirements of this specification.

.3 Departmental Representative will, within fourteen (14) days of receiving the above submission, advise the Contractor of the acceptability of the proposed materials and procedures.

.4 During pipe bedding/surround production, the Contractor shall conduct ongoing quality control sampling and testing at the loading conveyor to confirm that the gradation of the fill materials conform to the specification. The material gradation testing rate for pipe bedding/surround shall be at least **two (2) tests** over the course of the work. The testing rate for in-situ compacted density of pipe bedding/surround shall be not less than **one test for every 20 m** length of trench; the testing rate for reference dry density (ASTM D1557) shall be not less than **two (2) tests** over the course of the work. All quality control test reports shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.5 During placement, Departmental Representative may, at his discretion, inspect the pipe bedding/surround material for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to the Contractor, unless material does not conform, whereon the testing shall be at the Contractor's expense.

.6 Failure of a sample to meet any one of the specified gradation and physical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative. Subject to Departmental Representative's agreement, rejected pipe bedding/surround material may be used instead as General Fill material.

2.8 BACKFILL MATERIAL

.1 General Fill in accordance with Section 31 23 33.01 (Excavation, Trenching and Backfilling).

2.9 PIPE DISINFECTION

.1 Use sodium hypochlorite to ANSI/AWWA B300 to disinfect water mains.

.2 Undertake disinfection of water mains in accordance with ANSI/AWWA C651.

Part 3 Execution

3.1 PREPARATION

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 (Excavation, Trenching and Backfilling).

.2 Trench depth to provide cover over pipe of not less than 1000 mm from finished grade.

.3 Trench alignment to be uniform and free of dips, bends or deviations in grade.

.4 Trench alignment and depth require Departmental Representative's approval prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

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

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

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

.4 Compact each layer full width of bed to at least 95 % modified Proctor maximum dry density to ASTM D1557.

.5 Fill excavation below design elevation of bottom of specified bedding with compacted general fill in accordance with Section 31 23 33.01 (Excavation, Trenching and Backfilling).

3.4 PIPE INSTALLATION

.1 Lay and join pipes to manufacturer's standard instructions and specifications except as noted otherwise herein: PVC pipe to AWWA M23 and C605.

.2 Handle pipe by methods approved by Departmental Representative. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.3 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. Remove and replace defective pipe. Correct pipe which is not in true alignment or grade, or pipe which shows undue settlement after installation.

.4 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up-grade.

.5 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

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

.7 Position and join pipes with equipment and methods approved by Departmental Representative.

.8 Cut pipes in an approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.9 Align pipes carefully before jointing.

.10 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.11 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.

.12 Install pipe joint restraints in accordance with manufacturer's written instructions.

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

.14 Minimize deflection after joint has been made.

.15 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.16 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.

.17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.18 Do not lay pipe on frozen bedding.

.19 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material. Backfill remainder of trench.

3.5 VALVE INSTALLATION

.1 Install valves to manufacturer's recommendations at locations as indicated on the Drawings.

.2 Install underground post-type indicator valves as indicated.

3.6 THRUST BLOCKS

.1 Do concrete work in accordance with Section 03 30 00 (General Concrete Requirements)

.2 Place concrete thrust blocks at valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings on undisturbed ground or compacted fill as indicated.

.3 Keep joints and couplings free of concrete.

.4 Do not backfill over concrete within twenty-four (24) hours after placing.

3.7 HYDROSTATIC AND LEAKAGE TESTING

.1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.2 Notify Departmental Representative at least seventy-two (72) hours in advance of all proposed tests. Perform tests in presence of Departmental Representative.

.3 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least five (5) days after placing concrete, or at least two (2) days if high early strength concrete is used.

.4 Leave valves, joints and fittings exposed.

.5 When testing is done during freezing weather, protect valves, joints and fittings from freezing.

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

.7 Open valves.

.8 Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.

.9 Thoroughly examine exposed parts and correct for leakage as necessary.

.10 Apply hydrostatic test pressure of 1040 kPa based on elevation of lowest point in main and corrected to elevation of test gauge, for a period of one (1) hour.

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

.12 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.13 Repeat hydrostatic test until all defects have been corrected.

.14 Apply a leakage test pressure of 1.5 times normal working pressure after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of two (2) hours.

.15 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for two (2) hours.

.16 Do not exceed allowable leakage of 0.03 litres/mm diameter per 300 m of pipe, including lateral connections, per hour.

.17 Locate and repair defects if leakage is greater than amount specified.

.18 Repeat test until leakage is within specified allowance for full length of water main.

3.8 PIPE SURROUND

.1 Upon completion of pipe laying and after Departmental Representative has inspected work in place, surround and cover pipes as indicated.

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

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

.4 Compact each layer from pipe invert up to underside of backfill to at least 95 % modified Proctor maximum dry density to ASTM D1557.

3.9 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to subgrade level.

.2 Compact backfill to at least 95 % modified Proctor maximum dry density to ASTM D1557.

3.10 FLUSHING AND DISINFECTING

.1 Flushing and disinfecting operations to be witnessed by Departmental Representative.

.2 Flush piping with clean water at a minimum velocity of 1.2 m/s (4'/s) at 205 kPa (30 psi) minimum pressure until all foreign materials have been removed and the flushed water is clear.

.3 Provide connections and pumps for flushing as required.

.4 Open and close valves, hydrants and service connections to ensure thorough flushing.

.5 When flushing has been completed to Departmental Representative approval, introduce strong solution of chlorine in accordance with AWWA C601-68 and as approved by Departmental Representative into water main and ensure that it is distributed throughout entire system.

.6 Rate of chlorine application to be proportional to rate of water entering pipe.

.7 Chlorine application to be close to point of filling water main and to occur at same time.

.8 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.9 Flush line to remove chlorine solution after 24 hours. Dispose chlorinated water to sanitary sewer.

.10 Measure chlorine residuals at extreme end of pipe-line being tested.

.11 Perform bacteriological tests on water main, after chlorine solution has been flushed out. Take samples daily for minimum of two days. Should contamination remain or recur during this period, repeat disinfecting procedure.

.12 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.

.13 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.

.14 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

3.11 OPERATIONS AND MAINTENANCE MANUALS

.1 Provide operation and maintenance manuals, as stipulated in Section 01 78 00 (Closeout Submittals), for the following:

.1 Backflow preventer valves, gate valves, automatic breach containment valves fire hydrants, and heat tracing; and,

.2 All other supplied mechanical and electrical equipment.

END OF SECTION

1. PART 1 – GENERAL

1.1 Description

.1 This Section covers the supply and installation of the temporary and permanent sanitary sewer force main in the service tunnel and around the dock extension. Section to be read in conjunction with Section 22 13 16 (Drainage Waste and Vent Piping) and Section 22 20 00 (Site Services).

1.2 Related Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 78 30 (Closeout Submittals)

.3 Section 20 05 10 (Basic Mechanical Materials and Methods)

.4 Section 22 13 16 (Drainage Waste and Vent Piping)

.5 Section 22 13 29 (Drainage Pumps and Accessories),

.6 Section 22 20 00 (Site Services)

.7 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

1.3 Measurement and Payment Procedures

.1 Permanent and temporary sanitary sewer force mains will not be measured individually. Permanent sanitary sewer force mains will be paid for at the Lump Sum price tendered for SANITARY SEWER FORCE MAINS. Payment shall be full compensation for laying, jointing, installation, flushing, testing, supply and delivery of materials including pipe, fittings, valves, hangers, supports, thrust blocks, removal and disposal offsite of temporary services after use in the Work, and all work necessary or incidental thereto for which separate measurement is not provided elsewhere.

.2 The service tunnel lift station pump system will not be measured individually. Service tunnel sanitary pump system will be paid for at the Lump Sum price tendered for SANITARY SEWER FORCE MAINS. Payment shall be full compensation for the scope of work described on the Drawings and relevant specifications, including Section 22 13 29 (Drainage Pumps and Accessories), or specifications incidental thereto for which separate measurement is not provided elsewhere, for supply and installation of the service tunnel sanitary pump system complete with framing and grating for hatches as shown on the Drawings.

1.4 References

.1 CSA B137.1, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

.2 ASTM D-3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

.3 ASTM F-714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR). Based on Outside Diameter.

.4 AWWA C906, Standard for Polyethylene (PE) Pressure Pipe and Fittings 4 in. Through 63in. for Water Distribution.

.5 ASTM D2657, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings

.6 ASTM D2837 - 08 Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

1.5 Definitions - Not Used

1.6 Submittals

.1 At least twenty-eight (14) days prior to commencing the construction of sanitary sewer force main facilities, submit shop drawings and product data to Departmental Representative for review in accordance with Section 01 33 00 (Shop Drawings, Product Data and Samples).

.2 Material Certification: At least twenty-eight (14) days prior to commencing work, submit manufacturer's test data and certification that pipe materials meet the requirements of this Section. Include manufacturer's drawings, information and shop drawings where pertinent.

1.7 Scheduling of Work

.1 Schedule work to minimize interruptions to existing services.

.2 Sanitary sewer force main to remain in service throughout construction, except as allowed in 1.7.6 and 1.7.7 of this Section.

.3 Temporary sanitary sewer force main to be installed prior to disconnecting existing sanitary sewer force main.

.4 Temporary sanitary sewer force main to be installed and connected to existing sanitary sewer force main prior to demolition of east end section of existing sanitary sewer force main.

.5 Permanent sanitary sewer force main to be installed prior to disconnecting temporary sanitary sewer force main.

.6 Change over between **existing** sanitary sewer force main and **temporary** sanitary sewer force main shall be coordinated with Departmental Representative, and shall be performed in a manner to minimize impact on dry dock operations. Change over shall take no longer than 12 hours and shall be scheduled to take place at night between 6:00 pm and 6:00 am.

.7 Change over between **temporary** sanitary sewer force main and **permanent** sanitary sewer force main shall be coordinated with Departmental Representative, and shall be performed in a manner to minimize impact on dry dock operations. Change over shall take no longer than 12 hours and shall be scheduled to take place at night between 6:00 pm and 6:00 am.

.8 Notify Departmental Representative a minimum of fourteen (14) days prior to any planned interruption in service. Notify Departmental Representative immediately of any accidental interruption of sanitary sewer force main.

2. PART 2 – PRODUCTS

2.1 Pipe, Joints and Fittings

.1 **Sewer – (pressurized main) –** Pipe shall be manufactured from a PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F 2389 or CSA B137.11. The pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. All pipe shall be made in an extrusion process. Piping shall contain a fiber layer to restrict thermal expansion and have a wall thickness of SDR 11. All pipe shall comply with the rated pressure requirements of ASTM F 2389 or CSA B137.11. All pipe shall be certified by NSF International as complying with NSF 14, and ASTM F 2389 or CSA B137.

2.2 Hangers and Supports

.1 Pipe hangers and supports as shown on the Drawings.

.2 Pipe hangers and supports to Section 20 05 10 Basic Mechanical Materials and Methods.

.3 Pipe hangers and support to manufacturer's standard production components, parts and assemblies.

3. PART 3 – EXECUTION

3.1 Preparation

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 Pipe Installation

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

.2 Polyethylene pipe shall be joined by thermal butt fusion wherever possible as outlined in ASTM D2657. Butt fusion joining of the pipe and fittings shall be performed in accordance with manufacturer's recommendations.

.3 Cut pipes in an approved manner as recommended by pipe manufacturer, without damaging pipe and to leave smooth end at right angles to axis of pipe.

.4 Align pipes carefully before jointing.

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

.6 Minimize deflection after joint has been made.

.7 For temporary sanitary sewer force main, provide insulation of exposed pipes, joints and fittings against freezing.

3.3 Hanger Installation

.1 Install hangers to manufacturer's recommendations.

.2 Install hanger so that rod is vertical under operating conditions.

.3 Adjust hangers to equalize load.

3.4 Hydrostatic and Leakage Testing

.1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.2 Notify Departmental Representative at least twenty-four (24) hours in advance of all proposed tests. Perform tests in presence of Departmental Representative.

.3 Where any section of system is provided with concrete thrust blocks, do not conduct tests until at least five (5) days after placing concrete, or at least two (2) days if high early strength concrete is used.

.4 Leave valves, joints and fittings exposed.

.5 When testing is done during freezing weather, protect valves, joints and fittings from freezing.

.6 Expel air from main by slowly filling main with water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs.

.7 Thoroughly examine exposed parts and correct for leakage as necessary.

.8 Test the pipe in two phases as set out in the manufacturer's literature.

.9 Provide a three (3) hour expansion phase after initial pressurization of pipe.

.10 Measure make-up water required to maintain the test pressure following the expansion phase. Compare leakage relative to allowable leakage as specified by the manufacturer.

.11 The pressure test shall be conducted for a period of two (2) hours at 1000 kPa. In no case shall the total of the expansion phase and pressure test be greater than six (6) hours.

.12 Apply hydrostatic test pressure of 1400 kPa based on elevation of lowest point in main and corrected to elevation of test gauge.

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

.14 Remove joints, fittings and appurtenances showing leakage and replace with new sound material and make watertight.

.15 Repeat hydrostatic test until all defects have been corrected.

.16 Do not exceed allowable leakage as set out above.

.17 Locate and repair defects if leakage is greater than amount specified.

.18 Repeat test until leakage is within specified allowance for full length of water main.

3.5 Removal of Temporary Service after Use

.1 Disconnect, remove and dispose offsite the temporary sanitary sewer force main service after use in the Work.

3.6 Operation and Maintenance Manuals

.1 Provide operation and maintenance manuals, as stipulated in Section 01 78 30 (Closeout Submittals) for new valves or other equipment items installed in the work, if any.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers provision of permanent stormwater surface drainage, as shown on the Drawings.

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 78 00 (Closeout Submittals)

.3 Section 03 20 00 (Concrete Reinforcing)

.4 Section 03 30 00 (Cast-in-Place Concrete)

.5 Section 03 39 00 (In-Situ Concrete Structures)

.6 Section 05 50 00 (Metal Fabrications)

.7 Section 31 23 33.01 (Excavation, Trenching and Backfilling)

.8 Section 31 24 15 (General Fill)

.9 Section 33 05 13 (Manholes and Catch Basins)

1.3 MEASUREMENT AND PAYMENT

.1 The storm utility drainage system will not be measured individually. Storm utility drainage will be paid for at the Lump Sum price tendered for STORM UTILITY DRAINAGE. Payment shall be full compensation for the scope of work described on the Drawings and in the Specification, or incidental thereto for which separate measurement is not provided elsewhere, for supply and installation of the storm utility drainage piping, drains/covers, drain junction boxes, catch basins, manholes, miscellaneous metalwork related to temporary and permanent storm utility drainage and modifications to the existing storm drainage system, concrete and reinforcing associated with storm drainage.

.2 The service tunnel drainage pump system will not be measured individually. Service tunnel drainage pump system will be paid for at the Lump Sum price tendered for STORM UTILITY DRAINAGE. Payment shall be full compensation for the scope of work described on the Drawings and specifications, or incidental thereto for which separate measurement is not provided elsewhere, for supply and installation of the service tunnel drainage pump system complete with framing and grating for drainage sump, and drain run from this system to the existing storm water drainage system as shown on the Drawings, and for protection of existing storm water drainage systems during the work.

1.4 REFERENCES

.1 ASTM Cl4M, Specifications for Concrete Sewer, Storm Drain and Culvert Pipe.

.2 ASTM Cl17, Test Method for Material Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.

.3 ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM C443M, Specification for Joints for Circular Concrete Pipe and Manholes, Using Rubber Gaskets.

.5 ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

.6 ASTM D3034, Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

.7 ASTM D3212, Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

.8 ASTM F477, Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

.9 CAN/CSA-A5, Portland Cement.

.10 CAN/CSA-A257-M, Standards for Concrete Pipe.

.11 CAN/CSA-B182.11, Recommended Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

.12 CAN/CSA-B182.2, PVC Sewer Pipe and Fittings (PSM Type).

.13 CAN/CGSB-8.1, Sieves Testing, Woven Wire.

.14 CAN/CGSB-8.2-M, Sieves Testing, Woven Wire, Metric.

.15 Ministry of Transportation Electrical and Signing Material Standards, section 402.

.16 CSA C22.3 No. 7-94 Underground Systems.

.17 CSA C22.1-02 and BC Electrical Safety Branch Amendments.

.18 CSA C22.2 No. 211.2-M, Rigid PVC (Unplasticized) Conduit.

.19 CSA C22.2 No.211.1-M, Rigid types EBI and DB2/ES2 PVC Conduit.

.20 CSA C22.2 No. 131-M, Type TECK 90 Cable.

.21 CSA C22.2 No .0.3-96, Test Methods for Electrical Wires and Cables.

.22 Abbreviations for electrical terms: to CSA Z85.

.23 ASTM D1056-91, Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

1.5 DEFINITIONS

.1 NOT USED

1.6 SUBMITTALS

.1 At least twenty-eight (28) days prior to commencing the construction of any permanent stormwater drainage facilities, and the service tunnel drainage pump system, submit drainage shop drawings to Departmental Representative for review in accordance with Section 01 33 00 (Submittal Procedures).

.2 Material Certification: At least twenty-eight (28) days prior to commencing work, submit manufacturer's test data and certification that pipe materials meet the requirements of this Section. Include manufacturer's drawings, information and shop drawings where pertinent.

1.7 SCHEDULING OF WORK

.1 Schedule and arrange the work of this Section to avoid interruptions to existing storm water drainage systems and to other utilities.

.2 Contractor shall be responsible throughout construction for providing and maintaining temporary stormwater drainage within the work site. The routing of any temporary stormwater drainage runs shall be subject to Departmental Representative's approval, and shall account for treatment of the runoff before discharge.

.3 Schedule work to minimize variations in sub-grade quality.

.4 All storm sewers (including catch basins, and manholes) are to be installed and backfilled prior to placing granular sub-base for asphalt pavement.

Part 2 Products

2.1 CONCRETE PIPE

.1 Non-reinforced circular concrete pipe and fittings to ASTM C14M, 450 mm dia., Class IV as indicated, designed for flexible rubber gasket joints to ASTM C443M.

2.2 PLASTIC PIPE

.1 Poly Vinyl Chloride (PVC) pipe manufactured to specifications for pipe size ranges as follows:

.1 100 mm dia. – 375 mm dia. to ASTM D3034

.2 Pipes to be certified by Canadian Standards Association to CAN/CSA-Bl82.2.

.3 Standard Dimensional Ratio (SDR): 35.

.4 Joints: To conform to ASTM D3212; pipe to include integral bell and spigot ends with stiffened wall section and formed groove for rubber gasket; elastomeric gaskets to ASTM F477.

2.3 PIPE BEDDING AND SURROUND MATERIAL

.1 Pipe bedding and surround material to be crushed stone, gravel or sand consisting of hard, durable, particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials. Gradations to be within the limits specified in Table 1 when tested to ASTM C136 and ASTM C1l7. Sieve sizes to CAN/CGSB-8.1.

TABLE 1 – PIPE BEDDING AND SURROUND

Sieve Size (U.S. Standard)	Gradation Limits (% Passing by Dry Weight)
19 mm (3/4 in.)	100
12.5 mm (1/2 in.)	70 - 100
9.5 mm (3/8 in.)	50 - 85
4.75 mm (No. 4)	30 - 60
2.0 mm (No. 10)	15 - 40
0.40 mm (No.40)	10 - 30
0.075 mm (No.200)	0 - 5

.2 Drain rock to be clean round or crushed rock meeting the gradations given in Table 2.

TABLE 2 – DRAIN ROCK

Sieve Size (U.S. Standard)	Gradation Limits (% Passing by Dry Weight)
25 mm (1 in.)	100
19 mm (3/4 in.)	0 – 100
9.5 mm (3/8 in.)	0 – 5
4.75 mm (No. 4)	0

.3 Concrete mixes and materials required for bedding, cradles, encasement, supports, manhole, catch basin and oil-water separator bases, manhole benching to Section 03 30 00 (Cast-In-Place Concrete)Type D.

.4 At least twenty-eight (28) days prior to commencing placement of pipe bedding or surround materials, Contractor shall notify Departmental Representative of the proposed material source(s) and placement procedures and provide, at Contractor's own cost, qualification test results confirming that the proposed material from each source meets or exceeds the requirements of this Section of the Specification.

.5 Departmental Representative will, within fourteen (14) days of receiving the above submission, advise Contractor of the acceptability of the proposed materials and procedures.

.6 During pipe bedding/surround production, Contractor shall conduct ongoing quality control sampling and testing at the loading conveyor to confirm that the gradation of the fill materials conform to the specification. The material gradation testing rate for pipe bedding/surround shall be at least **two (2) tests** over the course of the work. The testing rate for in-situ compacted density of pipe bedding/surround shall be not less than **one test for every 20 m** length of trench; the testing rate for reference dry density (ASTM D1557) shall be not less than **two (2) tests** over the course of the work. All quality control test reports shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.7 During placement, Departmental Representative may, at his discretion, inspect the fill materials for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to Contractor, unless material does not conform, whereon the testing shall be at Contractor's own expense.

.8 Failure of a sample to meet any one of the specified gradation and physical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative. Subject to Departmental Representative's agreement, rejected pipe bedding or surround materials may be used instead as general fill.

2.4 BACKFILL MATERIAL

.1 General fill in accordance with Section 31 24 15 (General Fill).

2.5 SERVICE TUNNEL DRAINAGE PUMP SYSTEM

.1 Provide a drainage pump system, complete with all mechanical equipment and control panel as shown on the drawings and as specified in Section 22 13 29 and .

2.6 MISCELLANEOUS METAL WORK

.1 Deck drains/covers, bends, tees, deck drain junction boxes and other miscellaneous metalwork to be in accordance with Section 05 50 00 (Metal Fabrications).

Part 3 Execution

3.1 PREPARATION

.1 Clean new pipes and fittings of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

.2 Where drainage piping is to be connected to existing piping, clean the existing pipes and fittings of debris. Carefully inspect the existing piping for damage and defects, and inform Departmental Representative if any damage or defects are found.

3.2 TRENCHING

.1 Do trenching work in accordance with Section 31 23 33.01 (Excavation, Trenching and Backfilling) and as shown on the Drawings.

.2 Do not allow contents of any sewer, or sewer connection, to flow into trench.

.3 Ensure trench alignment and depth are to approval of Departmental Representative, prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

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

.2 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.

.3 Shape transverse depressions as required to suit joints.

.4 Compact each layer full width of bed to at least 95 % modified Proctor maximum dry density to ASTM D1557, and as shown on the Drawings.

.5 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted general fill.

3.4 INSTALLATION - GENERAL

.1 Handle pipe by approved methods. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.2 Lay and join pipe in accordance with manufacturer’s recommendations. Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

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

.4 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.5 Do not allow water to flow through pipes during construction except as may be permitted by Departmental Representative.

.6 Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.7 Position and joint pipes by methods approved by Departmental Representative.

.8 Install PVC pipe and fittings in accordance with CAN/CSA-B182.11.

3.5 PIPE 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 to 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.

.9 When any stoppage of work occurs, restrain pipes to prevent "creep" during down time.

.10 Cut pipes as required for special inserts, fittings or closure pieces in neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.11 Make watertight connections to manholes and catch basins. Use shrinkage compensating grout when suitable gaskets are not available.

.12 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes. Joint to be structurally sound and watertight.

.13 Plug open upstream ends of pipes with removable watertight concrete, steel or wooden bulkheads.

3.6 PIPE SURROUND

.1 Upon completion of pipe laying and after Departmental Representative has inspected work in place, surround and cover pipes as specified.

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

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

.4 Compact each layer from pipe invert up to underside of backfill to at least 95 % modified Proctor maximum dry density to ASTM D1557.

.5 Install concrete encasement where indicated on the Drawings. Use Type D concrete to Section 03 30 00 (Cast-in-Place Concrete).

3.7 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to subgrade level.

.2 Compact backfill to at least 95 % modified Proctor corrected maximum dry density to ASTM D1557.

.3 Install wooden stake markers on the ground surface at plugs and caps such that the ends of the buried pipes can be easily located by others.

3.8 FIELD TESTING

.1 Repair or replace pipe, pipe joints or bedding found defective.

.2 When directed by Departmental Representative, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Departmental Representative may carry out inspection of installed pipe by television camera, photographic camera or by other related means. Provided no defective work is found by such inspections, Departmental Representative will pay costs for inspectors, trained operators, equipment rental and materials. If defective work is found by such inspections, pay Departmental Representative a part of total inspection cost proportional to number of defective sections of sewer to total number of sections inspected. A section is defined as length of pipe between successive catch basins and/or manholes. Regardless of the inspection outcome, Contractor shall assist Departmental Representative to gain access to the storm water drainage system, provide safety precautions in compliance with WorkSafeBC regulations, and provide temporary electrical power/lighting as required for inspection and testing.

3.9 OPERATION AND MAINTENANCE MANUALS

.1 Provide operation and maintenance manuals, as stipulated in Section 01 78 00 (Closeout Submittals), for all supplied mechanical and electrical equipment.

END OF SECTION

1. PART 1 – GENERAL

1.1 Description

.1 This Section covers installation of concrete duct banks and vaults (pull pits) for electrical, control, grounding and telephone wires, and connection into existing duct banks and vaults.

1.2 Related Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 03 10 00 (Concrete Forming and Accessories)

.3 Section 03 20 00 (Concrete Reinforcing)

.4 Section 03 30 00 (Cast-in-Place Concrete)

.5 Section 05 50 00 (Metal Fabrications)

.6 Section 26 02 00 (Common Work Results – Electrical)

.7 Section 26 05 27 (Grounding)

.8 Section 26 05 34 (Conduits, Conduit Fastenings and Fittings)

.9 Section 31 23 33.01 (Excavating, Trenching and Backfilling)

1.3 Measurement and Payment Procedures

.1 Concrete encased duct banks will be measured in lineal metres of duct banks installed, except for ducts embedded within the dry dock structure or within retaining wall structures.

.2 Duct banks covered by this Section will be paid for at the relevant unit prices tendered for each type of duct bank, the various types being defined by the number of ducts enclosed. Payment shall be full compensation for supply and installation of ducts in concrete duct banks, flexible connections, concrete encasement complete with reinforcing steel, bedding and backfill, compaction of bedding and backfill, connection to concrete structures, connection into existing duct bank system, and all work incidental thereto. Payment for hauling and excavation of all material encountered is covered in Section 31 23 33.01 (Excavating, Trenching and Backfilling).

.1 CONCRETE DUCT BANK: TYPE CDB1 (includes EEA and EEE).

.2 CONCRETE DUCT BANK: TYPE CDB2 (includes EEB and EED)

.3 CONCRETE DUCT BANK: TYPE CDB3 (includes EEC).

.3 Ducts embedded in concrete structures (except duct banks) will not be measured separately, but considered incidental to the work. All costs in connection with ducts embedded in concrete structures (except duct banks) shall be included in the unit prices tendered for concrete to Section 03 39 00 (In-situ Concrete Structures).

.4 Electrical vaults (pull pits) will not be measured individually. All work related to electrical vaults will be paid for at the Lump Sum price tendered for ELECTRICAL VAULTS (PULL PITS). Payment shall be full compensation for materials, hauling, excavation of all material encountered, removal and disposal of waste materials, construction and installation of concrete vaults complete with reinforcing, gratings, pulling eyes, channel inserts, drain pipes with backwater valves, filter cloth, bedding and backfill including compaction, and all work incidental thereto.

.5 Covers and frames for electrical vaults in this Section will be measured to Section 05 50 00 (Metal Fabrications), and payment shall include all costs in connection with covers and frames for electrical vaults.

1.4 References

.1 CAN/CSA-C22.1, Canadian Electrical Code Part 1, Safety Standard for Electrical Installation.

.2 CAN/CSA-C22.2 No. 221.1-M, PVC Conduit and Associated Fittings.

.3 CAN3-C22.3 No. 7-M, Underground Systems.

.4 ASTM C117, Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.

.5 ASTM C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.6 ASTM D1557, Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

.7 CAN/CGSB-8.1, Sieves, Testing, Woven Wire, Inch Series.

.8 CAN/CGSB-8.2, Sieves, Testing, Woven Wire, Metric.

.9 CAN/CSA-A23.1-M, Concrete Materials and Methods of Concrete Construction.

.10 BC Hydro Standard ES54, Section H - Duct Installations, URD, UD and Feeder Banks.

1.5 Definitions – Not Used

1.6 Submittals

.1 At least twenty-eight (14) days prior to commencing the construction of any concrete duct banks and vaults, submit duct bank and vault details and shop drawings to Departmental Representative for review in accordance with Section 01 33 00 (Shop Drawings, Product Data and Samples).

1.7 Scheduling of Work

.1 Schedule work to minimize variations in sub-grade quality.

.2 All duct banks (including vaults) in the dock apron area are to installed and backfilled prior to placing granular sub-base for the apron roadway.

2. PART 2 – PRODUCTS

2.1 Materials

.1 Duct bank bedding material shall be crushed or screened sand and gravel consisting of hard, durable particles, free from clay lumps, cementation, organic material, frozen and other deleterious material. Gradations to be within the limits given in Table 1, when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB 8.1.

TABLE 1 – DUCT BANK BEDDING

Sieve Size (U.S. Standard)	Gradation Limits (% Passing by Dry Weight)
19 mm (3/4 in.)	100
12.5 mm (1/2 in.)	70 - 100
9.5 mm (3/8 in.)	50 - 85
4.75 mm (# 4)	30 - 60
2.0 mm (# 10)	15 - 40
0.40 mm (# 40)	10 - 30
0.075 mm (# 200)	0 - 5

.2 At least twenty-eight (14) days prior to commencing duct bank bedding placement, the Contractor shall notify Departmental Representative of the proposed material source(s) and placement procedures and provide, at Contractor's cost, qualification test results confirming that the proposed material from each source meets or exceeds the requirements of this specification.

.3 Departmental Representative will, within fourteen (14) days of receiving the above submission, advise the Contractor of the acceptability of the proposed materials and procedures.

.4 During duct bank bedding production, the Contractor shall conduct ongoing quality control sampling and testing at the loading conveyor to confirm that the gradation of the fill materials conform to the specification. The material gradation testing rate for duct bank bedding shall be at least **two (2) tests** over the course of the work. The testing rate for in-situ compacted density of duct bank bedding shall be not less than **one test for every 20 m** length of trench; the testing rate for reference dry density (ASTM D1557) shall be not less than **two (2) tests** over the course of the work. All quality control test reports shall be submitted to Departmental Representative for review and approval prior to placement of that material in the Work.

.5 During placement, Departmental Representative may, at his discretion, inspect the duct bank bedding material for conformance to the specification. This quality assurance inspection may include sampling and testing at no cost to the Contractor, unless material does not conform, whereon the testing shall be at the Contractor's expense.

.6 Failure of a sample to meet any one of the specified gradation and physical properties constitutes an unacceptable material and such material may be subject to rejection by Departmental Representative. Subject to Departmental Representative's agreement, rejected duct bank bedding material may be used instead as general fill material.

.7 Backfill material shall be general fill in accordance with Section 31 23 10 (Excavating, Trenching and Backfilling).

.8 Underground duct shall be DB-2 PVC Electrical Duct to CSA C22.2 No. 211.1-M.

.9 All cast-in-place concrete shall conform to Section 03 30 00 (Cast-in-Place Concrete).

.10 All concrete reinforcement shall conform to Section 03 20 00 (Concrete Reinforcing).

.11 All grounding shall conform to Section 26 05 27 (Grounding).

.12 Pre-cast concrete vaults type and dimensions shall be as indicated on the Drawings.

.13 Pre-cast concrete vaults shall come complete with standard drainage.

.14 Vault covers and frames: The types and/or model numbers shown on the Drawings for metal covers and frames are provided to indicate style and size only, and do not necessarily indicate their load carrying capacity. All vault covers and frames shall be designed to withstand loads specified on the Drawings. Vault covers shall be marked "ELECTRICAL" in the casting and include the Vault Number as shown on the Drawings.

3. PART 3 – EXECUTION

3.1 Trenching

.1 Do trenching work in accordance with Section 31 23 33.01 (Excavating, Trenching and Backfilling).

.2 Trench depth to provide cover over concrete duct bank of not less than 1000 mm from finished grade.

.3 Trench alignment and depth require Departmental Representative's approval prior to placing bedding material and duct bank.

3.2 Granular Bedding

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

.2 Compact each layer full width of bed to at least 95 % modified Proctor corrected maximum dry density when tested to ASTM D1557.

.3 Fill any over-excavation with compacted General Fill.

.4 For granular bedding details under vaults, refer to the Drawings.

3.3 Underground Duct

.1 Before placement of concrete encasement, all duct connections shall be made watertight using solvent welded joints.

.2 Ducts shall be graded to ensure that all duct runs are self-draining.

.3 All duct ends are to be belled.

.4 All ducts shall be adequately held in position while the encasement concrete is being poured.

.5 All ducts shall have a 9 gauge soft wire installed without kinks or bends for the length of the duct as a pulling leader. This leader wire shall be continuous without joints and shall have 1 metre spare neatly coiled at each end.

.6 Duct spacers are to be used as shown on the Drawings.

.7 If any duct is observed to have been subject to contamination it shall have a mandrel and swab pulled through it in the presence of Departmental Representative.

.8 The Contractor will be required to pull a full sized mandrel through any two ducts selected at random by Departmental Representative to prove the accessibility of the duct system.

3.4 Grounding

.1 Grounding conductors are to be encased in the duct bank concrete as shown on the drawings and as covered in Section 26 05 27 (Grounding).

.2 Grounding conductors are to be adequately held in position while the encasement concrete is being poured.

.3 Each grounding conductor is to be connected to duct bank reinforcement with compression type connectors in at least two locations per run.

.4 Each grounding conductor is to be connected to ground rods at either end with compression type connectors.

3.5 Concrete Encasement

.1 Do concrete work in accordance with Section 03 30 00 (Cast-in-Place Concrete).

.2 Place concrete reinforcement in accordance with Section 03 20 00 (Concrete Reinforcing).

3.6 Backfilling

.1 Place and compact backfill as specified except that compaction of fill within a distance of 450 mm over duct banks shall be carried out using approved hand operated mechanical compactors.

.2 No backfilling shall be done until the work has been inspected and tested and permission given by Departmental Representative.

.3 During backfilling operations, care shall be taken to ensure that buried services are not damaged in any way.

.4 Any damaged or defective areas shall be removed and replaced by the Contractor at his own expense.

.5 Place PVC warning tape at least 300 mm below finished grade above full length of duct bank.

END OF SECTION

1. PART 1 – GENERAL

1.1 Description

This Section covers supply and installation for underground electrical service.

1.2 Related Sections

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 61 10 (Product Requirements)

.3 Section 26 05 00 (Common Work Results - Electrical)

.4 Section 26 05 21 (Wires and Cables (0-1000V))

.5 Section 26 05 27 (Grounding)

.6 Section 26 05 43.01 (Installation of Cables in Ducts)

.7 Section 31 23 33.01 (Excavating, Trenching and Backfilling)

.8 Section 33 65 73 (Concrete Duct Banks and Vaults)

1.3 Measurement and Payment Procedures

.1 No measurement or payment will be made under this Section. All work performed to satisfy the requirements of this Section shall be paid under the relevant payment item in Section 26 05 21 (Wires and Cables (0-1000V)).

1.4 References

.1 CAN/CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

.2 CSA C22.2 No. 211.1, Rigid Types EBI and DB2/ES2 PVC Conduit.

.3 CAN3-C22.3 No. 7-M, Underground Systems.

1.5 Submittals

.1 At least twenty-eight (28) days prior to commencing work, provide submittals to Departmental Representative in accordance with Section 01 33 00 (Submittal Procedures)

.2 Product Data:

.1 Submit manufacturer’s printed product literature, specifications and datasheets and include product characteristics, performance criteria, physical size, materials, finish and limitations.

.2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures and maintenance instructions and manuals.

1.6 Delivery, Storage and Handling

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle materials in accordance with Section 01 61 10 (Product Requirements).

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Storage and Protection:

.1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

2. PART 2 – PRODUCTS

2.1 Materials

.1 Underground ducts: as indicated on the Drawings, to CSA C22.2 No. 211.1.

.2 Conductors: copper type RWU90, to Section 26 05 21 (Wires and Cables (0-1000V)), size and number of conductors as indicated on the Drawings.

.3 Pulling Iron: 22 mm diameter hot dipped galvanized steel bar with exposed triangular shaped opening.

3. PART 3 – EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 Installation

.1 Install cables in ducts in accordance with Section 26 05 43.01 (Installation of Cables in Ducts).

.2 Allow adequate conductor length for connection to power supply and to service equipment.

.3 Install pulling irons as required.

.4 Make grounding connections in accordance with Section 26 05 27 (Grounding).

.5 Install concrete encased ducts for electrical systems as indicated and in accordance with CAN/CSA A23.1.

.6 Seal ducts and conduits at building entrance locations after installation or removal of cable.

3.3 Field Quality Control

.1 Site Tests:

.1 Perform tests in accordance with Section 26 05 00 (Common Work Results - Electrical).

.2 Perform additional tests if required by authority having jurisdiction.

.2 Submit written test results to Departmental Representative for approval.

3.4 Cleaning

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 This Section covers the supply and installation of Mooring Devices (i.e. bollards and cleats).

1.2 RELATED SECTIONS

.1 Section 01 33 00 (Submittal Procedures)

.2 Section 01 11 55 (General Instructions)

.3 Section 03 10 00 (Concrete Forming and Accessories)

.4 Section 03 20 00 (Concrete Reinforcing)

.5 Section 03 30 00 (Cast-in-Place Concrete)

.6 Section 03 30 39 (In-Situ Concrete Structures)

.7 Section 05 50 00 (Metal Fabrications)

.8 Section 04 05 12 (Grout)

.9 Section 09 97 19 (Painting Exterior Metal Surfaces)

1.3 MEASUREMENT AND PAYMENT

.1 Mooring Devices will be measured per unit incorporated into the work for each type of mooring device.

.2 Mooring Devices will be paid for at the unit prices tendered for MOORING CLEATS: 34 TONNE (37.5T), as appropriate. Payment shall include for all costs in connection with supplying and installing the bollards/cleats at the concrete support structures including anchor bolts, nuts, washers, anchor plates, painting, grout and all other materials and costs to complete the work as shown on the Drawings, and to the satisfaction of Departmental Representative.

.3 Anchor bolts and other miscellaneous steel fabrications will not be measured separately, but considered incidental to the work. All costs in connection with anchor bolts and other miscellaneous steel fabrications shall be included in the unit prices tendered for the associated work covered by this Section.

.4 No measurement or payment will be made for reinforcing bars required for anchorage of Mooring Devices.

.5 Reinforced concrete required for Mooring Devices will be measured to Section 03 30 39 (In-Situ Concrete Structures).

1.4 REFERENCES

.1 ASTM A148/148M-01, Specification for Steel Castings, High-Strength, for Structural Purposes.

.2 ASTM A123/A123M, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A153/Al53M, Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware.

.4 ASTM A325M, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength.

.5 ASTM E1030-00, Standard Test Method for Radiographic Examination of Metallic Castings.

.6 ASTM E186-93, Standard Reference Radiographs for Heavy-Walled (2” to 4.5”) Steel Castings.

.7 CAN/CSA G40.20-04/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.8 CAN/CSA-S16.1, Limit States Design of Steel Structures.

.9 CSA G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.5 DEFINITIONS

.1 Mooring Device: For definition refer to Section 01 11 55 (General Instructions).

1.6 DESIGN CRITERIA FOR ALTERNATIVE MOORING DEVICES

.1 In the event that the Contractor proposes alternative Mooring Devices, the alternative shall comply with the requirements of this Section of the specification and the following criteria:

.1 Each Mooring Device (cleat and its anchor bolts) shall be rated by the supplier to carry the specified mooring line loading for each application: 34 tonnes (37.5 tons) for cleats. Each cleat and its anchor bolts shall be capable of resisting the specified mooring line loading with a minimum factor of safety, based on breaking, of 2.0. The direction of loading shall be any waterside direction within a 180° arc centered on a line normal to the dry dock face (at the mooring device location) in the horizontal plane, and in the vertical plane from horizontal up to +30° above horizontal;

.2 Bollards/cleats shall be cast steel as specified herein formed in a single casting operation, and shall be twin horn/post type of the shape and size shown on the Drawings;

.3 Alternative Mooring Devices, and in particular their anchor bolt arrangement, may require modifications to the concrete structures. Details of the proposed structural modifications shall be submitted with the

alternative Mooring Device proposal. The impact of these modifications on the design and on construction will be considered during the evaluation of proposed alternative Mooring Devices;

.4 In addition, alternative Mooring Devices will be evaluated on the basis of operational suitability, durability, maintenance and reliability as demonstrated by case histories of similar bollard/cleat installations. The manufacturer of the proposed alternative Mooring Devices shall have been in the business of manufacturing cast steel bollards/cleats for at least twenty (20) years, and show proof of five (5) similar installations each having been in service for at least ten (10) years;

.5 Departmental Representative reserves the right not to approve any proposed bollard/cleat alternative on any of the above grounds; and

.6 The following data shall be submitted with proposed alternative mooring device schemes: Description of bollards/cleats, anchor bolts and plates with fully detailed drawings; throat height and load rating for bollards/cleats; load rating for anchor bolts; steel grades for all components; details of surface coatings; and location of manufacturing plant.

1.7 OPERATING ENVIRONMENT

.1 Mooring bollards/cleats and anchor bolts will be located in the seawater splash and spray zones.

.2 The seawater may be contaminated by oil products.

.3 The design ambient temperature range is from -5°C minimum to 23°C maximum.

.4 Coated surfaces of the mooring bollards/cleats will be subject to abrasion from tensioned mooring lines.

1.8 SUBMITTALS

.1 At least twenty-eight (28) days before making any bollard/cleat castings, submit shop drawings for Mooring Devices, in accordance with Section 01 33 00 (Submittal Procedures). Indicate the following items on the fully detailed shop drawings:

.1 Description and general arrangement for each type of mooring device;

.2 Location, sizes and details of anchor bolts and anchor plates;

.3 Throat height and load rating for bollards and cleats;

.4 Load rating for anchor bolts;

.5 Steel grades for all components;

.6 Details of surface coatings; and,

.7 Location of manufacturing plant.

.2 At least twenty-eight (28) days before making any castings, submit confirmation that the bollard/cleat manufacturer has been in the business of manufacturing cast steel bollards and cleats for at least twenty (20) years, and show proof of five (5) similar installations each having been in service for at least ten (10) years.

.3 At least fourteen (14) days before installation of castings in the work submit, to Departmental Representative for his review, certification of all castings per ASTM A148/A148M supplementary requirement S6.

1.9 QUALITY CONTROL

.1 Submit certified test report, or certificate of conformance or compliance, attesting that mooring bollards/cleats and anchor bolts furnished under this specification meet the rated capacity requirements herein.

Part 2 Products

2.1 MATERIALS

.1 Mooring bollards and cleats shall be cast steel to ASTM A148M/A148M-01, Grade 80-50, formed in a single casting operation and shall be free of cracks or other defects. Make castings and perform tensile testing as specified in ASTM A148/A148M-01. Inspect and repair, as necessary, all castings. All mooring bollards and cleats shall be clearly embossed with rated capacity in a prominent location visible from the dock apron.

.2 Perform non-destructive quality control testing on bollards/cleats as specified, before painting. ASTM A148/A148M-01 supplementary requirement S1 (magnetic particle testing) applies to the first single casting made for each type of bollard and cleat. In addition, perform straight- beam ultrasonic non-destructive testing on the first single casting made for each type of bollard and cleat. The ultrasonic testing is intended to find internal voids/inclusions in the castings. The magnetic particle testing is intended to find surface cracking which might be missed by ultrasonic testing.

.1 Await acceptance, by Departmental Representative, of the results of the magnetic particle and ultrasonic tests before proceeding with the remaining casting work; and,

.2 If the magnetic particle and ultrasonic tests reveal unacceptable flaws in the first casting of each type of bollard or cleat, then make appropriate modifications to casting methodology to produce acceptable test results. Perform such modifications and subsequent acceptance testing at no cost to Departmental Representative.

.3 ASTM A148/A148M-01 supplementary requirement S6 (certification) applies to all castings. Provide certification of all castings.

.4 Anchor bolts shall conform to strength and ductility requirements of ASTM A325 or approved equal. The upper 300 mm length of anchor bolts (minimum), including nut and washer, shall be galvanized to ASTM A153 or equivalent. Contractor shall ensure that, after galvanizing, the anchor bolts still conform to the strength and ductility requirements of ASTM A325M.

.5 Anchor plates shall conform to CAN/CSA G40.21-M Grade 300W.

.6 Mooring bollards and cleats shall be coated as specified in Section 09 97 19 (Painting Exterior Metal Surfaces), with finish paint colour as selected by Departmental Representative from available colours.

.7 Bedding grout shall be shrinkage compensating non-metallic cementitious "flowable" grout, with 7-day compressive strength not less than 35 MPa, and as specified in Section 04 05 12 (Grout).

Part 3 Execution

3.1 INSTALLATION

.1 Install mooring bollards and cleats in accordance with the manufacturer's instructions.

.2 Contractor shall not damage metal fabrications or coatings in storing, handling and installing the bollards/cleats and hardware.

.3 Adequate provision shall be made to keep the metal fabrications plumb and in true alignment during installation.

.4 Anchor bolts and plates to be embedded in concrete shall be accurately set and held firmly in position while concrete is being placed and cured. Any embedded fabrications that are incorrectly placed or that move during embedment to an extent that will affect their proper operation or alignment shall be removed and replaced correctly or shall be corrected by other approved means.

.5 Bolt recesses in the bollard base plates shall be filled with grout after installation.

.6 Exposed surfaces of the bollards and cleats shall be thoroughly cleaned and painted as specified by Section 09 97 19 (Painting Exterior Metal Surfaces). The underside of the base plates shall not be painted.

.7 Ensure that paintwork is fully cured before installing bollards or cleats in the work. All damage to painting shall be restored by Contractor with touch-up painting to provide an unbroken paint film equal to the original coating. Protect coated surfaces against damage until completely hardened.

3.2 GROUTING

.1 Set all mooring bollards and cleats at locations and elevations as indicated. After positioning of shims/wedges and tightening of anchor bolts, grout under bollard/cleat base plate.

.2 Mix and apply grout in accordance with Section 04 05 12 (Grout).

.3 Ensure that temperatures of foundation, air, base and grout are within range specified by grout manufacturer.

.4 Ensure the grout completely fills the gap between base plate and concrete surface to provide full contact bearing area under the bollard or cleat.

.5 Plug inspection holes in bollards/cleats to prevent loss of grout.

END OF SECTION

A

ESQUIMALT GRAVING DOCK

PRELIMINARY HAZARD ASSESSMENT FORM

Number of Pages: 3

Public Works and Government Services Canada | Travaux publics et Services gouvernementaux Canada

PRELIMINARY HAZARD ASSESSMENT FORM

Project Number:	R.096320.002 East End Dock Extension and Section 3 Dock Floor and Wall Refurbishment
Location:	Esquimalt Graving Dock, Victoria, B.C.
Date:	July 6, 2020
Name of Departmental Representative:	Philip Tam, Project Manager
Name of Client:	EGD

Site Specific Orientation Provided at Project Location ☐ **Yes**

Notice of Project Required ☐ **Yes**

NOTE:
PWGSC REQUIRES A Notice of Project FOR ALL CONSTRUCTION WORK RELATED ACTIVITIES

NOTE:
OHS law is made up of many municipal, provincial, and federal acts, regulations, bylaws and codes. There are also many other pieces of legislation in British Columbia that impose OHS obligations.

Important Notice: This hazard assessment has been prepared by PSPC for its own project planning process, and to inform the service provider of actual and potential hazards that may be encountered in performance of the work. PSPC does not warrant the completeness or adequacy of this hazard assessment for the project and the paramount responsibility for project hazard assessment rests with the service provider.

TYPES OF HAZARDS TO CONSIDER	Potential Risk for:				COMMENTS
Examples: Chemical, Biological, Natural, Physical, and Ergonomic Listed below are common construction related hazards. Your project may include pre-existing hazards that are not listed. Contact the Regional Construction Safety Coordinator for assistance should this issue arise.	PWGSC, OGD's, or tenants		General Public or other contractors		Note: When thinking about this pre-construction hazard assessment, remember a **hazard** is anything that may cause harm, such as chemicals, electricity, working from heights, etc; the **risk** is the chance, high or low, that somebody could be harmed by these and other hazards, together with an indication of how serious the harm could be.
	Yes	**No**	**Yes** (TBD by contractor)	**No** (TBD by contractor)	

Typical Construction Hazards					
Concealed/Buried Services (electrical, gas, water, sewer etc)	X				
Slip Hazards or Unsound Footing	X				
Working at Heights	X				
Working Over or Around Water		X			
Heavy overhead lifting operations, mobile	X				

Canada

cranes etc.					
Marine and/or Vehicular Traffic (site vehicles, public vehicles, etc.	X				
Fire and Explosion Hazards	X				
High Noise Levels	X				
Excavations	X				
Blasting	X				
Construction Equipment	X				
Pedestrian Traffic (site personnel, tenants, visitors, public)	X				
Multiple Employer Worksite	X				

Electrical Hazards					**Comments**
Contact With Overhead Wires		X			
Live Electrical Systems or Equipment	X				
Other:					
Physical Hazards					
Equipment Slippage Due To Slopes/Ground Conditions	X				
Earthquake	X				
Tsunami	X				
Avalanche		X			
Forest Fires		X			
Fire and Explosion Hazards	X				
Working in Isolation	X				
Working Alone	X				
Violence in the Workplace	X				
High Noise Levels	X				
Inclement weather	X				
High Pressure Systems	X				
Other:					
Hazardous Work Environments					
Confined Spaces / Restricted Spaces PSPC employees do not enter confined space.	X				
Suspended / Mobile Work Platforms	X				
Other:					
Biological Hazards					
Mould Proliferations	X				
Accumulation of Bird or Bat Guano		X			
Bacteria / Legionella in Cooling Towers / Process Water		X			
Rodent / Insect Infestation	X				
Poisonous Plants		X			
Sharp or Potentially Infectious Objects in Wastes	X				
Wildlife		X			
Chemical Hazards					

Asbestos Materials on Site	X				
Designated Substance Present	X				
Chemicals Used in work	X				
Lead in paint	X				
Mercury in Thermostats or Switches		X			
Application of Chemicals or Pesticides		X			
PCB Liquids in Electrical Equipment	X				
Radioactive Materials in Equipment		X			
Other:					
Contaminated Sites Hazards					
Hazardous Waste	X				
Hydrocarbons	X				
Metals	X				
Other:					
Security Hazards					**Comments**
Risk of Assault	X				
Other:					
Other Hazards					
Working in close Proximity to others	X				Social Distancing may not be maintained
Other Compliance and Permit Requirements[1]			**YES**	**NO**	**Notes / Comments[2]**
Is a Building Permit required?				X	
Is an Electrical permit required?			X		
Is a Plumbing Permit required?			X		
Is a Sewage Permit required?			X		
Is a Dumping Permit required?			X		
Is a Hot Work Permit required?			X		
Is a Permit to Work required?			X		
Is a Confined Space Entry Permit required?			X		
Is a Confined Space Entry Log required			X		
Discharge Approval for treated water required			X		

Notes:

(1) Does not relieve Service Provider from complying with all applicable federal, provincial, and municipal laws and regulations.

(2) TBD means To Be Determined by Service Provider.

Service Provider Acknowledgement: We confirm receipt and review of this Pre-Project Hazard Assessment and acknowledge our responsibility for conducting our own assessment of project hazards, and taking all necessary protective measures (which may exceed those cited herein) for performance of the work.			
Service Provider Name			
Signatory for Service Provider		**Date Signed**	
RETURN EXECUTED DOCUMENT TO PSPC DEPARTMENTAL REPRESENTATIVE PRIOR TO ANY WORK COMMENCING			

B

ESQUIMALT GRAVING DOCK

EGD SURVEY STANDARDS AND PROCEDURES

Number of Pages: 8

Esquimalt Graving Dock (EGD)
STANDARDS FOR SURVEYS

Revised 2020-03-02

1. INTRODUCTION

This standard is written to provide the British Columbia Land Surveyor (BCLS) a guideline for producing acceptable topographic survey for all EGD projects.

2. APPLICATION OF THE STANDARD

This standard applies to surveys that are intended to show new installation of structures, utilities and underground conduits including the existing structures, utilities and underground conduits in the vicinity of the project and as requested by an EGD Representative.

The Surveyor in making topographic surveys uses accepted terrestrial and/or GPS/GNSS surveying methods. Topographic surveys that depict the location of property lines must be in compliance with all acts, and the regulations under them that govern the practice of cadastral surveying in British Columbia.

3. DEFINITIONS

1) A Benchmark is a permanent material object, natural or artificial, bearing a marked point whose elevation above or below an adopted datum is known.
2) A Control Monument or Control Point is a permanent material object, natural or artificial, bearing a marked point whose horizontal coordinates are known and referenced to an accepted coordinate system (UTM NAD83CSRS Zone 10). A control monument or control point may also be referenced to an accepted datum.
3) A Contour is a line on a map or plan that joins points of equal elevation above or below a specified datum.
4) The Parcel is the area designated by an EGD Representative and is usually, but not necessarily, given by a legal description of the property.
5) Utilities are services provided by governmental and private entities that provide the following: electric power, telephone, water, sanitary and storm sewer, gas, etc.
6) Acronyms and Definitions:
    - BCLS: British Columbia Land Surveyor
    - EGD: Esquimalt Graving Dock
    - PNEZD: Point Number, Northing, Easting, Elevation, Description – Coordinates
    - PBM: Permanent Benchmark (Control point)
    - TBM: Temporary Benchmark (Control point)

- Headwall: concrete wall structure on top of or on each side of culvert

4. RESEARCH AND INVESTIGATION

1) The Surveyor shall acquire the elevation and datum of all benchmarks to be used in the survey. The elevation used shall be based on a nationally accepted datum whenever practical or unless otherwise instructed by an EGD Representative. The EGD Representative shall specifically describe the parcel to be surveyed.
2) At least four (4) benchmarks shall be established using Global Positioning System (GPS/GNSS) and total stations, in which the position of all survey works and detected objects shall relate.
3) The benchmarks shall be established on stable ground within 6 m (20ft.) adjacent to the project site or as directed by EGD Representative. The benchmarks shall have reference numbers, coordinates and heights above the established datum (geodetic and/or chart datum).

5. THE SURVEY

The survey shall be performed on the ground to obtain the information required in this standard and any additional information requested by EGD. The Surveyor shall select the equipment and procedures necessary to obtain the horizontal and vertical positional accuracy required by these standards.

6. DATA

The surveyor shall locate and show on the survey map the following information:

1) The location of permanent structures including retaining walls and culverts.
2) The location of street or road paving, entrances, driveway openings and sidewalks.
3) Elevations on the top of curbs, gutters and sidewalks.
4) EGD building numbers assigned to the parcel.
5) North arrow and scale of drawing.
6) Legend depicting the symbols and abbreviations used on the drawing.
7) Provide building footing corners, exterior corners, roof line corners and main floor elevations of all required buildings listed in Appendix A.
8) Location and elevation of existing structures, utilities, underground conduits or drainage courses on or near the surveyed parcel.
9) Schedule of all benchmarks with the reference numbers, coordinates (UTM NAD83 CSRS Zone 10) and heights above the established datum

(geodetic and/or chart). Description and location of the benchmarks shall also be submitted.

10) Original copy of the survey field logbooks or electronic logbook printouts data. All survey data from field logbooks or electronic notebooks shall include and clearly indicate corrections or errors done during surveying work.

11) Certificates showing that the surveying equipment used have been calibrated in the last twelve (12) months shall also be attached. These certificates shall also be submitted prior to start of work.

12) The surveyor map grid coordinate system shall be based on NAD 83 (North American Datum) UTM Zone 10.

13) Levels related to established datum (geodetic and/or chart).

14) All other items listed in **Appendix A**.

7. POSITIONAL ACCURACY

The following relative positional accuracies are provided as a guide for surveys.

	Vertical Positional Accuracy Feet	**Horizontal Positional Accuracy Feet**
Contour line 300 mm (1') interval	± 200 mm (0.65 ft)	± 300 mm (1 ft)
Contour line 600 mm (2') interval	± 400 mm (1.30 ft)	± 600 mm (2 ft)
Contour line 1.2 m (4') interval	± 800 mm (2.60 ft)	± 1.200 m (4 ft)
Contour line 1.5 m (5') interval	± 1.000 m (3.20 ft)	± 1.200 m (4 ft)
Contour line 3.0 m (10') interval	± 2.000 m (6.50 ft)	± 2.400 m (8 ft)
Floor elevations	± 10 mm (0.05 ft)	± 300 mm (1 ft)
Spot paving elevations	± 10 mm (0.05 ft)	± 300 mm (1 ft)
Spot ground elevations	± 50 mm (0.20 ft)	± 600 mm (2 ft)
Sewer invert elevations	± 10 mm (0.05ft)	± 300 mm (1 ft)
Underground utilities/conduits	± 10 mm (0.05ft)	± 300 mm (1 ft)
All underground services/structure	± 10 mm (0.05ft)	± 300 mm (1 ft)

Positional Accuracy is given at the 95 percent confidence level.

8. ELECTRONIC DATA DISTRIBUTION

Surveyor to provide the survey data in an AutoCAD 2017 .dwg drawing file. The surveyor shall also provide a signed and sealed hard copy drawing. This drawing shall be the official map and shall be deemed to be correct and superior to the electronic data.

The electronic data file shall also contain a statement that the file is not a certified document and that the official document was issued and sealed by (*name and commission number of the BCLS*) on (*date*). Surveyor to also provide a table of the survey points data (PNEZD) in electronic format (MS Excel, MS Word or PDF).

Esquimalt Graving Dock (EGD)
STANDARDS FOR SURVEYS

Appendix A - ITEMS TO BE INCLUDED IN SURVEY

Revised 2012-02-28

The following items marked with an **(X)** are to be included in the survey:

( ) Boundary survey of the parcel.

( ) Plot the location of easements and rights-of-way as shown on the recorded subdivision, subdivision plan and all easements evidenced by a recorded document provided by EGD. The plan or document number of each shall be shown.

( ) Vicinity map with subject property highlighted.

( ) Observable evidence of recent earth moving work, borrow or fill.

( ) Cross-section of offsite drainage courses for engineering studies.

( ) Spot elevations covering the entire survey limits showing high points, low points, grade changes, and at sufficient intervals to represent the general character of the terrain. Existing contours shall be drawn with major contour lines at 10m (25') intervals and minor contour lines at 2m (5') intervals unless otherwise noted.

( ) Elevations at the inside of walk, top of curb, and gutter at approximately 3 cm (1") intervals at the final map scale.

( ) Dimensions of curb, sidewalk, and gutter lines or ditch lines and centerline of all streets, alleys or roads adjoining the parcel. Indicate type of paving surface and condition.

( ) Location, width and elevation at both ends of all existing sidewalks. Include a description of the kind and general condition of the sidewalk.

( ) Location, diameter, and species of all trees over 10 cm diameter.

( ) Perimeter outline only of thickly wooded areas unless otherwise directed.

Esquimalt Graving Dock (EGD)
STANDARDS FOR SURVEYS

Appendix A - ITEMS TO BE INCLUDED IN SURVEY

Revised 2012-02-28

( ) Electric utilities – the location of:

- ( ) power poles – 1 point at ground elevation
- ( ) power poles – 1 point at top of pole

elevation ( ) guy wires – 1 point

- ( ) anchors – 1 point
- ( ) Rectangular junction/pull boxes – 4 corners
- ( ) Round junction/pull boxes – cover center
- ( ) Underground conduits – all tie-ins (existing or new) and change of directions
- ( ) vaults – 4 corners

( ) Storm, sanitary or combined sewers – the location of:

- ( ) manholes – cover center
- ( ) culverts – 2 centerline measurements to show direction of flow
- ( ) headwalls – 4 corners
- ( ) catch basins – 4 corners + 1 center measurement at gutter line
- ( ) clean-outs – center point
- ( ) Include elevations of the top and bottom of manholes, culverts, headwall and catch basins.
- ( ) Show type, size and direction of flow and invert elevation of all pipes, culverts and trench drains.
- ( ) Trench drain – center point of trench, and start and end of drains.

( ) Water – the location of:

- ( ) all water valves – center point
- ( ) standpipes – center point
- ( ) regulators – center point
- ( ) fire hydrants – 1 point at ground elevation
- ( ) fire hydrants – 1 point at top of hydrant elevation

( ) Gas – the location of:

- ( ) all valves – center point
- ( ) meters – center point
- ( ) gas line markers – center point

( ) Show elevation on top of any valves.

( ) Telephone – the location of:

( ) all poles – 1 point at ground elevation

( ) all poles – 1 point at top of pole elevation

( ) manholes – center point and two perimeter points

( ) Rectangular junction/pull boxes – 2 opposite corners

( ) Round junction/pull boxes – cover center and two perimeter points

( ) Street/Roads – the location of:

( ) all lamp poles – 1 point at ground elevation

( ) all lamp poles – 1 point at top of pole elevation

( ) Rectangular junction/pull boxes – 4 corners

( ) Round junction/pull boxes – cover center, and two perimeter points

( ) Road cross-section: Survey spot levels along cross-sections at maximum 5m (15') intervals up to 30m (100') beyond the edges of the road shoulder. The interval of the spot levels shall be varied based on the condition at site. If required, closer spacing shall be surveyed where the terrain is not uniform such as deep gullies and creek areas.

( ) Heating – the location of:

( ) steam manholes – center point and two perimeter points

( ) vaults – 4 corners

( ) Location and dimensions of:

( ) tanks – 2 opposite corners minimum

( ) fences – corners/gates + changes of direction

( ) fences cross-section: Survey spot levels along cross-sections at maximum 5m (15') intervals up to 30m (100') beyond the edges of the fences lines. The interval of the spot levels shall be varied based on the condition at site. If required, closer spacing shall be surveyed where the terrain is not uniform such as deep gullies and creek areas.

( ) obstructions – 2 opposite corners minimum

Esquimalt Graving Dock (EGD)
STANDARDS FOR SURVEYS

Appendix A - ITEMS TO BE INCLUDED IN SURVEY

Revised 2012-02-28

( ) Existing buildings – the location of:

- ( ) _____
- ( ) _____
- ( ) _____
- ( ) _____
- ( ) _____

( ) Location and description of any building or major structure on adjoining land that is not more than _____ meters outside the parcel being surveyed.

( ) Other – the location of:

- ( ) _____
- ( ) _____
- ( ) _____
- ( ) _____
- ( ) _____
- ( ) _____
- ( ) _____

C

ESQUIMALT GRAVING DOCK

DATA REPORTS

Esquimalt Graving Dock –East End Dock Extension Environmental Management Plan, SLR, July 24, 2020 – (163 pages)

EGD East End Extension Geotechnical Summary Report, WSP Canada Inc, August 31, 2020 – (95 pages)

EGD East End GPR and Air Track Investigation, Klohn Crippen Berger, Sept 5th 2008 – (13 pages)

EGD East Slope Stability Investigation, Klohn Crippen Berger, Sept 17th 2008 – (13 pages)

EGD East End Extension Geotechnical Data Report, Klohn Crippen Berger, Feb 25th 2010 – (55 pages)

EGD East End Extension Project, Environmental Assessment Screening Report, Golder Associates, Jun 10th 2010 – (110 pages)

Soil Excavation Quality for the East End Dock Extension Construction Project at the Esquimalt Graving Dock, SLR, July 3rd, 2020 – (188 pages)

Assessment of Graving Dock Slab, Levelton Consultants Limited, February 7th, 2013 – (18 pages)

global environmental solutions

ESQUIMALT GRAVING DOCK – EAST END DOCK EXTENSION
825 ADMIRALS ROAD, VICTORIA, BC
Environmental Management Plan

July 2020
SLR Project No.: 205.04024.00000

ESQUIMALT GRAVING DOCK – EAST END DOCK EXTENSION

ENVIRONMENTAL MANAGEMENT PLAN

825 ADMIRALS ROAD, VICTORIA

SLR Project No.: 205.04024.00000

Prepared by
SLR Consulting (Canada) Ltd.
303 – 3960 Quadra Street
Victoria, BC V8V 1M8

for

PUBLIC SERVICES AND PROCUREMENT CANADA (PSPC)
825 ADMIRALS ROAD
VICTORIA, BC V9A 2P1

24 July 2020

Prepared by:

Nancy Elliott, B.Sc., RPBio., P.Biol.
Senior Aquatic Ecologist

Reviewed by:

David McKeown, B.Sc., RPBio.
Senior Scientist

CONFIDENTIAL

Distribution: 1 copy – PSPC
1 copy – SLR Consulting (Canada) Ltd.

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Background and Site Description 1
1.2 Project Description 1
1.3 Objective of the EMP 2
2.0 ENVIRONMENTAL SETTING 3
2.1 Aquatic Environment 3
2.2 Terrestrial Environment 3
3.0 ENVIRONMENTAL RESPONSIBILITIES 4
4.0 ENVIRONMENTAL MONITORING 5
5.0 MEETINGS 5
5.1 Pre-construction Meeting(s) 5
5.2 Tailgate Meetings 5
6.0 ENVIRONMENTAL REPORTING 6
6.1 Environmental Monitoring Reports 6
6.2 Environmental Incident Reporting 6
7.0 REGULATORY SETTING 7
8.0 ENVIRONMENTAL PROTECTION PLAN 8
8.1 Water Management and Disposal 9
8.1.1 Mitigation 9
8.2 Spill Prevention and Emergency Response 10
8.2.1 Mitigation 10
8.2.1.1 Emergency Spill Response 11
8.3 Excavation, Blasting, and Soil Management 11
8.3.1 Mitigation 12
8.4 Erosion and Sediment Control 12
8.4.1 Mitigation 12
8.5 Concrete Work 13
8.5.1 Mitigation 13
8.6 General Housekeeping and Waste 13
8.6.1 Mitigation 13
8.7 Hazardous Materials Management 14
8.7.1 Mitigation 14
8.8 Wildlife 15
8.8.1 Mitigation 15
8.9 Archaeology 16
8.9.1 Mitigation 16
8.10 Noise/Light 16
8.10.1 Mitigation 16
8.11 Air Quality and Dust Control 17
8.11.1 Mitigation 17
8.12 Vegetation 17
8.12.1 Mitigation 18
9.0 REFERENCES 18
10.0 LIMITATIONS 18

DRAWINGS

Drawing 1 Site Location

Drawing 2 Site Plan

APPENDICES

Appendix A Esquimalt Graving Dock Environmental Best Management Practices

Appendix B Updated Soil Management Plan for the Esquimalt Graving Dock

ACRONYMS AND ABBREVIATIONS

AIA	Archaeological Impact Assessment
AOA	Archaeological Overview Assessment
BC ENV	BC Ministry of Environment and Climate Change Strategy
BMP	Best Management Practices
CCME	Canadian Council of Ministers of the Environment
DR	Departmental Representative
DFO	Fisheries and Oceans Canada
EBMP	Environmental Best Management Practices
EIR	Environmental Incident Report
EGD	Esquimalt Graving Dock
EM	Environmental Monitor
EMP	Environmental Management Plan
EMS	Environmental Management System
EPP	Environmental Protection Plan
RL	Residential land use
SDS	Safety Data Sheets
SLR	SLR Consulting (Canada) Ltd.
PSPC	Public Services and Procurement Canada
PCB	polychlorinated biphenyl
QEP	Qualified Environmental Professional
the Project	East End Dock Extension Construction Project at the Esquimalt Graving Dock

1.0 INTRODUCTION

1.1 Background and Site Description

SLR Consulting (Canada) Ltd. (SLR) was retained by Public Services and Procurement Canada (PSPC) to prepare an Environmental Management Plan (EMP) to support the East End Dock Extension Construction Project at the Esquimalt Graving Dock (EGD), Victoria BC (the Project).

The location of the site is shown on Drawing 1 and a site plan is provided on Drawing 2.

The EGD is situated on the north shore of Constance Cove in the southeast section of Esquimalt Harbour at 825 Admirals Road. The EGD is an irregular shaped property that encompasses an upland lot with an approximate size of 20.5 hectares (ha) and a water lot with an approximate size of 9.7 ha. Since its development in 1925, the EGD has been in almost continual use as a naval and commercial vessel maintenance, repair and building facility, which includes a solid concrete dry dock (i.e., Graving Dock) located near the centre of the site. The Graving Dock is owned and operated by PSPC for dry access repairs and maintenance of naval and commercial vessels.

The Graving Dock can be divided into three sections by placing caissons, a floating gate ballasted with concrete and sea water, at various fixed positions in the dock basin. There is a tunnel located on the north side of the dock that connects to tunnels in each section. The tunnel system is used to fill and empty the dock. Each section of the drydock can fill independently. The EGD facility is fenced and reinforced concrete retaining walls border the east end of the dock basin.

The current size and configuration of the Graving Dock is not optimal for the typical user fleet because many vessels are slightly longer than one section of the dock and these vessels inefficiently end up using two sections. In addition, the Graving Dock is currently operating at full capacity and it has been forecasted that capacity will begin to become an issue with the Graving Dock in its current configuration. Models have shown that extending Section 3 of the Graving Dock will significantly improve capacity to satisfy demand by accommodating many of the vessels that exceed the current longest sections of the Graving Dock and minimizing the use of two sections at a time. In order to meet the increased demand and better suit dry-docking of vessels and frigates over the next 40 to 50 years, PSPC plans to increase the size of Section 3 of the Graving Dock toward the east.

1.2 Project Description

The Project includes extending the existing Section 3 at the eastern end to allow the dock to accommodate additional bookings and increase the efficiency of the current facility. The Project also involves a refurbishment of the existing Section 3 dock walls and floor in conjunction with the extension project. The proposed extended dock section is approximately 36 metres (m) long by 40 m wide by 15 m deep. Construction of the addition will involve significant overburden and bedrock excavation, demolition of mass concrete, installation of rock anchors, construction of new cast in place concrete walls and dock floor slab, as well as refurbishment of existing dock wall and floor concrete and drainage systems.

Construction components have the potential to cause environmental impact through a variety of pathways and as such, an overarching environmental program to direct development of individual component construction environmental plans is required to facilitate environmental protection, stewardship and consistency during the construction process. This EMP addresses, but is not

limited to, the following construction activities associated with the Project:

- Mobilization;
- Contractor facility set up (if required);
- Demolition of the existing dry dock east end concrete wall and other miscellaneous concrete structures;
- Demolition of existing electrical and mechanical services in the east end service tunnel;
- Blasting and excavation of rock and excavation of overburden materials;
- Construction of a cast-in-place concrete dry dock extension and service tunnel modifications;
- Construction of cast-in-place crane beams and crane rails;
- Construction of service tunnel drainage pump system and drain run to existing storm water drainage system;
- Construction of access stairways;
- Installation of sanitary lift station;
- Construction of a removable bridge at the east end of the dock extension;
- Refurbish Section 3 dock walls, including concrete removal and repairs;
- Refurbish Section 3 dock floor, including repair of the existing granite floor blocks, installation of new trench drains, grit channels, and grate covers;
- Backfilling, asphalt paving and road markings;
- Construction of fire water mains, hydrants, valves, valve boxes around the extended dock section;
- Construction of sanitary sewer line;
- Construction of compressed air line; and
- Construction of electrical vaults and duct banks.

1.3 Objective of the EMP

The EMP is provided to guide the development of each component environmental protection plan (EPP) and identifies expectations for the delivery of mitigation during construction to avoid adverse effects to the environment. The EMP will identify the following:

- Environmental responsibilities;
- Regulatory obligations;
- Environmental protection requirements, including environmental mitigation and monitoring; and
- Environmental reporting requirements, including incident reporting.

The EMP allows for a process of continuous improvement and adaptive management if additional risks or changes to legislation, best practices, changes in project scope or design elements are identified as the project progresses.

If there is a discrepancy or conflict between the EMP and the provisions of any legislation, regulations, or municipal bylaws, the more stringent requirement shall apply resulting in the greater protection of the environment and greater environmental protection and safety.

2.0 ENVIRONMENTAL SETTING

2.1 Aquatic Environment

The EGD is in Constance Cove on the eastern side of Esquimalt Harbour. The overall abundance and diversity of macroalgae and invertebrates is relatively low in the intertidal area near the EGD (Golder 2019). Neither eelgrass nor clam beds have been identified in the area. Kelp beds (primarily laminarians) have been documented along the low intertidal / upper subtidal zone, between the northwest to the southeast of Munroe Head and the northern shoreline of Pilgrim Cove (Golder 2012).

Rockfish (*Sebastes* sp.), Pacific herring (*Clupea pallasii*) and several Pacific salmon species (*Oncorhynchus* sp.) have been observed in the EGD and surrounding area (G3 Consulting 2014). Finfish observations have been infrequent and dominated by flounders and sculpins (Archipelago 2009).

Aquatic mammals observed in Esquimalt Harbour include Harbour seals (*Phoca vitulina richardsi*), northern river otter (*Lontra canadensis*), and California (*Zalophus californianus*) and Steller (*Eumetopias jubatus*) sea lions (Golder 2012, 2019). Dall's porpoises (*Phocoenoides dalli*), harbour porpoise (*Phocoena phocoena*) and larger marine mammals, such as killer whales (*Orcinus orca*) and cetaceans are unlikely to frequent Esquimalt Harbour and may only occur rarely (G3 Consulting 2014, Golder 2012, 2019).

Aquatic species listed as threatened or endangered under provincial or federal designations that may occur in the area include (Golder 2012):

- Canary rockfish (*Sebastes pinniger*);
- Cutthroat trout (*Oncorhynchus clarkii clarkii*);
- Northern abalone (*Haliotis kamtschatkana*);
- Olympia oyster (*Ostrea conchaphila*);
- Steller sea lion;
- Harbour porpoise; and
- Killer whale (Northeast Pacific southern resident population).

2.2 Terrestrial Environment

Terrestrial wildlife, such as deer, raccoons and mink, has been observed within the EGD property (G3 Consulting 2014). Birds protected under the federal *Migratory Bird Convention Act* (1994) that may be found in the Project Area include osprey, swans, geese, ducks, shorebirds, gulls, loons, grebes, herons, and cormorants (Golder 2012).

Osprey (*Pandion haliaetus*) have been observed nesting near the Project area. An osprey nest was located on a light stand near the western end of the South Jetty until February, 2012, but relocated to an upland area removed from the Project under a permit issued pursuant to the British Columbia Wildlife Act (Permit #NA 12-76959) (G3 Consulting 2014).

Terrestrial species listed as threatened or endangered that may occur in the area include (Golder 2012):

- Barn swallow (*Hirundo rustica*);
- Brandt's (*Phalacrocorax penicillatus*) and double-crested (*P. auritus*) cormorants;

- Caspian tern (*Hydroprogne caspia*);
- Common murre (*Uria aalge*);
- Great blue heron (*Ardea herodias fannini*);
- Marbled murrelet (*Brachyramphus marmoratus*); and
- Purple martin (*Progne subis*).

3.0 ENVIRONMENTAL RESPONSIBILITIES

The Contractor will be responsible for all agents, employees, and subcontractors retained throughout the Project and will ensure environmental protection measures are in place and working effectively. The Contractor will retain an appropriately skilled environmental professional or Qualified Environmental Professional (QEP) to prepare an Environmental Protection Plan (EPP). A QEP is an individual that is registered and in good standing in BC with the appropriate professional association constituted under an Act for the individual's profession (e.g., RPBio., P.Ag.) and can be reasonably relied on to provide advice within their area of expertise, within the scope of professional practice for the individual's profession, and under the code of ethics of the appropriate professional association and is subject to disciplinary action by that professional association. The EPP will be prepared prior to start of construction for the Contractor's component of the work for submission to and approval by the PSPC DR.

The Contractor shall take all reasonable and necessary measures to ensure that any activities undertaken in the performance of the work are conducted in such a way as to minimize disturbance or damage to the environment. This includes protecting ground surfaces, waterbodies, marine environment, wildlife, fish and heritage and archaeological resources. It also includes minimizing disturbance to the general public and EGD workers. Any condition which has resulted from the Contractor's work and which constitutes, or which could result in, unnecessary damage or disturbance to property and the environment must be corrected to the satisfaction of and within the time period specified by the PSPC Departmental Representative (DR).

The Contractor will communicate effectively with all work crews and subcontractors to ensure that environmental responsibilities and requirements are understood prior to the commencement of work and are carried forward for the duration of their work. The Contractor will ensure that their employees are familiar with, and comply with, the contents of this EMP and the Contractor's EPP. A copy of this EMP and the Contractor's EPP will be kept at the Project construction office/trailer for review by all new contractors, employees, and site visitors. The Contractor shall complete project activities according to the work specifications, environmental requirements and best management practices. EGD's Environmental Best Management Practices (EBMPs) shall apply to all unspecified routine work (PSPC 2016; Appendix A).

Liaison between PSPC, the Contractor and the Contractor's EM, as well as between PSPC and the site users, will be necessary because the site is in a highly active area. It is expected that the Project construction activities will impact facilities and personnel in the immediate vicinity of the site. In addition, the construction activities are likely to increase traffic along the site access routes. Traffic management, site access, parking, and Contractor facilities are to be appropriately planned in coordination with the PSPC DR.

The Contractor will retain an Environmental Monitor (EM) to confirm that environmental management measures and controls are implemented in accordance with regulatory documents, environmental components of the contract requirements, including this EMP as well as the Contractor's EPP. Environmental monitoring is to be conducted by, or under the supervision of a QEP.

4.0 ENVIRONMENTAL MONITORING

The Contractor's EM will inspect the work site to ensure compliance with the Contractor's EPP, this EMP, and relevant Best Management Practices (BMPs), including EGD's Environmental Best Management Practices (EBMP). An EM will complete inspections of construction activities including environmental support in the event of an environmental incident during all project activities at an appropriate frequency to facilitate environmental protection and compliance. The Contractor will ensure that emergency contact numbers for all key project representatives are available and any subsequent changes are updated as required within their site-specific EPP. The EM has written authority to modify and/or halt any construction activity if deemed necessary for the protection of the environment or to meet conditions of the Contractor's EPP or this EMP.

Inspections of all work areas will be conducted by the EM during all phases of the Project to identify any potential sources of environmental impairment that are to be addressed and rectified by the Contractor. Inspections will include, but may not be limited to, all waste (e.g., hazardous, construction materials, and domestic refuse) storage areas, all hazardous materials storage areas, vehicle refuelling, maintenance, storage areas, general equipment inspections, and inspections of all active work areas. Inspections should also include inspections of sediment and erosion control measures, water management and areas of exposed soil.

All workers are required to report all incidents that involve a potential for environmental impacts to the EM, PSPC DR or other appropriate representative. Records of all inspections will be filed on site, and any potential sources of environmental impairment, and appropriate actions taken will be immediately reported to the Contractor's Site Supervisor.

If the Contractor encounters any additional or unforeseen activities during the execution of the project that may pose an environmental risk, the Contractor shall contact the PSPC DR and/or the EM for assistance prior to commencing or continuing work.

5.0 MEETINGS

Regular meetings will occur to provide the Contractor and their crews with information to fulfil the obligations of regulatory approvals and permits and the environmental requirements of the contract, including this EMP.

5.1 Pre-construction Meeting(s)

A pre-construction meeting will be held between PSPC, the Contractor, and EM to review environmental requirements of the contract as well as discuss items including, but not limited to the following:

- Relevant information not previously communicated that pertains to the contract;
- Consequences of non-compliance with environmental law, authorizations, approvals, permits, and contract specific environmental requirements;
- Review of communication protocols; and
- Reporting of environmental incidents and emergencies.

5.2 Tailgate Meetings

Daily tailgate meetings are required to address environmental requirements based on the nature of the work being conducted. The tailgate meetings will be used to document potential hazards,

processes, equipment, tools, environment and materials and to inform all workers of the risks in their surroundings. The Contractor will keep a record of all environmental requirements addressed in daily tailgate meetings and provide to the PSPC DR upon request.

6.0 ENVIRONMENTAL REPORTING

6.1 Environmental Monitoring Reports

Environmental monitoring reports will be compiled after each site visit and submitted within 48-hours of the completion of the EM inspection. These reports will include, at a minimum, the following:

- Monitoring results;
- A description of site works in progress including photos;
- Summary of visit and rationale for site visit;
- Any environmental issues that arose during the inspection and mitigation measures implemented, including photos;
- Summary of environmental measurements or samples collected; and
- Communications with project personnel.

Additional reporting elements that will be included as needed include:

- Results from any water or soil chemical analyses;
- Environmental Incident Reports; and
- Communications required with any regulatory agencies.

During inspections, the EM may recommend improvements or changes to the Contractor's Site Supervisor. These recommendations will be included on the monitoring forms.

Upon completion of the Project, the Contractor will prepare an environmental completion report. The report will include a summary of monitoring data collected, a summary of construction activities, representative site photographs, environmental management and issues during construction, how these issues were managed, and mitigation implemented.

6.2 Environmental Incident Reporting

An environmental incident refers to an event that has caused or has the potential to cause one or more of the following:

- Adverse impact on the quality of air, land or water, wildlife, aquatic species or species at risk;
- Exceedance of compliance requirement limits as documented in a regulatory instrument (i.e. permit, order, license, authorization, agreements, etc.);
- Violation of legislation, related policies or regulations;
- Notification to external agencies due to an emergency beyond normal circumstances;
- Adverse publicity with respect to the environment;
- Alteration of, or damage to, heritage or archaeological resources; and
- Legal or regulatory action with respect to any of the above.

Examples of environmental incidents include spills of any quantity of oil, fuel, hydraulic fluid or other hazardous substances (regardless of their size), discharge of deleterious substances to an aquatic environment, or harm to wildlife.

In the event an environmental incident, the Contractor and any subcontractors will immediately take action to protect persons from injury and mitigate damage to property and the environment. The Contractor will notify the PSPC DR (or delegate) of the incident as soon as is safe to do so and submit a complete Environmental Incident Report (EIR) within 24-hours of the incident.

The Contractor's EIR will include the following:

- Cause and nature of the incident;
- Approximate volume of release, area of habitat affected;
- Aquatic, terrestrial and/or cultural resources affected;
- Mitigation measures taken to control or limit the activity causing the incident;
- Additional proposed remedial or corrective actions recommended;
- Communications held with project personnel; and
- Communications with regulatory agencies.

7.0 REGULATORY SETTING

Although EGD is a federal site and under federal regulatory regime, the Contractor will respect all provincial laws and municipal by-laws that generally do not apply on federal lands. It is the Contractor's responsibility to understand the regulatory context governing their activities. If the Contractor should need clarification of any environmental issue, they should consult the original regulations or legislative documents and seek clarification with the PSPC DR. All components of the work shall be carried out in accordance with the principles listed below:

- Avoid causing environmental impacts;
- Restore or repair habitat if environmental impacts have been created; and
- Meet or exceed applicable environmental laws, regulations and other requirements, which may include, but not be limited to:
    - Local municipal bylaws;
    - *British Columbia Riparian Areas Protection Act* [SBC 1997] c.21;
    - *British Columbia Water Sustainability Act* [SBC 2014] c.15;
    - *British Columbia Environmental Management Act* [SBC 2003] c.53:
        - Spill Reporting Regulation (Reg.221/2017);
        - Contaminated Sites Regulation (Reg.13/2019);
        - Hazardous Waste Regulation (Reg.243/2016); and
        - Waste Discharge Regulation (Reg.154/2019).
    - *British Columbia Weed Control Act* [RSBC 1996, c.487];
    - *British Columbia Wildlife Act* [RSBC 1996] c.488;
    - *British Columbia Heritage Conservation Act* [RSBC 1996] c.187;
    - *Fisheries Act* [1985];
    - *Transportation of Dangerous Goods Act* [1992, c.34];
    - *Canadian Environmental Protection Act* [1999, c.33];
    - *Species at Risk Act* [2002, c.29]; and
    - *Migratory Birds Convention Act* [1994, c.22].

The EGD has implemented an Environmental Management System (EMS) that provides the framework for identifying environmental impacts and ensuring adequate controls are in place to

manage the impacts effectively. EBMPs have been developed to reduce impacts to the environment related to common activities and operations at the EGD (PSPC 2016). The contractor is expected to follow the EBMPs and all applicable regulatory requirements.

Additional BMPs and guidelines that may be applicable include the following:

- BC Guidelines for Industry Emergency Response Plans[1];
- Fisheries and Oceans Canada's (DFO's) Measures to Protect Fish and Fish Habitat[2];
- Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia[3]; and
- Develop with Care 2014: Fact Sheet #10 Bald Eagles and Ospreys.

8.0 ENVIRONMENTAL PROTECTION PLAN

The Contractor is required to prepare a site-specific EPP that identifies the Contractor's means and methods for complying with the environmental protection requirements of the standards and other requirements of the EGD EBMP, the EMP, and any other environmental requirements under federal, provincial, municipal, local, or other legislation, regulations, codes, or by-laws. The EPP also identifies the procedures by which the Contractor will establish and maintain quality control for environmental protection of all components of the work. The Contractor will need to submit a site-specific EPP for approval by the PSPC DR prior to construction.

The EPP will include, but may not be limited to, the following information:

- Roles and responsibilities of PSPC, the EM, and the Contractor(s) for implementing, inspecting, and reporting on the effectiveness of the environmental protection and mitigation measures;
- Policies, plans and procedures for communicating environmental protection matters;
- Environmental awareness training procedures for all personnel to verify that personnel in environmentally critical roles are qualified and competent;
- Site and activity-specific measures to determine the environmental hazards associated with all aspects of the planned work or activity, to evaluate the risk potential of such hazards, and to identify and implement appropriate mitigation strategies for the proposed work or activity;
- List of all structures, facilities, equipment and systems critical to environmental protection, and a summary of the system in place for their inspection, testing and maintenance;
- Identify potential environmental emergencies and hazards and provide the appropriate emergency plans and procedures and/or spill response plan(s) that would be implemented;
- Summarize and reference the procedures for the reporting of all environmental incidents; and
- Contingency procedures to identify and deal with nonconformities or problems related to procedures and equipment that have caused or could cause poor environmental performance, spills or pollution.

[1] https://www2.gov.bc.ca/gov/content/environment/air-land-water/spills-environmental-emergencies/planning-prevention-response/industry-emergency-response-plans

[2] https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html

[3] https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/laws-policies-standards-guidance/best-management-practices/develop-with-care

The Contractor's EPP will include, but not be limited to, procedures for the following:

- Wastewater management and disposal;
- Spill prevention and emergency response;
- Excavation, blasting, and soil management;
- Erosion and sedimentation control;
- Concrete work;
- Non-hazardous waste reduction, storage and disposal;
- Hazardous materials storage, treatment/stabilization and disposal;
- Wildlife;
- Archaeology;
- Noise/Light;
- Air quality and dust control; and
- Vegetation management.

The following sections outline various protection measures and mitigation plans that may apply to construction activities based on the scope of the Project. Mitigation measures have been identified for the Project from site mobilization to demobilization.

8.1 Water Management and Disposal

During the EGD east end dock extension and Section 3 dock floor and wall refurbishment, water management is expected to be a high priority. The drydock floor tunnel drainage system leads directly to the Esquimalt Harbour; therefore, any material entering the tunnel drainage system, either through tunnel grate drains or open sump well valves, will be released into Esquimalt Harbour. A primary pathway of contaminant loading to Esquimalt Harbour is by stormwater. Five upland stormwater catchment areas terminate into the Esquimalt Harbour from the EGD property.

There will be no discharge of any kind within the EGD Facility without permission from the EGD DR. Deleterious materials must not be allowed to enter the storm or tunnel drain system. Wastewater generated or encountered as part of the construction activities that cannot be treated by the Contractor to reduce contaminant concentration to levels acceptable for discharge to the environment, will be disposed of at a wastewater treatment and disposal facility.

Additional information on water management can be found within the *Pressure Washing (High and Ultra High) EGD EBMP#1, Dry Dock Floor Management and Clean Up EGD EBMP#4, and Stormwater Management EBMP#17* in Appendix A.

8.1.1 Mitigation

To reduce the risk of deleterious substances reaching the marine environment, at a minimum, the following measures should be incorporated into the Contractor's EPP and followed:

- Divert and contain surficial stormwater runoff with proper materials and filtration, prior to entering the drains (e.g., use filter cloth, catch basin covers, hay bales, sandbags);
- During heavy stormwater events, ensure storm drains and trenches are kept clear of debris to prevent flooding;
- Conduct regular inspections of storm and trench drains to ensure they are kept clear of debris;
- Cover all tunnel drains and net cages during construction to prevent contaminants from entering the marine environment;

- Close all sump well valves in the drydock floor collection system prior to and during construction;
- All wastewater containing contaminants must be directed to the collection trench drains and sump wells on the drydock floor, collected, and sent for proper treatment; and
- Ensure all non-contaminated water is directed away from work areas and into the tunnel drain system.

8.2 Spill Prevention and Emergency Response

A spill is an unauthorized discharge or release of a material or substance into the environment that is equal to or exceeds the regulated amount for that deleterious substance. Spill management is designed to reduce the risk of a harmful exposure to individuals and the surrounding environment. Requirements for reporting spills are defined in the Federal *Transportation of Dangerous Goods Act* (2011) and *Canadian Environmental Protection Act (1999).*

All users operating at the EGD must have the capability to effectively manage spills resulting from their activities and operations. Information on preparing a spill prevention and emergency response plan can be found at: www.env.gov.bc.ca/eemp/resources/guidelines/bc.htm. At a minimum, the plan will include:

- A general measure of the probability and severity of an adverse effect to health, property, or the environment, based on fuel, oil, and other hazardous materials consumed, handled, and stored.
- Spill/release notification and alerting procedures;
- Adequate training procedures for staff in spill response;
- Established procedures for addressing spills and releases of deleterious substances;
- Provision and access to spill response equipment and materials appropriate to the work that is performed;
- Spill incident report forms; and
- Names and telephone numbers of persons and organizations that may be contacted in the event of a potential environmental incident, including PSPC and EGD representatives, the EM, Contractor(s) representative, and local emergency response organizations.

The Plan will be available for inspection by PSPC and regulatory agency personnel and will be posted at visible locations in the Work Site and in relevant machinery.

All spills at the EGD facility must be reported to the PSPC DR and to EGD Management. Environmental emergency contact information can be found in the EGD EBMP#14 Spill Preparedness and Response in Appendix A.

8.2.1 Mitigation

To reduce the risk of fluid spills reaching the marine environment, at a minimum, the following measures should be incorporated into the Contractor's EPP and followed:

- Fuel storage and handling equipment shall comply with *A Field Guide to Fuel Handling, Transportation and Storage* (BC Ministry of Water, Land and Air Protection 2002);
- Vehicles and equipment, including their hydraulic fittings, shall be inspected daily to ensure that they are in good condition and free of leaks;
- Operate storage areas so that containment systems are effective during wet weather;

- All fuel supply trucks, and vehicle tidy tanks shall always be clean and well maintained. All fuel or grease spills occurring from their use or operation are to be cleaned immediately. Poorly maintained fuel storage tanks will be taken off-site immediately and replaced with a new clean tank at the Contractor's expense;
- A Spill Contingency Plan will be prepared by the Contractor and shall be kept on site and will include the names of those to be contacted;
- All containment basins shall be inspected daily for leaks and wear points;
- Containment basins shall be cleaned regularly, and any accumulated waters removed;
- Where leaks or wear points are found, they shall be repaired promptly to restore full containment; and
- Additional major spill kits are to be located at the site.

In addition to the above, and as per the *EGD EBMP#7 Fuelling and Oil Transfer,* no fuel or oil transfers are to be completed next to drainage pathways to the marine environment (i.e., the on-site trench drain). The EGD EBMPs can be found in Appendix A.

8.2.1.1 *Emergency Spill Response*

In the event an environmental incident, the Contractor and any subcontractors will immediately take action to protect persons from injury and mitigate damage to property and the environment. The Contractor will notify the PSPC Representative (or delegate) of the incident as soon as is safe to do so and submit a complete EIR within 24-hours of the incident. Copies of emergency response procedures will be maintained by the Contractor and stored in an accessible location on site.

The Contractor's EIR will include the following:

- Cause and nature of the incident;
- Approximate volume of release and identification of spill location/feature;
- Aquatic, terrestrial and/or cultural resources affected;
- Mitigation measures taken to control or limit the activity causing the incident;
- Additional proposed remedial or corrective actions recommended;
- Communications held with project personnel; and
- Communications with regulatory agencies.

All emergency spill response plans and activities on the site will follow the BC Guidelines for Industry Emergency Response Plans (BC MOE 2002).

8.3 Excavation, Blasting, and Soil Management

The Contractor is also required to prepare and adhere to a Contaminated Soil and Water Management Plan for the project. Contaminated soil will be handled, stored, sampled and tested as needed, transported and disposed in accordance with the Contractor's EPP and applicable regulations and requirements.

A detailed review of the EGD EBMPs relating to excavation and soils management can be found within *EGD EBMP#18 Property and Infrastructure Maintenance, Modifications and Construction* in Appendix A. In addition, soil management practices should adhere to the *Updated Soil Management Plan for the Esquimalt Graving Dock* dated March 2020 and included in Appendix B.

8.3.1 Mitigation

The following procedures have been designed to facilitate environmental compliance if soils are temporarily stockpiled at the EGD:

- Imported backfill material should be stockpiled separately from removed contaminated soils;
- Soil shall not be stockpiled on roadways or driveways;
- Excavated soils must be stockpiled 15 m away from any drainage features, drains, ditches and 30 m away from any waterbody or watercourse;
- Excavated soil must be staged on 10 mil polyethylene liner (poly) and when inactive, covered with 10 mil poly, weighted down to secure the cover; and
- Excavated soil must be segregated based on source site and contaminant classification. Blending or mixing of soils of varying classifications or quality is not permitted unless otherwise directed by the PSPC Representative.

If required, confirmatory samples will be collected by the EM from excavation walls and floors in accordance with BC Ministry of Environment and Climate Change Strategy (BC ENV) *Technical Guidance Document #1: Site Characterization and Confirmation Testing* where possible.

Imported fill quality documentation must be submitted to, and approved by, the PSPC DR prior to being imported to site. The fill material is required to have been characterized by a QEP within the previous three months as per BC ENV, *Technical Guidance Document #1 – Site Characterization and Confirmation Testing*. The imported backfill must be shown to meet Canadian Council of Ministers of the Environment (CCME) Residential I and use (RL) guidelines prior to importation onto the site.

Backfill will be compacted to a geotechnical engineer-specified density based on the future site use as defined by PSPC. A geotechnical engineering firm commissioned by the Contractor shall provide in-situ density testing of backfill soil as required.

8.4 Erosion and Sediment Control

Ground disturbance has the potential to create turbid or sediment laden water that may enter the trench drain which ultimately discharges to Esquimalt Harbour, potentially causing harm to the marine environment. The trench drain and drain infrastructure will be protected during construction. Erosion and sediment control measures will be implemented as necessary to reduce erosion and sediment generation at the site.

8.4.1 Mitigation

To reduce the risk of turbid or sediment laden water reaching the marine environment, at a minimum, the following measures should be incorporated into the Contractor's EPP and followed:

- Restrict vehicle access to certain areas of the site;
- Slope texturing on exposed soils;
- Install and maintain filter fabric inside the trench drain collecting runoff from the site;
- Direct runoff and wastewater from excavations where possible;
- Install sediment fencing to ensure no sediment laden runoff enters any adjacent properties;
- If applicable, excavated soil must be stockpiled on 10 mil poly and when inactive, completely cover and secure with 10 mil poly; and

- If applicable, do not stockpile soil within 15 m of any drainage features, drains, ditches, and 30 m of any waterbody or water course.

8.5 Concrete Work

Wet concrete, a mixture of cement and water, creates a very high pH solution often with high metals concentrations that is highly toxic to fish and other aquatic life. All uncured concrete and concrete leachate must be prevented from entering the aquatic environment.

8.5.1 Mitigation

At a minimum the following should be considered when preparing the site-specific EPP:

- Protect the surrounding environment and establish a protocol for discarding of unused concrete;
- Concrete laden equipment must be washed off-site, or at a designated location that poses no risk of the wash-water entering the aquatic environment;
- Contain dust emissions from concrete cutting and drilling;
- Prevent concrete slurry runoff from entering the trench and tunnel drains, storm drains and pooling on the drydock floor;
- Prevent debris from mixing concrete from entering storm drains or the marine environment;
- Concrete will be poured into leak-free forms and poured in isolation of water;
- If a hose is used to pump concrete, the hose must be sealed and leak-free;
- The poured concrete will be covered with material until fully cured; and
- Any spill should be contained immediately and removed as quickly as possible.

The Contractor is responsible for disposing off-site any demolished concrete including reinforcing steel or embedded timber.

8.6 General Housekeeping and Waste

Specific measures to manage non-hazardous waste will include at a minimum a list of approved locations that will accept recyclable and non-recyclable solid non-hazardous construction wastes; a list of the types and quantities of materials to be recycled and disposed; and names of construction waste material haulers.

Additional information on housekeeping can be found within the *EGD EBMP#16 Housekeeping* and on waste management and recycling can be found within the *EGD EBMP#6 Waste Management and Recycling* in Appendix A.

8.6.1 Mitigation

At a minimum the following should be considered when preparing the site-specific EPP:

Equipment laydown and material storage areas will be designated by the PSPC DR. The lay down area will include the following environmental considerations:

- Spill kits in all equipment;
- Larger spill kits are to be located at the project site and hazardous materials storage locations;
- Solid waste bin storage;
- Ensure trench and storm drains are kept clean and free of debris;

- Sweep and/or clean active work areas on a regular basis; and
- Recycle all construction and industrial materials to the extent possible.

General waste accumulated throughout the site will be segregated and stored at a designated location prior to removal. Measures to ensure that appropriate care is given to general waste are as follows:

- Remove surplus construction material and waste from work sites, and dispose of at an appropriately authorized facility;
- Recyclable and non-recyclable waste should be separated and stored in appropriately labelled, covered, waterproof containers for storage and transport;
- All waste material should be removed from site in a timely manner on an as needed basis and at a minimum at the completion of the project;
- Recyclable materials should be removed from site by an approved waste management company and taken to the appropriate facilities;
- Decommission erosion and sediment control materials and features following project completion (if no longer required); and
- All waste material (i.e. wood, cardboard, steel, concrete) shall be separated into individual bins and taken off-site to a certified disposal facility or recycling facility.

8.7 Hazardous Materials Management

Hazardous waste will be managed to prevent contamination of soils or the marine environment in Esquimalt Harbour from accidental spills and to prevent uncontrolled or accidental fires. Hazardous materials include “dangerous goods” and “controlled products”. These include, but are not limited to: fuels, oils, solvents, paints, greases, asbestos and asbestos containing materials, polychlorinated biphenyl (PCB) oils, and batteries.

Hazardous materials used during construction activities will be stored and handled in accordance with all applicable legislation and BMPs, for example, the *Transportation of Dangerous Goods Act*, and product-specific Safety Data Sheets (SDS).

In addition to the above, and as per the *EGD EBMP#5 Hazardous Materials Handling and Storage*, any containers placed directly over top or beside a trench drain have the potential to spill to the drain leading directly to the harbour. Therefore, hazardous materials must be stored and/or handled away from the on-site trench drain.

8.7.1 Mitigation

Hazardous materials will be disposed of in accordance with law and the requirements of all authorities having jurisdiction. General storage, handling and disposal requirements for hazardous materials should be considered when preparing the site-specific EPP:

- Copies of SDS for any hazardous materials used during the project will be maintained by the Contractor and stored in an accessible location on site;
- The Contractor will ensure that all staff and subcontractors are adequately trained (and certified where required) in handling and transporting any hazardous materials they encounter during their job activities;
- Storage and handling of hazardous materials will be conducted to avoid loss and provide containment in the event of a spill;

- Transfer and temporary storage of hazardous materials and wastes will occur only in an area designated for this purpose. The designated area will be clearly labelled and controlled using barriers, anchored tarps, and/or separate storage containers;
- All containers used for storage or transfer will be labelled, handled and transported in accordance with the *Transportation of Dangerous Goods Act*;
- Disposal of hazardous wastes generated during the project will be in compliance with the *Environmental Management Act*, the *Transportation of Dangerous Goods Act* and the Hazardous Waste Regulation; and
- The Contractor will maintain records for all hazardous waste/materials including:
    - Inventories of types and quantities of materials or waste generated, stored or removed;
    - Hazardous Waste Manifests identifying licensed waste haulers and disposal destinations; and
    - Disposal certification documents.

8.8 Wildlife

A variety of wildlife is known to occupy areas of the EGD property. In some cases, wildlife may use the facility as a nesting/breeding ground, while others are present for short periods of time during migration or to feed. Activities and operations at the EGD have the potential to impact the well-being of wildlife at the facility, including deer, raccoon, mink, river otter, great blue heron, osprey, raven, Canada goose and a variety of other common waterfowl, nesting and songbirds and pollinators (e.g. bats, native bees).

Additional information on wildlife management can be found within the *EGD EBMP#9 Fish and Wildlife Management* in Appendix A.

8.8.1 Mitigation

The following general measures to mitigate wildlife impacts should be considered when preparing the site-specific EPP:

- Do not feed, attract or harass wildlife;
- All wildlife must be left alone. Do not approach or handle newborn or juvenile wildlife;
- Injured or orphaned wildlife must not be handled without proper experience and equipment;
- Report observations of injured or deceased animals to the PSPC DR;
- Food waste and garbage will be disposed of in animal-proof containers and removed from site daily;
- All staff and subcontractors will adhere to maximum speed limits and be alert while driving to avoid potential wildlife-vehicle collisions;
- Conduct works outside of the general nesting period for migratory birds that are protected under the *Migratory Birds Convention Act*. If a bird nest is identified, the EM will be notified, and all protection will be afforded to the nest. Raptor nests are protected year-round and therefore are not to be disturbed. If a bird nest is identified, additional strategies for nest management may also be required at the direction of the EM;
- If species-at-risk or provincially rare species are observed on the site, the EM will be notified immediately. No interaction with the animal shall occur unless required and under appropriate Provincial or Federal permit; and
- Lighting will be limited to only essential work areas and night work will be avoided whenever possible.

8.9 Archaeology

An Archaeological Overview Assessment (AOA) was completed in 2010 which outlines the archaeologically sensitive areas on the EGD property and identifies areas of high archaeological potential (PSPC 2016). Archaeological significant materials found during excavation projects at the facility include artefacts, shell midden, faunal and human remains. Archaeologically significant materials have been found on the EGD property such as Songhees First Nation midden soil piles located northeast of the Project site. Archeological awareness training will be provided to all site workers prior to excavation activities.

Additional information on archaeological considerations can be found within the *EGD EBMP#18 Property and Infrastructure Maintenance, Modifications and Construction* in Appendix A.

8.9.1 Mitigation

If sites or artifacts of heritage or archaeological importance are discovered, stop work immediately and contact the PSPC DR. If evidence of cultural artifacts is found (i.e., human bones, stone tools, shell deposits and rock paintings) the following procedures are to be followed:

- Immediately stop work in the vicinity of the suspected archaeological find and immediately notify the PSPC DR;
- Do not undertake any further work that could disturb the site;
- Do not move soil from the vicinity of the site;
- Do not move or collect the artifacts;
- Do not take pictures of the artifacts;
- Secure the area by staking or flagging off the affected location to prevent additional disturbances; and
- Do not backfill the area.

8.10 Noise/Light

All work should comply with local noise bylaws unless exemptions have been obtained prior to commencing any site works. Specific measures will be undertaken and equipment used to minimize nuisance noise and light and to meet applicable bylaws and BMPs.

Additional information on noise and nuisance pollution can be found within the *EGD EBMP#12 Nuisance Pollution (Noise/Odour/Light)* in Appendix A.

8.10.1 Mitigation

The following noise control measures should be considered when preparing the site-specific EPP:

- Equipment should be maintained in good working condition. Fleet vehicles should be maintained according to manufacturer's guidelines. Vehicles and equipment should be inspected on a regular basis and maintained as required;
- Standard practices and use of best available control technologies should be implemented to control equipment, including hand-held, and vehicle noise. Noise levels will be managed using standard noise reduction mufflers. Mufflers are to be maintained in good working condition to meet their warranted operating efficiency;
- Schedule noisy activities for daytime hours on weekdays;

- The Contractor will consider the requirements of the Municipality of Esquimalt Bylaw 2826 Maintenance of Property, Unsightly Properties and Nuisance Bylaw Part III Nuisances Noise Control; and
- Spotlights will be directed away from residential areas or lights will be fitted with shrouds to direct light to the immediate work area.

8.11 Air Quality and Dust Control

Air quality may be affected by construction activities. Construction equipment and vehicles may temporarily emit greenhouse gases, deleterious substances, and particulate matter.

Additional information on dust suppression can be found within the *EGD EBMP#10 Water Use* and on idle reduction and emissions management within the *EGD EBMP#11 Energy Conservation* in Appendix A.

8.11.1 Mitigation

In order to minimize the potential impacts to air quality, the following should be considered when preparing the site-specific EPP:

- The movement of equipment, vehicles, and wind over bare soil and/or unpaved roads may cause temporary fugitive dust emissions;
- Minimize the time unpaved surfaces are exposed or cover potential dust sources. Paved surfaces shall be swept regularly to reduce issues related to fugitive dust;
- Stockpiles should be covered with 10 mil poly sheets, if applicable;
- Apply water to dry soils, lay down areas, and work areas during periods of high wind and/or dry weather if there is evidence that wind erosion is a problem (e.g., drifting of stockpiles) or if dust control is required. When using water, caution shall be used to prevent run-off into adjacent catch basins, trenches, or ditches; and
- Do not use oils or other similar products as dust suppressants.

In order to minimize greenhouse gas emissions during construction activities, the following practices shall be implemented by the Contractor:

- Ensure that all equipment is maintained in good working order and has properly functioning emission controls;
- Locate operating vehicles away from sensitive receptors such as fresh air intakes, air conditioners and windows;
- Do not idle vehicles near building doorways or air intakes;
- Vehicles must be turned off if idling for more than 3 minutes in a 60-minute period; and
- Establish a staging zone for trucks that are waiting to load or unload material at the site, away from sensitive receptors.

8.12 Vegetation

The EGD property includes an area of vegetation with several sensitive native plant species that provides habitat for wildlife, and acts as a buffer between the industrial operations of the drydock and ship repair operations and the neighbouring residential area. The Project site is in a busy industrial area and is relatively cleared of vegetation except for occasional shrubs and minor amounts of invasive plants (e.g., Himalayan blackberry).

Additional information on vegetation management can be found within the *EGD EBMP#8 Invasive Species* in Appendix A.

8.12.1 Mitigation

If vegetation removal be required, the following should be considered when preparing the site-specific EPP:

- Segregate invasive plant species from native plant species and remove the entire invasive plant, including all root structures;
- Invasive plant material should be contained in sturdy plastic bags or other sealable containers and disposed at a landfill / facility permitted to accept invasive plant material; and
- Limit the potential spread of seeds during the removal and transport of the invasive plant material.

9.0 REFERENCES

Archipelago (Archipelago Marine Research Ltd.). 2009. Esquimalt Graving Dock and CFSA/Munroe Head Marine Habitat Assessments Esquimalt Harbour-Rev B-FINAL. Prepared for PWGSC. November 16, 2009.

British Columbia Ministry of Environment (BC MOE). 2002. BC Guidelines for Industry Emergency Response Plans. Prepared by the BC Ministry of Environment under the BC Emergency Program Act and its regulation (Schedule 1) and by mandate. Updated July 2002.

British Columbia Ministry of Water, Land and Air Protection, and BC Forestry Service. 2002. A Field Guide to Fuel Handling, Transportation and Storage 3rd Edition.

G3 Consulting Ltd. 2014. Esquimalt Graving Dock Waterlot Phase 2 South Jetty Under-Pier Sediment Remediation Project Environmental Management Plan. Prepared for Public Works and Government Services Canada. Victoria, BC by G3 Consulting Ltd., Surrey BC. Pages 73 + Appendices.

Golder Associates Ltd. (Golder). 2012. Final Environmental Management Plan. Esquimalt Graving Dock Waterlot Sediment Remediation Project. Submitted to Public Works and Government Services Canada. December 6, 2012.

Golder. 2019. Environmental Management Plan Central Constance Cove Remediation Project (C3RP). Submitted to Public Services and Procurement Canada. March 22, 2019.

Public Services and Procurement Canada (PSPC). Esquimalt Graving Dock, Environmental Best Management Practices. October 2016. Version: 05.

SLR Consulting (Canada) Ltd. Updated Soil Management Plan for the Esquimalt Graving Dock. 825 Admirals Road, Victoria, BC. March 2020.

10.0 LIMITATIONS

This EMP has been prepared for the work referred to in this plan being undertaken by PSPC. It is intended for the sole and exclusive use of PSPC and their authorized agents for the purpose(s) set out in this plan. Any use of, reliance on or decision made based on this plan by any person

other than PSPC for any purpose, or by PSPC for a purpose other than the purpose(s) set out in this plan, is the sole responsibility of such other person or PSPC. SLR makes no representation or warranty to any other person with regard to this plan and the work referred to in this plan and they accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this plan or the work referred to in this plan.

Any conclusions or recommendations made in this plan reflect SLR's judgment based on an understanding of Project activities. While efforts have been made to substantiate information provided by third parties, SLR makes no representation or warranty as to its completeness or accuracy.

If site conditions change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this plan may be necessary.

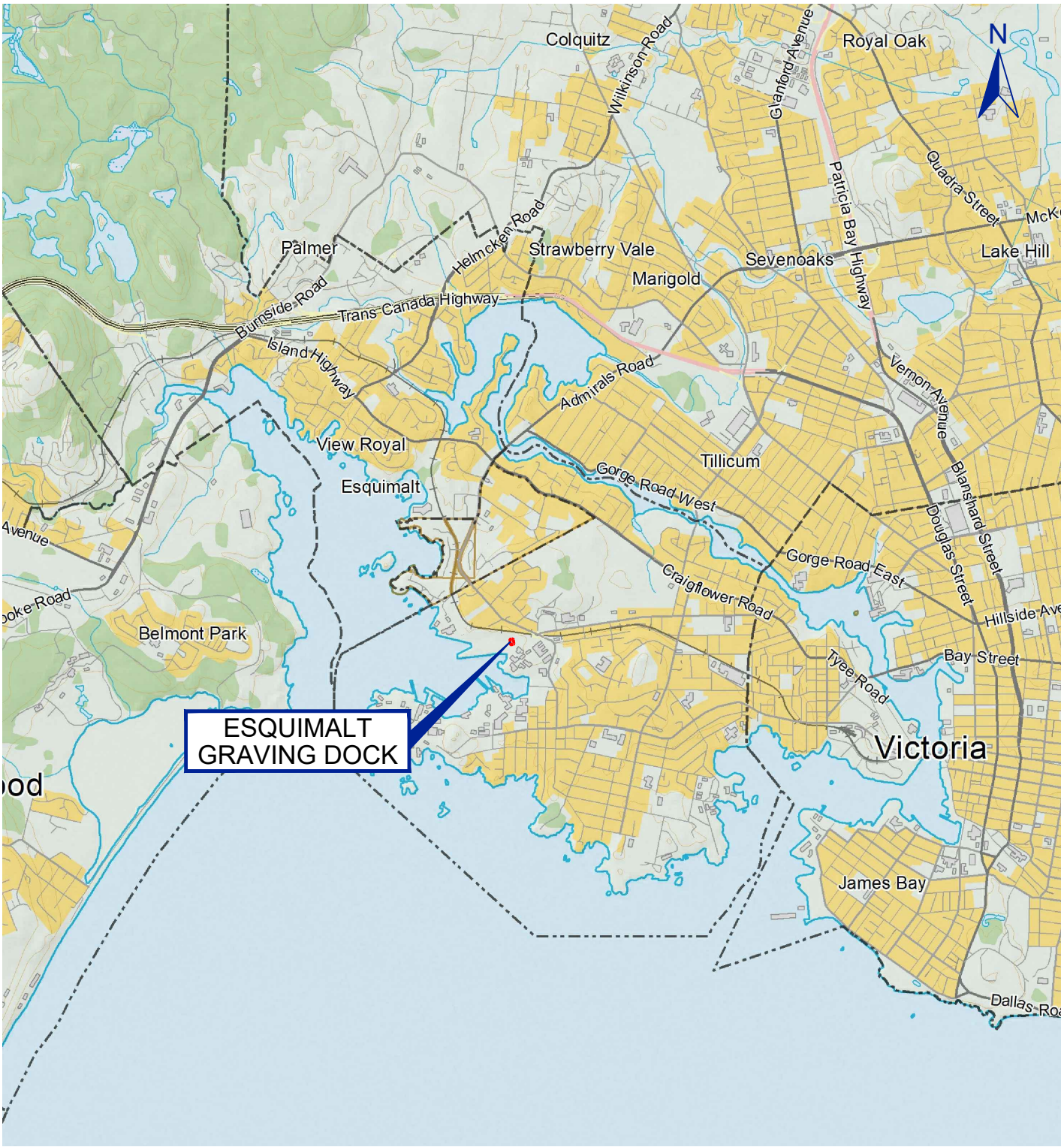
Nothing in this EMP is intended to constitute or provide a legal opinion. SLR makes no representation as to the requirements of or compliance with environmental laws, rules, regulations or policies established by federal, provincial or local government bodies. Revisions to the regulatory standards referred to in this plan may be expected over time. As a result, modifications to the findings, conclusions and recommendations in this plan may be necessary.

Other than by PSPC and as set out herein, copying or distribution of this plan or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of SLR.

Notwithstanding the stated limitations, PSPC may submit this plan to Environmental Regulatory Authorities (Municipal, Provincial, and Federal) and/or other designated persons of authority (collectively called "Authorities"). Furthermore, those Authorities may rely on this plan for review and comment purposes on matters pertaining directly to this plan or to the subject Project.

DRAWINGS

Environmental Management Plan
Esquimalt Graving Dock – East End Dock Extension
825 Admirals Rd., Victoria, BC
SLR Project No.: 205.04024.00000



BASEDATA:
© Department of Natural Resources Canada, All rights reserved; National Road Network, National Railway Network Geobase®, Downloaded March 2014; Aboriginal Lands, Geobase®, Downloaded March, 2014; BC regional Districts and Municipalities, GeoBC,Downloaded March 2014;Fresh Water Atlas, GeoBC®, Downloaded December 2014

NOTES:

- Site Location
- Rail Line
- Contour (20m)
- Municipality Boundary
- Watercourse
- Buildings
- Wooded Area
- Developed Area
- Expressway / Highway
- Freeway
- Arterial

0 0.5 1 2 3 km

SCALE 1:50,000

WHEN PLOTTED CORRECTLY ON A 8.5 x 11 PAGE LAYOUT
NAD 1983 UTM Zone 10N

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

SLR

PUBLIC SERVICES AND PROCUREMENT CANADA
ESQUIMALT GRAVING DOCK -
EAST END DOCK EXTENSION
825 ADMIRALS ROAD
VICTORIA, BC

ENVIRONMENTAL MANAGEMENT PLAN

SITE LOCATION

Date: July 22, 2020

Project No. 205.04024.00000

Drawing No. 1

Cadfile name: N:\Vancouver\CAD\Project Drawings\205\205.04024\205.04024.00000\S_205-04024-00000-A3.dwg

NOTES:
NOT A LEGAL SURVEY. DO NOT USE FOR CONSTRUCTION.

WORLD IMAGERY - SATELLITE AND AERIAL IMAGERY PROVIDED BY CRD

LEGEND:

PROPERTY BOUNDARY

SITE BOUNDARY

0 25 50 100 m

SCALE 1:1,500
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM Zone 10N

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

PUBLIC SERVICES AND PROCUREMENT CANADA
ESQUIMALT GRAVING DOCK -
EAST END DOCK EXTENSION
825 ADMIRALS ROAD
VICTORIA, BC

ENVIRONMENTAL MANAGEMENT PLAN

SITE PLAN

Date: July 22, 2020

Project No. 205.04024.00000

Drawing No. 2

SLR

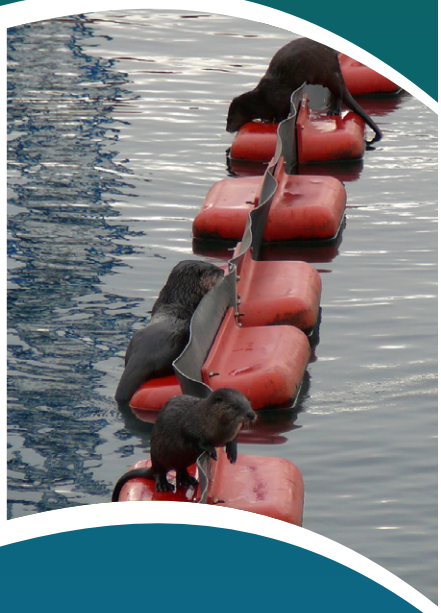
Cadfile name: N:\Vancouver\CAD\Project Drawings\205\205.04024\205.04024.00000\S_205-04024-00000-A3.dwg

APPENDIX A
Esquimalt Graving Dock Environmental Best Management Practices

Environmental Management Plan
Esquimalt Graving Dock – East End Dock Extension
825 Admirals Rd., Victoria, BC
SLR Project No.: 205.04024.00000

EGD
Esquimalt Graving Dock

Environmental Best Management Practices



Prepared by:
Public Services and Procurement Canada
Environmental Services

October 2016
Version: 05

INDEX

Overview

Risk Management Policy

EGD Site Map

EBMP #1: Pressure Washing (*High and Ultra High*)

EBMP #2: Abrasive Blasting

EBMP #3: Painting and Coating

EBMP #4: Dry Dock Floor Management and Clean Up

EBMP #5: Hazardous Materials Handling and Storage

EBMP #6: Waste Management and Recycling

EBMP #7: Fuelling and Oil Transfer

EBMP #8: Invasive Species

EBMP #9: Fish and Wildlife Management

EBMP #10: Water Use

EBMP #11: Energy Conservation

EBMP #12: Nuisance Pollution (*Noise/Odour/Light*)

EBMP #13: Sanitary Waste Management and Sewer Use

EBMP #14: Spill Preparedness and Response

EBMP #15: In-Water Hull Cleaning and Maintenance

EBMP #16: Housekeeping

EBMP #17: Stormwater Management

EBMP #18: Property and Infrastructure Maintenance, Modifications and Construction

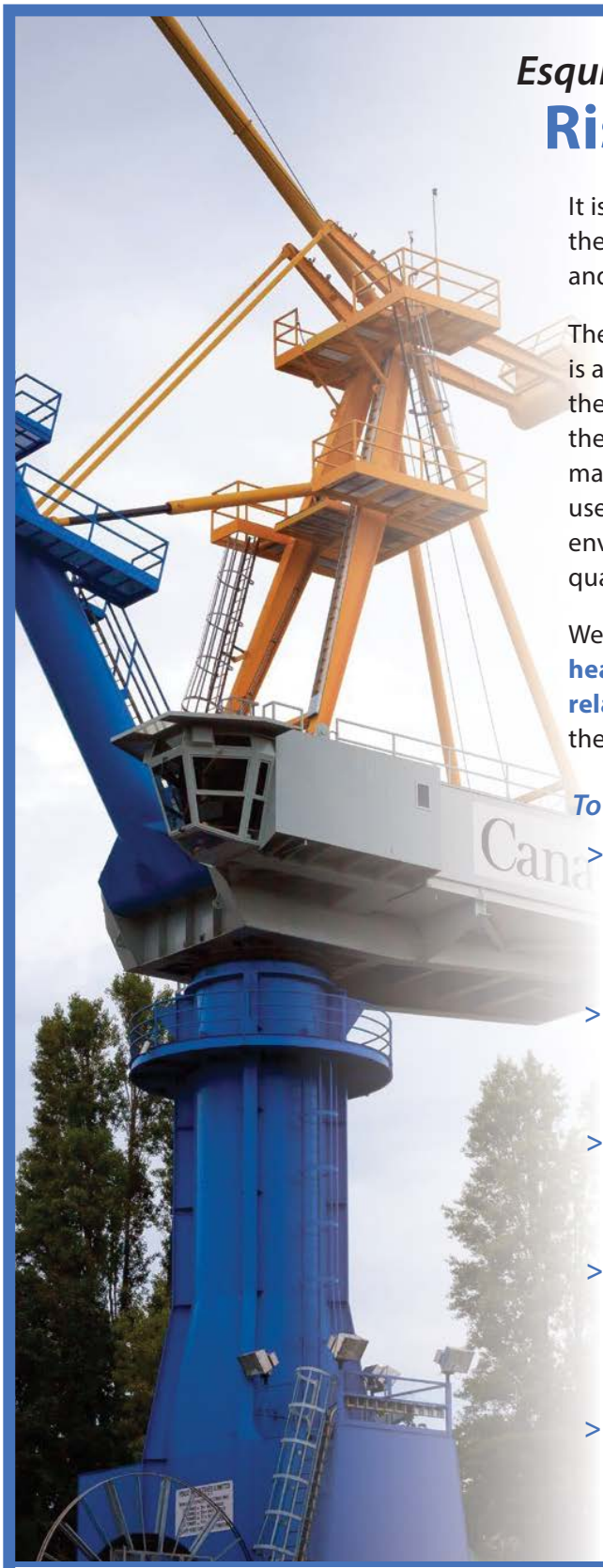
OVERVIEW

The **Esquimalt Graving Dock** (*EGD*) is a federal government owned and operated, multi-user ship repair and maintenance facility located in Esquimalt, British Columbia. The facility has been in operation since 1925, and provides service to local, Federal, and international vessels. The vessel repair and maintenance work at the EGD is carried out by privately owned shipyard repair contractors that rent the required sections of the drydock, lease upland work space from the government, and pay a fee for services such as cranes, compressed air, water, sewer and power.

The EGD is committed to managing the actual and potential health and safety, environmental, security, financial and public relations risks, while ensuring quality operations and services. In order to identify and manage these risks, the EGD has implemented an **Environmental Management System** (*EMS*) and a Risk Management Framework (*in conformance with the internationally recognized standards ISO 14001 and ISO 31000*). The EMS provides the framework for identifying environmental impacts, and ensures adequate controls are in place to effectively manage them.

This manual contains a series of **Environmental Best Management Practices** (*EBMPs*) developed to reduce impact to the environment related to common activities and operations at the Esquimalt Graving Dock. The manual contains guidance and recommendations for those operating at the EGD, and is intended to complement existing environmental legislation. It does not remove the responsibility of all contractors and companies operating at the EGD to abide by all applicable regulatory requirements and industry standards. All users of the facility are expected to follow the EBMPs.

For additional information contact the EGD Environmental Services Department.



Esquimalt Graving Dock

Risk Management Policy

It is the goal of the Esquimalt Graving Dock, in partnership with the ship repair industry, to be the premier ship repair, construction and maintenance facility on the west coast of North America.

The Esquimalt Graving Dock acknowledges that risk management is an integral part of attaining this goal. We recognize that risk is the effect of uncertainty on our operations and is inherent within the ship repair industry. Our objective is to identify, monitor and manage risk in order to prevent the harm of our employees, site users, contractors, neighbours, other stakeholders, the environment and our facility, while ensuring and maintaining quality operations and services.

We are committed to managing the actual and potential **health & safety, environmental, security, financial and public relation risks** pertaining to strategies, policies and practices at the Esquimalt Graving Dock.

To meet our commitment we will:

> *Implement systems and processes to consistently identify, measure, mitigate, minimize and report on risks, while continuing to uphold and adapt the established Environmental Management System and other relevant Management Frameworks.*

> *Meet or exceed applicable federal, provincial and municipal legislation and regulations, departmental policies, industry standards, practices and other requirements.*

> *Communicate openly with our employees to ensure they are aware of and understand our Risk Management Framework, the nature of our operations and their roles and responsibilities in managing risk.*

> *Monitor and review our Risk Management Framework to ensure we are meeting our goals. Ongoing oversight of the effectiveness of our Risk Management Framework is the responsibility of the Esquimalt Graving Dock Risk Management Team.*

> *Provide the necessary resources to effectively implement our Risk Management Framework, while continuing to improve our programs, procedures and operations.*

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

Jim Milne
Director
Esquimalt Graving Dock
Engineering Assets
Strategy Sector

David Latoski
Operations Manager
Esquimalt Graving Dock
Engineering Assets
Strategy Sector

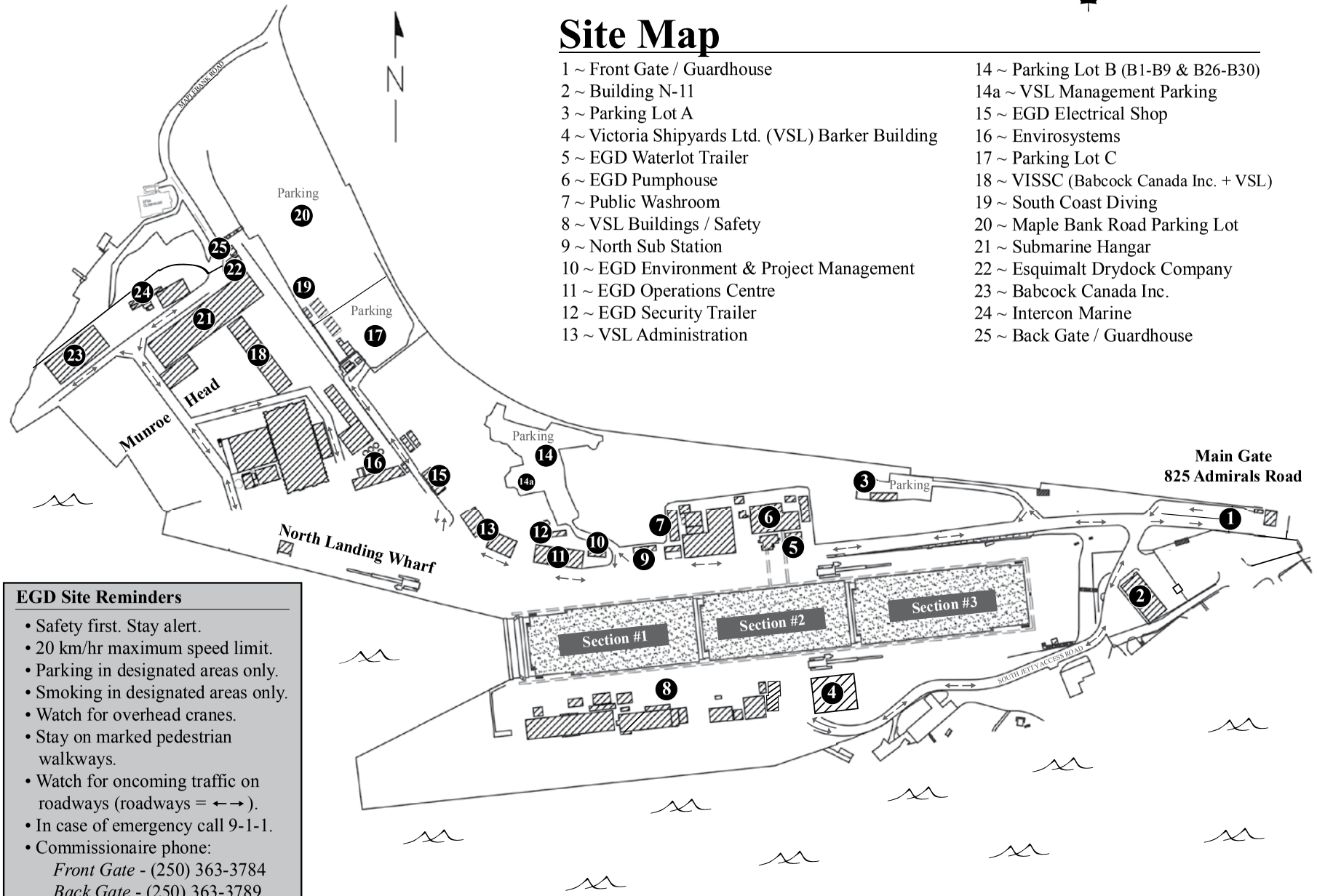
Canada

August 2015

EGD
Esquimalt Graving Dock

Site Map

1 ~ Front Gate / Guardhouse
2 ~ Building N-11
3 ~ Parking Lot A
4 ~ Victoria Shipyards Ltd. (VSL) Barker Building
5 ~ EGD Waterlot Trailer
6 ~ EGD Pumphouse
7 ~ Public Washroom
8 ~ VSL Buildings / Safety
9 ~ North Sub Station
10 ~ EGD Environment & Project Management
11 ~ EGD Operations Centre
12 ~ EGD Security Trailer
13 ~ VSL Administration
14 ~ Parking Lot B (B1-B9 & B26-B30)
14a ~ VSL Management Parking
15 ~ EGD Electrical Shop
16 ~ Envirosystems
17 ~ Parking Lot C
18 ~ VISSC (Babcock Canada Inc. + VSL)
19 ~ South Coast Diving
20 ~ Maple Bank Road Parking Lot
21 ~ Submarine Hangar
22 ~ Esquimalt Drydock Company
23 ~ Babcock Canada Inc.
24 ~ Intercon Marine
25 ~ Back Gate / Guardhouse



EGD Site Reminders

- Safety first. Stay alert.
- 20 km/hr maximum speed limit.
- Parking in designated areas only.
- Smoking in designated areas only.
- Watch for overhead cranes.
- Stay on marked pedestrian walkways.
- Watch for oncoming traffic on roadways (roadways = ←→).
- In case of emergency call 9-1-1.
- Commissionaire phone:
  Front Gate - (250) 363-3784
  Back Gate - (250) 363-3789

Environmental Best Management Practices

EBMP #1: Pressure Washing (High and Ultra High)

One of the first activities to occur on a drydocked vessel is pressure washing of the hull to remove salts, marine growth and residual paint, prior to surface preparation or painting. This typically involves pressure washing the underwater hull and/or super structure with water at 2,000 – 3,500 psi. This activity produces large volumes of paint contaminated wastewater (*e.g. washwater*). Ship repair contractors may also use an Ultra High Pressure (*UHP)* washing process (*from 40,000 – 55,000 psi*) to completely remove all paints, often eliminating the need for further surface preparation (*e.g. sandblasting*) prior to painting. UHP generates even larger volumes of wastewater and slurry solids. All wastewater created from pressure washing and UHP requires management (*i.e. assessment, collection, handling, treatment and disposal*).

Management of Wastewater on the Graving Dock Floor

- Ensure all wastes and wastewater discharges, resulting from hull and anchor chain washing, as well as dock bottom clean-up activities, are collected and disposed of properly.
- Close all sump well valves in the drydock floor collection system prior to and during pressure washing operations.
- Manage pumps to ensure they are handling the volume of washwater sufficiently.
- Manage washwater storage containers to ensure they are not overfilled.
- Divert contaminated wastewater, that falls outside of the drydock floor collection system, away from the tunnel drains.
- Direct non-contaminated water (*e.g. ballast water, cooling water, dock wall/moon pool leakage water*) away from contaminants on the drydock floor.
- Collect and dispose of stormwater that comes into contact with contaminants.
- Do not use detergents or additives in washwater.

Opening Sump Well Valves

Sump well valves in the drydock floor can be opened to manage rainwater under the following conditions ONLY:

- Dock floor has been pre-cleaned, prior to the completion of the work period.
- A filter cloth has been installed to reduce the migration of debris.

All wastewater containing paint contaminants must be directed to the collection trench drains and sump wells on the drydock floor, collected, and sent for proper treatment.

Antifoulant contaminated washwater entering the collection system (trench drains and sump wells) on the drydock floor.

The sill diversion pump removes clean seawater from the pool at the front of Section 1 (moon pool) and discharges into the tunnel drains through a hard pipe on the graving dock wall.

Sediment from the harbour often settles on dock bottom after dewatering. If this becomes contaminated with paint, etc., it must be disposed of.

The hull of a cruise ship being ultra high pressure washed.

Section 1 Considerations:
Caisson and Dock Wall Leakage & Drydock Floor Sediment

Managing Caisson and Dock Wall Leakage:

- Divert caisson leakage water away from pressure washing areas.
- Water leakage from the caisson can be diverted by using a sump pump connected to the PVC diversion pipe installed on the north wall of the drydock Section 1.
- Divert water leakage from the graving dock walls, during high tide, directly into the drainage tunnel.

Managing Entrained Sediment:

Harbour sediment may accumulate in the corners, trenches, keel blocks and sumps of the drydock Section 1 during normal docking procedure. Users of the section will need to consider management of this sediment and are responsible for removal and proper disposal if it becomes contaminated from their operations and activities on dock floor (*e.g. pressure washing wastewater, sandblast grit, paint chips, paint overspray, and other contaminants*).

Ultra High Pressure (UHP) Washing

Ultra high-pressure washing generates significant volumes of wastewater and sludge that may pose a challenge for collection and disposal.

- Prepare in advance for the management of UHP waste.
- Remove all water, sludge and debris, generated from UHP washing, from the drydock.
- Ensure the washwater and sludge is disposed of at an appropriately permitted facility.
- Disposal certificates may be requested, by EGD Management, to ensure washwater is being properly managed.

Management of Pressure Wastewater in Upland Areas/Dockside

- Perform pressure washing of small vessels and parts, in designated areas only, where wastewater management can be effectively achieved.
- Approval for pressure washing in upland areas (*including the use of a stormwater trench for water collection*) is required from EGD Management
- Wash vessel parts in a suitable contained area (*e.g. enclosed skip*).
- Completely block all drains in the area where pressure washing will occur (*e.g. cover nearby trench drains with filter cloth, place a foam bung in the trench drain to prevent migration of wash water should an incident occur*).
- Ensure sufficient equipment (*e.g. pumps, totes, tanks, foam blocks and sandbags*) is available for the timely collection, control and removal of washwater.
- Contaminated washwater requires proper treatment for disposal. Label containers.

A small vessel is power washed on the North Landing Wharf (NLW).

The trench drain is blocked and a sump pump is installed to collect wash water into a tote.

Example of high density styrofoam blocks used as a drain blocker on the NLW.

Large tank dockside with an attendant.

EBMP #2: Abrasive Blasting

Abrasive blasting is a common operation performed at the Esquimalt Graving Dock (*EGD*) to prepare vessel surfaces for painting. However, this operation creates challenges with respect to controlling air emissions and the waste materials generated.

The dust emissions generated from abrasive blasting operations can contain harmful environmental pollutants and have the potential to negatively effect employees, facility users, neighbours, equipment and infrastructure if it is not properly managed. Fugitive dust may also impact the local marine environment by entering the Esquimalt Harbour directly, or via stormwater runoff, and through direct deposit to uplands soil.

Waste grit may be highly contaminated with antifouling paint and other metals, which also poses a risk to the environment if not handled and disposed of properly.

Dust Control

- Establish dust suppression controls in advance of starting any work.
- Do not abrasive blast during conditions that render containment ineffective *(e.g. during windy conditions)*.
- No abrasive blasting of vessels shall be performed while vessels are docked alongside the North Landing Wharf or South Jetty.
- Minimize dust emissions by ensuring blast nozzles are angled perpendicular to the vessel and aimed slightly downward during blasting.
- Properly manage (*contained, covered and secure*) all sandblast product and wastes during transport.

ADEQUATE containment.

Hoarding (*Physical Containment*)

- Use containment such as tarps, shrouds or portable structures to prevent airborne particles from entering the atmosphere and surface waters.
- Containment should be large enough to adequately enclose or segregate the working area and reach the dock floor or walls.
- Ensure containment is properly installed (*connected and overlapped*) so there are no gaps.
- Used tarps with tears and holes should be replaced, repaired or doubled with additional layers.

INADEQUATE containment.

Water Use (*Fugitive Dust Suppression*)

- Where physical containment techniques are not sufficient to prevent fugitive dust emissions, water may be used to mitigate dust.
- Users may requisition use of Dust Suppression Units (*e.g. Dust Boss*) from the EGD. The units are highly effective at mitigating dust.
- Monitor areas where dust escapes physical containment and adjust dust suppression unit water spray accordingly.
- Do not allow water from the dust suppression units to enter other sections of the dock, especially in the case where another user occupies it.
- Do not allow water from the dust suppression units to come in contact with contaminants on the drydock floor or other work areas. Adjust water spray and relocate contaminants to mitigate impacts.
- Fire nozzle "water curtains" may only be used to control dust emissions when approved by EGD Management in advance. The dust suppression units generates a more effective water mist and uses significantly less fresh water during operation.

Waste Grit Management

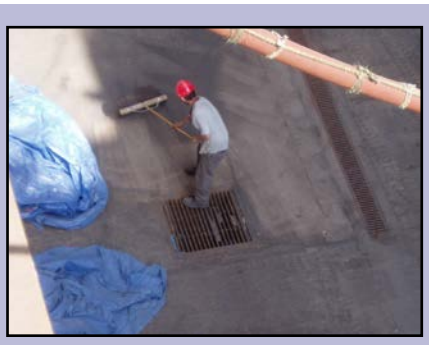
- Cover trench drains and tunnel grates in work areas with filter cloth. Replace the cloth as required.
- Manage waste grit by sweeping it into central areas, away from trenches, tunnel grates and dock floor traffic.
- Remove waste grit from work areas as soon as possible.
- Store all waste grit in appropriate containers to prevent leakage.
- Cover all skips, storage bins, tanks, and hoppers to prevent dust emissions and spills.
- Characterize and dispose of waste grit in accordance with applicable provincial regulations.

Dust suppression unit in operation.

Store all waste grit away from drains, to prevent contaminates migrating into the marine environment.

INADEQUATE waste grit storage.

ADEQUATE waste grit storage.



Clean up waste grit to prevent it from being washed into the drainage system by clean water (e.g. cooling water discharge, stormwater, dust suppression unit spray).

Store waste grit in appropriate containers.

Remove waste grit from work areas as soon as possible to prevent migration of contaminates throughout the drydock floor.

Keel / Bilge Blocks

Keel and bilge blocks on dock bottom present a challenge for the clean up of spent waste grit.

Waste grit must be removed from areas around excess blocks stored in the dock bottom. To prevent grit from collecting between the blocks, they can be relocated or covered prior to sandblasting.

Power washing at the base of the blocks can be effective in removing contaminants.

EBMP #3: Painting and Coating

Ship repair and maintenance often requires the painting and coating of vessel surfaces to protect them from corrosion or to inhibit the growth of marine life. The industrial nature of marine paints and solvents, in particular antifouling paints, may result in negative impacts to the environment and surrounding infrastructure, if not properly managed.

Spray Painting

Paint overspray has the potential to impact the marine environment, soils, neighbouring residences, and nearby equipment and infrastructure.

- Use containment such as tarps, shrouds or portable structures to prevent airborne particles from entering the atmosphere and surface waters.
    - Containment should be large enough to adequately enclose or segregate the working area.
    - Ensure containment is secured so there are no gaps.
    - Ensure that containment reaches the dock floor or walls.
    - Do not use keel blocks, dock floor or dock walls to test paint sprayers.
- Do not spray paint during conditions that render containment ineffective (*e.g. windy*).
- Place containment beneath and around structures being painted on dock floor and in work areas to ensure overspray does not reach the surrounding area (*e.g. during painting of anchor chains, or grates*).
- Manage overspray on the drydock floor to prevent safety hazards (*e.g. slippage*).
- When spray painting materials inside the stabilizer pockets, ensure the area is sealed and that the walls and floors are covered.
- For vessels docked in Section 1, ensure that overspray does not reach the caisson sill/moon pool water. Avoid docking vessels so they extend over sill area.

Spray Painting

ADEQUATE containment.

INADEQUATE containment.

INADEQUATE containment. Ensure tarps are in place to prevent overspray impacting the surrounding work area.

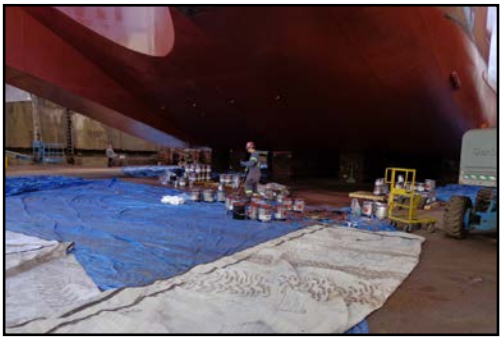
ADEQUATE containment on stablizer pocket doors.

Paint overspray due to INADEQUATE containment stablizer pocket doors.

Manual Painting

Painting by hand (*roller, brush*) can be conducted without shrouding the work area; however, the potential remains for product to migrate into the environment. Work spaces and product handling must be managed with care, similar to dockside painting.

- Containment should be large enough to adequately cover the work area and provide a barrier between the work and the environment (*e.g. dock floor, ocean and soil*).
- Ensure containment is secured so there are no gaps.
- Product container lids are to be secured.



ADEQUATE containment.

Painting Dockside

- Do not spray paint vessels docked alongside the wharves or jetties *(e.g. North Landing Wharf)*.
- Use rollers and brushes to paint vessels dockside.
- Ensure tarps are in place below work areas, as well as in between the vessel and the dock, to prevent spills and drips from entering the water.
- Ensure paint cans are stored securely when working alongside vessel edges.
- Ensure floor grates of manlifts are covered to prevent spills from going into the marine environment.
- Waste generated from painting and other activities such as grinding, hand tooling and welding, must be prevented from entering the marine environment.

While painting vessels docked alongside the wharves or jetties, do not spray paint. Take sufficient measures to prevent paint from entering the marine environment.

Environmental Best Management Practices

Empty paint cans must be properly stored on dock bottom and dock side.

Temporary Paint Storage/Mixing Areas

- Must be under cover to protect from inclement weather.
- Only in designated areas.
- Must be on secondary containment (*a tarp at minimum*).
- Ensure empty paint cans and other associated wastes from painting are stored properly, protected from the weather, and removed from dock bottom as soon as possible.
- Ensure empty paint containers being dried for disposal are protected from rain.
- Do not dispose of used paint containers that still contain wet paint.

IMPORTANT!

In rare situations (*e.g. shape of the vessel, combined with ideal weather conditions*) containment may not be necessary to prevent overspray from escaping the area.

In this situation, the User must notify EGD Management prior to beginning the work, and obtain approval (*in writing*) to paint without completely enclosing the vessel.

Restrictions and monitoring requirements will be applied.

To this date this has only been allowed in three situations:

- Painting underneath a flat bottom barge.
- Painting the underwater hull portion of the midsection of a cruise ship.
- Painting of a C-class ferry underwater hull area, during calm wind conditions.

Environmental Best Management Practices

EBMP #4: Dry Dock Floor Management and Clean Up

Drain Management

- All sump well valves must be closed prior to and during power washing operations.
- Cover all tunnel drains and net cages during sandblasting, painting and power washing to prevent contaminants from entering the marine environment.
- In the case of a spill or release on dock bottom all sump well valves must be closed and all contaminated material contained and removed from dock bottom.
- Direct all contaminated water to the trench drain system, to avoid entering the tunnel drains.
- Collect and properly dispose of all contaminated water. Ensure sufficient equipment is available for contaminated water collection.
- Ensure all non-contaminated water is directed away from work areas and into the tunnel drain system (*e.g. ballast water, cooling water, caisson sill water*).

Hazardous Materials Managementt

- Store hazardous materials (*e.g. fuel, paint, waste oils*) away from the drains on dock bottom.
- Store hazardous materials to the inside of the trench drains so that any spills or releases can be captured.
- Store hazardous materials in areas protected from the weather, water curtains and other water sources.
- Ensure adequate spill response equipment is in close proximity to hazardous material transfer operations. At a minimum one spill kit is required per section of the graving dock.

Collect and properly dispose of all contaminated water.

Sediment Management

- Segregate any marine sediment, that may enter the dock during vessel transfer, from the waste generated during vessel repair. This is to reduce the amount of wastes requiring disposal.
- Collect and properly dispose of marine sediment that becomes contaminated with waste generated from vessel repair.
- Remove all contaminants and residues from the trench drains and sump wells prior to flooding at the end of work period.

Housekeeping

- Remove waste sandblast grit from the work area as soon as possible to prevent migration of grit contaminants into tunnel drain system.
- Store wastes collected from the dock floor in appropriate secondary containment and remove from dock bottom as soon as possible.

Residual paint in the cans may drip out of the skip and enter the marine environment through the drain systems.

Leaving garbage around the work site attracts wildlife such as seagulls, racoons and rats.

When cleaning dock bottom, skips of waste sandblast grit may leak contaminated water and should be removed as soon as possible.

All hazardous materials must be stored in appropriate containment and away from tunnel drain system.

Inspection and Cleanliness

- Prior to flooding, the drydock must be cleaned to meet the Esquimalt Graving Dock (*EGD*) *Standard of Cleanliness (see below),* as determined by the EGD undocking supervisor.
- Users must ensure that the dock floor is free of deleterious substances prior to flooding.
- Water may be used to clean the dock floor; however, any wastewater generated must be collected and disposed of properly.
- If a vessel occupies a shared portion of a dock section each User must clean the trench drains up to and including the section sump well.

ADEQUATE:
Example of a dock floor that would pass inspection.

INADEQUATE:
Example of a dock floor that would not pass inspection.

EGD Standards of Cleanliness

Due to the importance of drydock cleanliness prior to flooding, and since quantitative testing is impractical due to time and cost restrictions, the following guidelines will be used to assess cleanliness of drydock surfaces.

- All drydock surfaces, including stairwells and sills must meet the standard for "**residue free**" prior to flooding of the drydock. "**Residue free**" is considered met when a person of normal visual acuity, while standing, is unable to detect visible accumulations of potential pollutants.
- This includes, but is not restricted to:
    - the removal of abrasive grit,
    - paint residues or paint chips,
    - cutting and grinding wastes,
    - oil and grease,
    - food and drink containers,
    - ear plugs,
    - dust masks,
    - rope,
    - cigarette butts, or
    - any other refuse that may have been deposited during the work period.
- Debris of natural origin that may have been deposited during the previous flooding of the drydock, such as wood, sand, silt, seaweed, or marine life may be exempt from these requirements, as long as it will not contaminate the environment upon reintroduction.

AREAS IN NEED OF *SPECIAL ATTENTION*

ACCEPTABLE		NOT ACCEPTABLE
	**RAMPS**	
	**SILLS**	
	**KEEL BLOCKS**	
	**TRENCH DRAINS**	
	**SUMP WELLS**	

Environmental Best Management Practices

EBMP #5: Hazardous Materials Handling and Storage

A variety of hazardous materials are used, stored and transported by Users at the Esquimalt Graving Dock (*EGD*). If not handled appropriately, these materials have the potential to negatively impact worker health and safety, infrastructure and the environment. Hazardous materials commonly used at the EGD include: antifoulant paint, fuels and oils, antifreeze.

Storage

Users must have designated storage areas suitable for the materials they use on site. Where applicable, these areas must:

- Have appropriate secondary containment suitable to the quantity and nature of the material in that area.
- Ensure materials are stored in accordance with compatibility requirements.
- Be protected from the weather (*covered, lids secured, valves closed*).
- Have placards and proper ventilation.
- Have controlled access.
- Be located away from pathways to the marine environment.
- Be located on impervious surfaces (*e.g. concrete*).

Handling

All hazardous materials must be:

- Labelled appropriately with the owner name, product name, first aid information, and PPE requirements.
- Secured appropriately during transport.
- Transported by equipment that can sufficiently handle its weight and size.
- Transported in containers that are stable and not in need of repair (*e.g. totes with broken feet, excessive rust, faulty valves*).

ADEQUATE storage.

ADEQUATE storage.

INADEQUATE storage.

Any container holding hazardous materials must be clearly and properly labelled.

Areas to Avoid Storing Hazardous Materials

Trench Storm Drains
Any containers placed directly over top or beside a trench drain have the potential to spill to the drain leading directly to the ocean.

Storm Drains
Any containers placed directly over top or beside a storm drain have the potential to spill to the drain leading directly to the ocean.

Alongside Wharves and Jetties
Any containers placed alongside the edge of the wharves and jetties at the EGD have the potential to spill directly to the ocean, as there are no berms or secondary containment available.

Dock Floor Trench Drains
If a tote or drum is placed directly over or beside a trench drain, hazardous materials have the potential to flow down the drain and into the marine environment. Although the drains are designed for rapid containment and recovery, there is no guarantee that workers will be present to close drain valves during an incident.

Dock Floor Sump Wells
When the sump well valve is open the sump drains directly into the marine environment. Any containers placed on top of or adjacent to the sump well have the potential to enter the ocean if a spill were to occur.

Dock Floor Tunnel Grate Drains
Tunnel grate drains lead directly to the marine environment. Any containers placed directly over top of or beside a tunnel grate have the potential to impact the marine environment, should a spill occur.

Environmental Best Management Practices

Safety Data Sheet *(formerly Material Data Safety Sheet)*

A Safety Data Sheet (SDS) is a document that contains information on the potential hazards (*health, fire, reactivity and environmental*) and how to work safely with the product. SDSs also contains information on the use, storage, handling and emergency procedures all related to the hazards of the material. SDSs must be available (*electronically or hardcopy*) for all products stored on site and be readily available to all employees.

Storage Tanks and Totes

Storage tanks and totes are used for a variety of materials at the EGD, including: washwater, fuel products, bilge water, waste oil/fuel and other waste liquids. Storage tanks and totes may be considered portable/mobile, temporary or permanent. The regulatory requirements for proper use of these tanks vary and is dependent on a variety of factors.

Federal Regulation for Fuel Storage Tanks

The EGD is a Federal facility; therefore, storage tanks onsite need to comply with the Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations. Users may be required to register their tanks with Environment Canada. **Contact EGD Environmental Services for information.**

There are four different fuel tanks at the Esquimalt Graving Dock.

National Fire Code

The National Fire Code outlines the requirements for containment, labelling and location of flammable liquid storage.

Environmental Best Management Practices

EBMP #6: Waste Management and Recycling

Operations at the Esquimalt Graving Dock (*EGD*) generate a variety of waste streams including hazardous waste, controlled waste, biological waste, international waste, and general refuse and recyclables.

Hazardous Waste

Hazardous wastes generated at the EGD may include waste oil and oil filters, antifreeze, batteries, paint and solvents, oily rags and absorbent materials, spent grit, solids generated during power washing, mercury, PCB containing equipment and asbestos. Appropriate management of hazardous waste will reduce environmental liability associated with inappropriate disposal and storage as well as reduce the risk of human injury and environmental impact.

Hazardous waste storage should be segregated from new product storage.

- Ensure designated storage areas are away from active work areas.
- Ensure areas are covered to reduce exposure to environment and wildlife.
- Ensure that waste accumulation areas are organized.

Hazardous waste should be segregated into separate containers.

- Ensure containers used are appropriate for the type of waste (*e.g. separate drums for waste oil, oil filters, antifreeze, batteries, paint and solvents, oily rags and absorbent material, spent grit*).
- Store batteries in a manner that prevents leakage of acid to the environment.
- Properly dispose of contaminated clean-up materials (*e.g. absorbents, rags, etc.*).
- Do not dilute or mix hazardous waste, other hazardous or non-hazardous wastes.
- Cover waste containers to prevent exposure to weather (*e.g. rain*).

All hazardous waste must be carefully stored and disposed of.

Asbestos

All asbestos containers and asbestos-containing materials must be identified by signage and labelling in accordance with applicable legislation.

Companies that engage in asbestos related work at the EGD must be qualified to do so.

Clearly label all hazardous waste containers.

- Labels should include: type of waste, generator/company name, and contact information.

Controlled Waste

Controlled waste such as animal feces, sewage, contaminated grit, stormwater catch basin waste, creosote wood and dead animals can be disposed of at the **Capital Regional District (*CRD*) Hartland Landfill.**

Controlled waste disposal at requires a permit.

For more information about Controlled Waste disposal contact the CRD Hotline at (250) 360-3030.

Large scale food waste bin.

An example of a Waste Management Area at the EGD.

Food Waste

During normal activity at the EGD, food waste is collected in conveniently located and accessible receptacles onsite and disposed of at the landfill. During larger projects, however, alternative measures are taken to account for the increase in generated wastes.

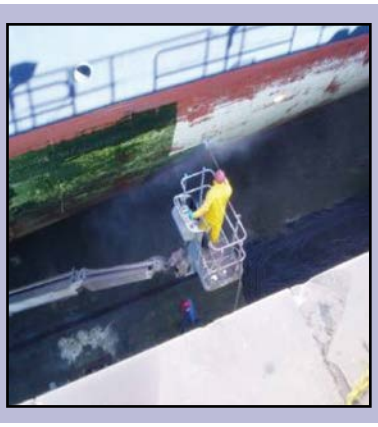
General Refuse

General refuse should be separated into categories to enable easy disposal. Users are responsible for properly disposing of refuse and recyclable materials. There are many containers throughout the site for disposal of common refuse materials (*e.g. steel, wood, glass, cardboard etc.*).

Biological Waste

Marine life removed from vessel hulls and sea chests may contain paint contaminants. This waste may be considered a controlled or hazardous waste and would need to be handled and disposed of accordingly.

Biological waste should be stored out of the sun, covered and removed from the facility quickly to prevent any odours from emanating.



Recycling

All Users of the EGD are responsible for collecting and disposing of the solid waste they generate from their activities, properties and vessels they are responsible for.

- Recycle solid waste such as plastic, glass, aluminum, mixed paper and cardboard. Recycling areas should be conveniently located and easily identifiable.
- Segregate other solid waste, such as scrap metal, wood, electronics, polystyrene foam and soft plastics for recycling at an approved facility.
- Leaf and yard waste collected on property should be composted or disposed of appropriately.
- Construction and demolition waste should be reused or recycled wherever cost effective and technically feasible.
- Encourage the use of recyclable products to reduce the solid waste impact on the environment.

International Waste

Like hazardous waste, International Wastes may pose a threat to human health and the environment.

Dunnage from vessels has been known to carry invasive species to local areas. Foreign dunnage must be identified, stored, and disposed of at an approved facility without delay.

Food wastes may carry pathogenic organisms that could cause illness to those handling it. Food wastes shall be kept in separate, closed containers. The **Canadian Food Inspection Agency *(CFIA)*** will inspect foreign vessels and issue directions on disposal.

EBMP #7:
Fuelling and Oil Transfer

The transfer of fuel and oil is a common activity at the Esquimalt Graving Dock (*EGD*). Transfer may be from ship to shore (*e.g. removal of waste fuel/oil*), from shore to ship (*e.g. refuelling a vessel from a truck)* or land based.

An accidental release during these operations has the potential to negatively impact the environment and health and safety of those at the facility.

- Prior to any fuelling or oil transfer operations:
    - the ***EGD Oil Transfer Checklist*** must be complete;
    - an emergency plan must be in place and readily available;
    - adequate spill response equipment must be available; and
    - personnel must be aware of spill response procedures.
- All transfer and storage equipment must be in good condition, tested, and properly connected.
- Do not place storage and transfer equipment near pathways to the marine environment (*e.g. storm drains, trench drains, edge of the dock*) without effective mitigation measures in place.

Vessel Fuelling and Bulk Oil Transfer
Definition of Oil: as described in the Canada Shipping Act **oil** is considered petroleum in any form, including: crude oil, fuel oil, sludge, oil refuse, gasoline, lube oil and refined products.

Berthed Vessels

- ALL berthed vessels receiving fuel from a truck or a barge require a containment boom.
- Transfers of fuel and oil to and from ALL berthed vessels require a containment boom.
- An ***EGD Oil Transfer Checklist*** must be filled out and signed by representatives from the truck and the vessel and submitted to EGD representatives in the Pumphouse prior to fuelling or oil transfer operations.
- Transfer operations must comply with the *Canada Shipping Act, Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals Subdivision 5*.

Vessels in Drydock

- ALL fuel and oil transfers occurring in the drydock require spill kits to be placed nearby and are not to be completed next to drainage pathways to the marine environment (*e.g. trench drains, sump wells, tunnel grate drains*).

On Land Transfers

- ALL fuel and oil transfers occurring on land require spill kits to be placed nearby and are not to be completed next to drainage pathways to the marine environment (*e.g. storm drains, edge of dock*).

Containment Boom Requisition

The Esquimalt Graving Dock has containment boom and deployment equipment available for requisition. To arrange for booking or rental, contact the EGD Operations Manager.

An orange inshore containment boom fully surrounds the vessel while being fuelled.

The hydraulic powered deployment reel with inshore containment boom available for requisition.

EXAMPLE SCENARIO REQUIREMENTS

Scenario 1: FUELLING A BERTHED VESSEL

- Completed and signed ***EGD Oil Transfer Checklist*** submitted to EGD Pumphouse.
- Containment boom deployed and effectively secured at both ends.
- Emergency response plan in place.
- Adequate spill response equipment and qualified personnel available.

EXAMPLE SCENARIO REQUIREMENTS (*Continued*)

Scenario 2: BULK OIL TRANSFER FROM A BERTHED VESSEL

- Completed and signed ***EGD Oil Transfer Checklist*** submitted to EGD Pumphouse.
- Containment boom deployed and adequately secured at both ends.
- Receiving containers located away from pathways to the harbour (*e.g. storm drains, edge of dock*).
- Receiving containers in secondary containment and in good condition.
- Emergency response plan in place.
- Adequate spill response equipment and qualified personnel available.

Scenario 3: FUELLING A VESSEL OR BULK OIL TRANSFER IN THE DRYDOCK

- Pumphouse operation on site prepared to shut down auxiliary pumps in case of an emergency.
- Receiving containers located away from pathways to the harbour (*e.g. trench drains, sump wells, tunnel grate drains*).
- Receiving containers in secondary containment and in good condition.
- Emergency response plan in place.
- Adequate spill response equipment and qualified personnel available.

Scenario 4: ONSHORE OIL TRANSFER BETWEEN CONTAINERS

- All containers located away from pathways to the harbour (*e.g. storm drains, edge of dock)*.
- Receiving containers in secondary containment and in good condition.
- Emergency response plan in place.
- Adequate spill response equipment and qualified personnel available.

Environmental Best Management Practices

EBMP #8: Invasive Species

Invasive species are a significant threat to the marine ecosystems of British Columbia. The Esquimalt Harbour is known to have a disproportionately high number of non-indigenous species. It has been widely recognized that the primary source of non indigenous marine species in local waters are the ballast tanks and hull surfaces of transoceanic vessels. Ship repair contractors are encouraged to report unusual species observed during hull cleaning activities.

Ballast Water

- Vessels must follow *Transport Canada Ballast Water Control and Management Regulations*

Ballast Tank Sediment

- Shipyards must follow *Transport Canada Ballast Water Control and Management Regulations*
- Sediments removed from the ballast tanks at the EGD must be contained, collected and disposed of at an authorized facility.
- Sediments must not be allowed to enter the harbour.

Anchor chain-growth

- All biological material removed from anchor chains must be contained, collected and disposed of appropriately.

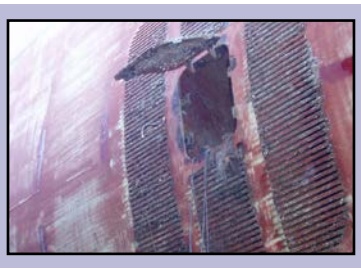
Sea chests

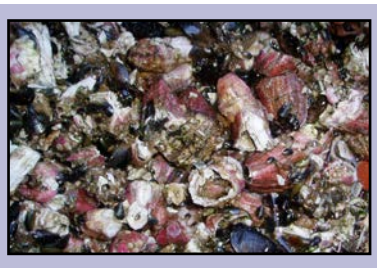
- All biological material removed from sea chests must be contained, covered and disposed of appropriately.
- Material must be stored away from direct sunlight/heat and disposed of as soon as possible, to avoid nuisance odour pollution.

Marine growth removed from vessel hulls must not be allowed to enter the harbour through the drydock drainage system.

INADEQUATE containment: Biological waste on drydock floor near drains.

INADEQUATE containment: Biological growth mixed with paint waste on drydock floor.





Sea chests, such as this one from a cruise ship docked at the EGD, often contain a significant amount of marine life.

If not managed appropriately, this marine life has the potential to negatively impact the local ecosystem of the harbour.

EBMP #9: Fish and Wildlife Management

The daily operations and activities of the Esquimalt Graving Dock (*EGD*) have the potential to negatively impact wildlife that frequents the property. The *EGD Wildlife Management Plan* has been developed to assist EGD employees and Users to properly manage interaction with fish and wildlife that are common to the facility.

Fish

Fish and other marine life have the potential to become stranded in the drydock during normal vessel docking/undocking operations. This may include, but is not limited to: salmon and other fish species, seals and octopus.

- The bubble curtain must be employed during vessel transfer into and out of the drydock.
- EGD employees must monitor the drydock for stranded fish and/or other marine life during dewatering and report cases to EGD Environmental Services.
- Whenever possible, EGD employees must retrieve fish and marine life and safely return them to the Esquimalt Harbour.
- Users are prohibited from removing fish and marine life from the drydock.

Report all cases of fish and marine life interaction with the drydock to EGD Environmental Services.

Wildlife

A variety of wildlife is known to occupy areas of the EGD property. In some cases wildlife may use the facility as a nesting/breeding ground, while others are present for short periods of time during migration or to feed. Activities and operations at the EGD have the potential to impact the well being of wildlife at the facility.

Such wildlife includes: deer, raccoon, mink, river otter, great blue heron, osprey, raven, Canada goose and a variety of other common waterfowl, nesting and songbirds and pollinators *(e.g. bats, native bees)*.

Bubble curtain employed during vessel transfer.

Stranded marine life must be carefully returned back to the Harbour.

Fisheries Act - Destruction of Fish

The EGD has received authorization for the destruction of fish associated with normal operation of the drydock from the Department of Fisheries and Oceans (*DFO*).

Conditions of the Authorization:

- Take all reasonable precautions to prevent the trapping and mortality of fish.
- Monitor the success of preventative measures and retrieval success.
- Report to the DFO annually.

Environmental Best Management Practices

- ALL wildlife must be left alone. Do not approach or handle newborn or juvenile wildlife.
- Injured or orphaned wildlife must not be handled without proper experience and equipment.
- Dispose of dead wildlife appropriately.
- Report observations of injured or deceased animals to EGD Environmental Services.
- Prior approval from EGD Environmental Services is required for the relocation or removal of nesting wildlife; a Migratory Bird Damage or Danger Permit is required to remove nests and retrieve eggs of migratory birds (*e.g. seagulls*).
- Never mistreat, remove or destroy any areas that could provide habitat for wildlife without prior approval and receipt of appropriate permits from the relevant authority.

Contact EGD Environmental Services for wildlife related information, incidents and interactions.
Contact the Front Gate Commissionaires for afterhours assistance.

A variety of wildlife is known to occupy areas of the Esquimalt Graving Dock property.

Incidents with wildlife are managed on a case by case basis.
Direction and/or assistance must be taken from the appropriate authority when required.

EBMP #10: Water Use

The Esquimalt Graving Dock (*EGD*) is considered a major consumer of fresh water. Water is provided to the facility by the Capital Regional District (*CRD*) distribution system, on a fee for use basis. Inefficient use of water may result in a negative economic and environmental impact. Water consumption and the quality of water are both considerations of the environmental management systems at the EGD.

Water Consumption

Large volumes of water are used during normal operations at the facility; because of this, the EGD is considered a high volume user of fresh water in the CRD. Users must be conscious of activities that consume high volumes of water and work to mitigate any water waste.

In order to reduce the amount of water consumed onsite:

- Mitigate dust in problem areas using high efficiency Dust Suppression Units, when physical containment techniques are not sufficient to prevent fugitive dust emissions.
- Use fire nozzle water curtains only when all other attempts to contain particulate emissions from sandblasting have failed. Water curtain use must be approved by EGD Management in advance.
- Avoid use of freshwater to clean work areas, where possible.
- Maintain fittings in buildings and on equipment to prevent leakages.

Water Consuming Activities

Activities associated with vessel surface preparation and dust control use significant amounts of water.

Conventional pressure washing and ultra high pressure (UHP) washing use large amounts of water at high pressure to scour paint and biological material from the hulls of ships.

Dust Suppression Units

Dust Suppression Units are used to mitigate the escape of dust from sandblasting operations in the drydock.

Water Quality

The water distribution system at the EGD was originally designed as a fire suppression system; therefore, the water in certain areas of the system may not be considered potable.

- Potable water is not available throughout the facility (*this includes intake to vessels moored alongside or in the drydock*).
- Users of the facility are responsible for ensuring that the water they use meets the guidelines for the purpose intended.
- Users must use backflow prevention when accessing the water distribution system.

The EGD maintains the fresh water distribution system.

- Flushing of the entire system is conducted on an annual basis.
- Collection and analysis of water, in comparison to drinking water quality guidelines, is conducted on an annual basis.

Metered Water Use at the Esquimalt Graving Dock

- Users of the facility must ensure that water is accessed from a metered line when connecting to the water distribution system.
- Portable meters are to be used when required.
- The EGD Pumphouse must be contacted for proper access to the water distribution system.

EBMP #11: Energy Conservation

The Esquimalt Graving Dock (*EGD*), as an industrial facility, is a major consumer of energy. Inefficient energy use may result in negative economic and environmental impacts. Economic impacts are associated with inefficient electrical usage (e.g. cost), while environmental impacts include those associated with the consumption of fuel (*e.g. air emissions*).

Energy consumption also results in the production and release of greenhouse gas emissions through the combustion of fossil fuels. Every aspect of work at the EGD results in the release of greenhouse gases, whether it is operating the cranes or printing a report. It is important to minimize energy consumption wherever possible to reduce the release of harmful greenhouse gases and conserve energy.

Electrical Consumption

There are a number of opportunities to increase the efficiency of electrical usage at the EGD:

- Turn off lights and equipment when not in use (*e.g. flood lights, office buildings*).
- Install energy efficient devices in buildings (*e.g. sensor switches, efficient light bulbs*).
- Use energy efficient equipment whenever possible and consider energy efficient options when purchasing new equipment.
- Stagger equipment start-up to decrease load on electrical system.

Environmental Best Management Practices

Fuel Consumption and Emissions

Opportunities to decrease the amount of fuel consumed by day to day activities include:

- Using energy efficient vehicles.
- Using alternative fuels where possible (*e.g. Biofuels*).
- Using alternative energy sources where possible (*e.g. LED, solar, rechargeable*).
- Avoid idling vehicles (*e.g. delivery vehicles*).
- Use shore power where possible.
- Encourage staff to try alternative means for commuting to work (*e.g. carpool, public transit, cycling*).

Be aware of the potential impacts of emmissions on neighours near the EGD.

Idling Vehicles

- Do not idle vehicles near building doorways or air intakes
- Vehicles must be turned off if idling for more than 3 minutes in a 60-minute period.

Idling vehicles produce unnecessary air emissions and noise.

Shore Power

For vessels moored alongside at the North Landing Wharf and in the drydock it is important that they utilize shore power when possible. With shore power, the auxiliary generator can be turned off, thereby saving fuel and preventing the release of harmful air pollutants.

Did You Know?

Shore Power may be accessed at the EGD:

- 208V and 480V available on the North Landing Wharf and drydock.

EBMP #12:
Nuisance Pollution (Noise/Odour/Light)

The daily operations of the Esquimalt Graving Dock (*EGD*) Users have the potential to negatively impact neighbouring residents and businesses, as well as the immediate work area. Nuisance pollution is often created by noise, odour and light.

Noise

- Noise pollution can be generated and recognized in decibel levels, pitch, oscillation and duration.
- The main sources of noise at the EGD include sandblasting, drilling, hammering, compressors, generators and the crane warning bell. Even general shop repair activities generate large amounts of noise.
- Sound carries. Operational noise, vehicle noise and loud voices can be heard in nearby areas. Site Users must be aware of the potential impacts of all activities taking place at EGD and be respectful of neighbours.
- Schedule noisy activities for daytime hours 0700 hrs to 2300 hrs on weekdays, weekends and holidays. Through worker education and good practice the generation of high-level intermittent or non-continuous noises can be minimized.
- Personal vehicles, including motorcycles, can disturb neighbouring residents. Your vigilance is appreciated especially during quiet hours. Warning signs are posted at parking areas to remind personnel to be respectful of neighbours when arriving and departing the EGD.
- The EGD recognizes applicable municipal laws and regulations. Operations will consider the requirements of the *Municipality of Esquimalt Bylaw 2826 Maintenance of Property, Unsightly Properties and Nuisance Bylaw Part III Nuisances Noise Contro*l.

The EGD is located in close proximity to residential areas.

Personal vehicles with loud engines can disturb neighbouring residents.

Warning signs in parking areas act as a reminder to minimize noise at EGD.

Responses to nuisance pollution complaints will be taken on a concern-by-concern basis.

To submit a nuisance complaint contact the Esquimalt Graving Dock Information Line at (250) 363-0227.

Environmental Best Management Practices

Odour

- Daily dock operations often create strong and unpleasant odours whether from the release of VOCs, H2S, organic materials, or chemicals. An offensive smell can reduce the quality of the work environment for neighbouring tenants and residents. Biological material removed from bilges, sea chests and hulls must be contained, covered and disposed of appropriately. Be proactive in planning for timely transport and proper disposal of material; a permit may be required for disposal.
- Material must be stored away from direct sunlight/heat and disposed of in a timely manner, to avoid nuisance odour pollution.
- Odour mitigating measures may be required, if odours are negatively affecting neighbouring properties or onsite personnel.
- The EGD recognizes applicable municipal laws and regulations. Operations will consider the requirements of the *Municipality of Esquimalt Bylaw 2826 Maintenance of Property, Unsightly Properties and Nuisance Bylaw Part III Odour and Disturbances*.

ADEQUATE containment of odorous waste.

INADEQUATE containment of odorous waste.

Light

- Night time dock operations require spotlights to provide a safe work environment. Be aware that strong spotlights can be a significant intrusion for residential neighbours.
- Only utilize spotlights when absolutely necessary. This will help prevent disturbing the neighbours, as well as to ensure a more energy efficient work environment.
- Changing the direction of stationary and portable lights in the workplace may reduce the effect they have on the neighbours.
- Turn off any unnecessary lights.
- The EGD recognizes applicable municipal laws and regulations. Operations will consider the requirements of the *Municipality of Esquimalt Bylaw 2826 Maintenance of Property, Unsightly Properties and Nuisance Bylaw Part III Odour and Disturbances.*

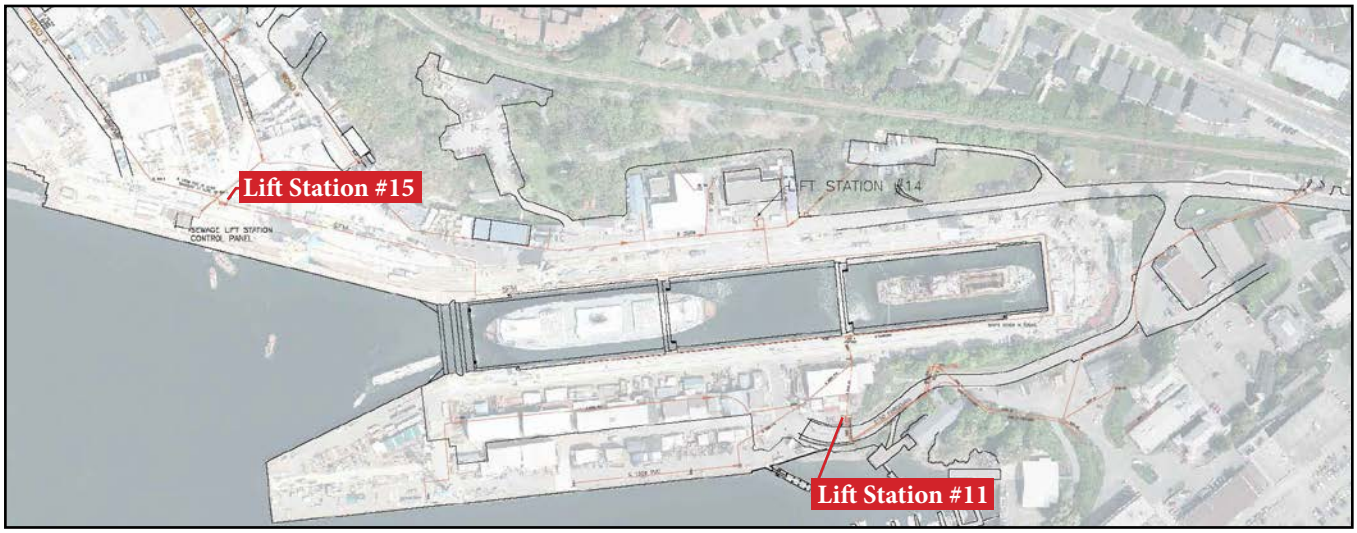
Only utilize spotlights when necessary.

Changing the direction of spotlights can reduce light impact on neighbours.

EBMP #13:
Sanitary Waste Management and Sewer Use

The Esquimalt Graving Dock (*EGD*) is authorized by the Capital Regional District (*CRD*) as a ship and boat waste disposal facility. The authorization allows for the proper discharge of sanitary waste, grey water and superchlorinated water at designated locations at the EGD, and stipulates the requirements that must be met prior to discharge.

Discharge to the sanitary sewer at any location other than at LS#15, LS#11 or at vessel connections located in the services tunnels of the drydock is prohibited.



Lift Station #11.

Lift Station Maintenance.

The EGD is authorized to discharge to the sanitary sewer at:

- Lift Station #15 (*LS#15*),
- Lift Station #11 (*LS#11*), and
- Vessel connections in the drydock.

Permitted wastes include:

- Sanitary waste, *
- Grey water, and
- Treated superchlorinated water.**

Sanitary Waste: *must contain <50,000 ppm total solids.*

***Superchlorinated Water:** must not be discharged to the sanitary sewer unless it has been de-chlorinated to less than 5 ppm chlorine.*

Prohibited wastes include:

- Bilge and ballast water,
- Wastewater sludge, and
- Fuel and oil, paint, paint thinner, solvents, and products containing toxic chemicals.

Other Wastes

Other wastes may be considered for discharge to the sanitary sewer on a case-by-case basis; approval *must be* requested from EGD Management prior to discharge.

Discharge to the sanitary sewer at locations other than those authorized may be considered on a case-by-case basis; approval *must be* requested from EGD Management prior to discharge.

Waste Discharge Notification

Envirosystems Inc. will, as a standard operating procedure, notify the EGD Pumphouse prior to large volume discharges to the sewer system (*e.g. any "batch discharge" in excess of 20,000 litres*). Coordination of discharge may be required depending on usage of the sanitary sewer system at the time.

Envirosystems Inc. will contact the Pumphouse on a regular work day if Envirosystems Inc. is planning to discharge large volumes during times other than Monday to Friday, day shift (*0730 hrs to 1600 hrs*) or on statutory holidays.

Envirosystems Inc. must contact EGD Management if there is a change in normal discharge operations (*e.g. increase in daily volume*).

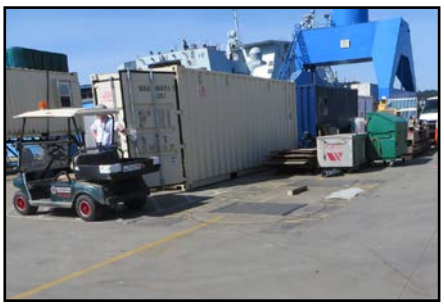
Access to the Sanitary Sewer

- Users must notify the Pumphouse before conducting any discharges to the sanitary sewer. Typical methods of discharge include: large (*direct connection and discharge from a vessel*), and small (*portable discharges from totes and tanks*).
- Users must complete a ***Sanitary Sewage Discharge Form*** and provide it to the Pumphouse prior to discharging to the sanitary sewer.
    - Pumphouse Operators will ensure that sanitary sewer discharges are in accordance with applicable regulations and authorizations.
    - Pumphouse Operators will provide all completed ***Sanitary Sewer Discharge Forms*** to EGD Environmental Services.
- Users must ensure a sample collection point is accessible at the point of discharge.
- Users must request approval from EGD Management to connect directly to the sanitary sewer for regular domestic waste (*e.g. washrooms, sinks, toilets*). Any other waste is prohibited from being discharged of through these lines.

Lift Station Maintenance

- Commissionaires will contact the Pumphouse on radio Channel 4 when DND sewer maintenance personnel enter the facility.
- Pumphouse staff will supervise DND personnel work on the lift stations where required.

AUTHORIZED Sanitary Sewer Discharge point, Lift Station #11.



AUTHORIZED Sanitary Sewer Discharge point, Lift Station #15.

UNAUTHORIZED Sanitary Sewer Discharge point (i.e. storm drain).

UNAUTHORIZED Sanitary Sewer Discharge point (i.e. trench drains).

UNAUTHORIZED Sanitary Sewer Discharge point (i.e. sewer manhole).

EBMP #14: Spill Preparedness and Response

The Esquimalt Graving Dock (*EGD*) is committed to the protection of human health and the environment. Safety and environmental management programs have been implemented at the EGD to reduce the potential for accidents and spills. Emphasis is placed on the prevention of spills, and although the potential for spills can be reduced through these programs, spills do still happen.

All Users operating at the EGD must have the capability to effectively manage spills resulting from their activities and operations.

- User employees must have adequate training in spill response.
- User employees must have access to spill response equipment and materials appropriate to the work they are performing.
- Users must have plans and procedures in place to respond to spills.

For spills which are beyond the capability of the User or are not being effectively responded to by the User, the EGD will provide assistance. The EGD has additional resources available, including:

- Spill kits and response materials for land and water based spills.
- Containment boom, deployment reels and boat.
- Pneumatic skimmer with drum and brush recovery modules, deployment and retrieval services.
- Staff trained to deal with land and water based spills.

For spills beyond the capability of the facility to manage, contact *Emergency Management* (EM*BC*). Additional resources will be coordinated for response to land and water based spills.

ALL Spills at the Facility
MUST BE REPORTED to EGD Management.
Details are to be provided in an *Incident or Spill Report*.

Spill response training at EGD.

Spill response training at EGD.

Spill response equipment: Skimmer.

Spill response equipment: Spill Kit.

Environmental Best Management Practices

Assess the situation.

Stop product flow.

Secure the area.

Steps to Spill Response

Assess the Situation

- Never rush in. Warn others in the immediate area.
- Stay upwind of the spill and avoid low lying areas.
- Quickly and accurately gather details that may need to be communicated to spill response personnel and the authorities including:
    - What equipment or work activity is involved?
    - What hazards are associated with the spilled product?
    - How large is the spill?
    - Is the situation under control or is it escalating?
    - What areas are or could be affected?
    - Proposed strategy to contain/control the spill.
    - Notify others in the area of the spill.

Stop Product Flow

- Act quickly to stop product flow, ONLY IF SAFE TO DO SO.
- Activate emergency shutdowns (*if applicable*).
- Close delivery truck manifold valves, etc. (*if applicable*).

Secure the Area

- Clear the area of public and untrained personnel.
- Ensure those onsite are wearing appropriate PPE.
- If spill is indoors, ensure the building is evacuated.
- Isolate large spills in all directions.
- Limit or prevent access to the site.
- Enforce safety procedures.

Contain the Spill

- Approach the spill from an upwind direction and avoid low lying areas.
- Use appropriate PPE (*e.g. gloves, eye protection, respirator*).
- Follow safe work procedures.
- Block drains, culverts, and ditches to prevent entry into waterways, sewers or confined areas.
- Contain spill with absorbent materials (*from spill kits*), earth, sand, or other non-combustible materials.

Notify the Authorities

- Contact your Supervisor immediately.
- Report the spill to EGD Management.
- For spills greater than 100L on land, or any spill of any size that enters the marine environment, contact: Emergency Management (*EMBC*) Reporting Line: 1-800-663-3456.
- Additional reporting requirements may be required depending on the spilled material.

Recovery and Clean Up

- Use appropriate materials to recover spilled product (*e.g. loose absorbent, pads, booms, socks*).
- Place waste in labelled 6mm plastic bags or leak proof containers.
- Store waste in secure, dry, well-ventilated location, away from heat and ignition sources.
- Consult with authorities before removing waste from site.
- Arrange for waste disposal at an approved facility by a qualified contractor.

Investigation & Reporting

- Investigate the spill or incident and complete and submit required reports to the authority having jurisdiction.

Contain the spill.

Environmental Emergency Contacts (24 Hours):

EGD Commissionaires
250-363-3784

Emergency Management (*BC*) Reporting Line
1-800-663-3456

DND QHM
250-363-2160
or
VHF Channel 10

Recovery and clean up.

EBMP #15:
In-Water Hull Cleaning and Maintenance

The cleaning, maintenance and repair of the underwater hull and associated appendages in water has the potential to release harmful contaminants into the marine environment.

In-water Hull Cleaning

- In-water hull cleaning of vessel hulls, that are coated with antifouling paint, is **prohibited** at the Esquimalt Graving Dock.
- In-water hull cleaning of vessels coated in non-biocide containing paints (*such as silicone based*), **may be considered** on a case-by-case basis and must be approved by EGD Management prior to the commencement of work. This applies to in-water hull cleaning to remove organic growth only, NOT to coating removal.

In-water Maintenance

- In-water maintenance may be considered on a case by case basis and must be approved by EGD Management prior to the commencement of work. In-water maintenance may include but is not limited to:
    - Cleaning of anodes, inlets, props, and transducers for operational and inspection purposes only.

All vessels approved for in-water hull cleaning or maintenance must have a containment boom in place prior to work starting.

Additional requirements may be required on a case by case basis depending on the scope of work involved.

NOTE: Cleaning of the above water hull while berthed alongside the dock is PROHIBITED.

Did You Know?

Antifouling paints and their residues contain heavy metals, such as copper, which are toxic to aquatic organisms, including salmon and shellfish.

Wash water and solid residues from the washing, scraping, sanding and blasting of antifouling paints from boat hulls are considered "*deleterious substances*" under the *Fisheries Act*. Releasing these wastes to fish bearing waters is a violation of the Act.

Environmental Best Management Practices

EBMP #16: Housekeeping

An organized, clean facility provides an environment that reduces the potential for pollutants to enter surface and ground water through spills and accidents. General cleanliness will lead to more organized and consistent handling of hazardous materials and waste products. Good housekeeping programs will identify and assign responsibilities for shift clean up, day-to-day cleanup, proper waste disposal, removal of unused material, and regular inspection.

Clean-Up

- Clean debris from work areas immediately after any maintenance activity. Dispose of collected material appropriately.
- Ensure garbage and recycling containers are available in all leased areas and are emptied regularly.
- Do not use running water to clean the work areas where potentially contaminated water could enter the stormwater system.
- Ensure trench and storm drains within designated leased areas are kept clean and free of debris.
- Sweep and/or clean active working areas on a regular basis.

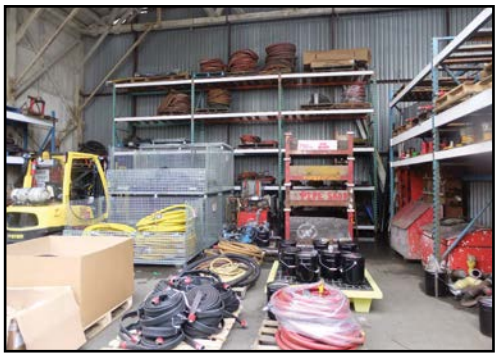
Storage

- Do not store materials or equipment outside of leased areas.
- Regularly inspect lease areas for unidentified or improperly stored materials.
- Ensure all stored products and wastes are clearly labelled and identifiable.
- Place a drip pan underneath vehicles and equipment when performing maintenance. Promptly transfer used fluids to the proper waste or recycling drums.
- Ensure all containers (*e.g. drums, totes, pails*) are in good condition and have a clean exterior at all times. Ensure containers are not left open; secure lids or cover containers when not in use.

INADEQUATE: Keep work areas neat & orderly.

INADEQUATE:
Keep trench and storm drains free of debris.

INADEQUATE:
Ensure storage containers are not left open.



ADEQUATE: Keep work spaces organized and clear of debris to prevent accidents.

EBMP #17: Stormwater Management

Stormwater has been identified as one of the primary pathways of contaminant loading to the local harbour associated with Esquimalt Graving Dock (*EGD*) operations. Common contaminants found in stormwater samples include metals, extractable petroleum hydrocarbons (*LEPH/HEPH)*, and total suspended solids (*TSS*). Five upland stormwater catchment areas terminate into the Esquimalt Harbour from the EGD property. The drydock floor tunnel drainage system leads directly to the Esquimalt Harbour. Any material entering the tunnel drainage system, either through tunnel grate drains or open sump well valves, will end up in the harbour. Deleterious materials must not be allowed to enter the storm or tunnel drain system.

Uplands Stormwater Management

- Store hazardous materials away from storm drains and trenches on the dock floor and in upland areas.
- Ensure totes, drums, pails and skips containing hazardous materials are protected from the weather (*e.g. lids secure, tarps in place*).
- Place filter cloth over storm and trench drains when working with deleterious substances that are in close proximity to, and that could pose a hazard to the marine environment.
- Divert and contain stormwater runoff containing contaminants and sediment with proper materials and filtration, prior to entering the drains (*e.g. use filter cloth, hay bales, sand bags*).
- During heavy stormwater events, ensure storm drains and trenches are kept clear of debris to prevent flooding.
- Conduct regular inspections of storm and trench drains in lease areas to ensure they are kept clear of debris.
- When using trench drains for secondary containment, ensure the containment system is monitored and removed in a stormwater event. A blocked trench drain may cause flooding of the area.

Prevent deleterious substances entering marine environment by placing filter cloth in the trench drains.

Sand bags used on dock bottom to divert and filter excess water.

Do not allow trench drains to build up with debris. This helps to prevent flooding during heavy stormwater events.

Drydock Floor Stormwater Management

- Stormwater has the potential to mix with washwater and other contaminants on the drydock floor during normal operations. Users of the drydock must plan in advance for stormwater management during their work period.
- To reduce the amount of washwater requiring treatment, stop power washing operations until stormwater can be controlled.
- To prevent contamination of stormwater with washwater, waste sandblast grit and other hazardous materials and wastes, cleanup work areas as soon as possible.
- Sump well valves may be opened to allow stormwater to drain into the tunnel drains when the trench drains, sump wells and dock floor area is clear of contaminants and debris. In the case where washwater collection is completed, but the trench drains, sump wells and dock floor have not been cleaned, a filter cloth may be secured over an open sump well valve to allow stormwater flow. This procedure prevents contaminants and debris from entering the drainage system. This method requires dedicated personnel management of the process and regular filter cloth replacement. Do not poke holes in the filter cloth.
- Tunnel grate drains on the drydock floor in Section 2 and 3 may be uncovered enough to allow stormwater to flow into the drains. Ensure the area is clear of contaminants and debris.
- Sump well valves must be closed in sumps containing visibly contaminated material. Sump wells must be pumped out and cleaned prior to opening the valves.
- Ensure there is capacity in the trench drain/sump well collection system to manage expected stormwater volume. This will allow for continued collection and will prevent flooding of the dock floor.
- Prior to flooding and dewatering of the drydock, ensure all sump well valves are open.

Uplands storm drain with filter cloth. Avoid storing hazardous materials near storm drains, which are directly linked to the marine environment.

Filter cloth secured over sump well valve to allow stormwater flow.

EBMP #18:
Property and Infrastructure Maintenance, Modifications and Construction

Significant environmental issues and potential impacts are known to be related to the management of Esquimalt Graving Dock (*EGD*) property and infrastructure. Any new property and infrastructure construction or modification projects at the EGD must consider environmental issues in project planning and implementation. Common environmental aspects that require consideration and management when planning and implementing projects include: dust emissions, hazardous materials and wastes, storm water runoff, noise, and prevention and response to accidental spills and releases. Requirements for the operational aspects are identified in specific sections of the EGD EBMPs.

Infrastructure Maintenance & Repair

Maintenance and repair of existing facility property and infrastructure often results in waste generation and other environmental aspect considerations to be addressed.

Minor Concrete Work

- Contain dust emissions from cutting and drilling.
- Prevent concrete slurry runoff from entering storm drains.
- Prevent debris from mixing concrete from entering storm drains or the marine environment.
- Prevent concrete slurry runoff from entering the trench and tunnel drains and the "moonpool" on the drydock floor.

Use of Preserved Wood

- Avoid use of creosote preserved wood products where possible.
- Follow applicable guideline for use of preserved wood products.
- Creosote wood waste may be considered a hazardous, restricted or controlled waste, and must be handled and disposed of accordingly.

Demolition/Renovation

- Ensure structures are assessed for the presence of hazardous materials prior to demolition or renovation (*e.g. asbestos, lead based paint, PCB and mercury containing ballasts, mould*).
- Hazardous materials and waste must be handled and disposed of according to applicable regulatory requirements.
- Halocarbon containing equipment must be managed in accordance with the Federal Halocarbon Regulations.

Land Use Application

The EGD Land Use Application (*EGD LUA*) contains sections specific to potential environmental aspects related to the project. These sections must be completed with all relevant information.

EGD Management will respond with additional environmental protection and mitigation measures if required.

Infrastructure Modification & Construction

All modification and construction projects at the EGD must be assessed for environmental impacts, and plans put in place to mitigate the identified impacts. Projects managed by the EGD will be completed in accordance with the national project management system and site specific requirements.

For projects managed by Users:

- Any changes to infrastructure, changes to an existing lease or application for a new lease, must be approved by EGD Management.
- Prior to the approval of a property or infrastructure project, the EGD Land Use Application must be completed in full and submitted to EGD Management for review.

Green Space and Vegetation

The EGD property includes areas of vegetation that provides many benefits, including important habitat for wildlife and sensitive native plant species, and act as a buffer between the industrial operations of the facility and the neighbouring residential area.

All projects which have the potential to impact green space, vegetation and wildlife habitat must be reviewed and approved by EGD Management.

Tree and Vegetation Compensation Policy

To facilitate the EGD wildlife management plan and reduce the likelihood of habitat loss at the facility, property and infrastructure projects that require the removal of vegetation must provide compensation in the form of appropriate vegetation replacement. Additional supplies are also required when compensation vegetation is purchased to ensure that new plantings will be successful (*e.g. soil, mulch, tree protection, and water bags*). Consult with EGD Management prior to work to determine what compensation is required.

Soil Management

The EGD has undergone significant capital and operation and maintenance projects in recent years. Extensive investigations into the soil conditions (*e.g. contamination and structure*), utility mapping and identification of archaeological conditions have taken place. The industrial history of the facility has resulted in known contamination of the soil and in-fill material used on site. The primary contaminants commonly found at levels exceeding industrial soil standards include: arsenic, cadmium, copper, lead, mercury, zinc, and polycyclic aromatic hydrocarbons (*PAH*).

Requirements for Excavation

Planning Excavation

1. Consult with EGD Management prior to excavation to identify:

- Project area and excavation boundaries.
- Known utilities, structures, and historical information regarding the proposed excavation area.
- Known contaminated soil locations and the nature and level of contaminants potentially in the soils to be excavated.
- Archaeologically significant areas, requirements for mitigation of archaeological impacts, and dealing with unanticipated archaeological finds.

2. Prepare a plan for soil management: stockpiling and sampling of soils to be excavated. Key issues to be considered include:

- Turnaround times for sample results may take up to 2 weeks.
- Parameters to be sampled may vary depending on the area of excavation. Common parameters include total metals, leachable metals, PAHs, and hydrocarbons (*LEPH, HEPH*).
- EGD Management must approve stockpile areas.
- Soils which exceed the CCME Industrial Levels or BC CSR Industrial Levels: must be disposed of off site at an approved disposal facility.
- Soils which are below industrial standards: may remain on site if geotechnically suitable, if there is an identified use for the soil, and when approved by EGD Management.

3. Ensure contractors and employees are aware of the health and environmental risks associated with the suspected contaminated soils and have procedures in place to mitigate the risks. This includes adequate Personal Protective Equipment (PPE) and hygiene practices (e.g. no smoking, wear gloves).

ADEQUATE soil stockpile management. Soils placed on poly and covered.

INADEQUATE stockpile of contaminated soil. Soil should be covered to prevent exposure to elements, runoff and people.

Conducting Excavation

- Ensure appropriate PPE and hygienic precautions are in place to prevent exposure to contaminants in the soils.
- Monitor all excavations for visible soil contamination or archaeologically significant material.
- Ensure soil is stockpiled, sampled and analyzed in accordance with the Environmental Management Act and Contaminated Sites Regulation, and BC Ministry of Environment Technical Guidance Document 1, Site Characterization BC Government Technical Guidance on Contaminated Sites (*January 2009*).
- Ensure soils suspected of contamination are stockpiled on an impervious surface (*e.g. 6 mil PVC or plastic poly liner*) and adequately covered to prevent exposure to wind, storm water runoff or people. Stockpiles must not exceed 50m^3 in size.
- Imported fill material used for surfacing, backfilling or any other use must meet CCME Residential/Parkland (*RL/PL)* Land Usage Soil Quality Guidelines. Fill material information must be provided to and approved by EGD Management before being used on site.

After Excavation

- Ensure all soil is disposed of at a facility that is permitted to accept that material.
- Obtain all disposal records, including: waste manifests, weigh bills and disposal certificates from the receiver.
- Report the volume, analysis results, excavation details and dimensions and disposal records to EGD Management.
- Provide all as-builts and project drawings to EGD Management in the format compatible with the EGD drawing standards.

Archaeological Considerations

The EGD property and surrounding area has a rich First Nations history. There are Provincially Registered Archaeological Sites listed within the property boundaries of the EGD.

- All excavation projects must be reviewed and approved by EGD Management prior to work beginning.
- Depending on the scope of the project a detailed Archaeological Impact Assessment may be required.
- All Users, including contractors and employees working on excavation projects, must be made aware of the potential for archaeological chance finds. In the case where suspect archaeological material is discovered during excavation, work must stop in that area and EGD Management must be notified immediately.

Archaeological Overview Assessment

An Archaeological Overview Assessment was conducted for the EGD which outlines the archaeologically sensitive areas on the property and identifies areas of high archaeological potential.

Archaeological significant materials found during excavation projects at the facility include shell midden, artifacts, faunal and human remains.

Many archaeologically sensitive areas exist on the EGD Property.

First Nations archaeologists examine materials unearthed during excavations at EGD.

APPENDIX B
Updated Soil Management Plan for the Esquimalt Graving Dock

Environmental Management Plan
Esquimalt Graving Dock – East End Dock Extension
825 Admirals Rd., Victoria, BC
SLR Project No.: 205.04024.0000

global environmental solutions

Updated Soil Management Plan for the Esquimalt Graving Dock
825 Admirals Road, Victoria, BC

Public Services and Procurement Canada

March 2020
SLR Project No.: 205.04015.00000

UPDATED SOIL MANAGEMENT PLAN

FOR THE ESQUIMALT GRAVING DOCK

825 ADMIRALS ROAD, ESQUIMALT, BC

SLR Project No.: 205.04015.00000

Prepared by
SLR Consulting (Canada) Ltd.
303 – 3960 Quadra Street
Victoria, BC V8X 4A3

for

PUBLIC SERVICES AND PROCUREMENT CANADA
SUITE 401-1230 GOVERNMENT STREET
VICTORIA, BC V8W 3X4

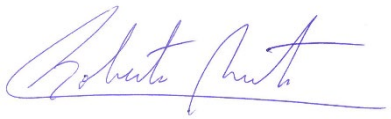
31 March 2020

Prepared by:

Jonathon Risinger, B.A., P.Geo.
Environmental Scientist

Reviewed by:

Aaron Haegele, B.Sc., A.Ag.
Senior Scientist



Roberto Prieto, M.Sc., P.Ag.
Environmental Scientist

CONFIDENTIAL

Distribution: 1 copy – PSPC
1 copy – SLR Consulting (Canada) Ltd.

EXECUTIVE SUMMARY

SLR Consulting (Canada) Ltd. (SLR) was retained by Public Services and Procurement Canada (PSPC) to update the Soil Management Plan (SMP) for the Esquimalt Graving Dock (EGD) located at 825 Admirals Road in Esquimalt, British Columbia (BC) (the "site"). The previous SMP for EGD was completed in March 2014. This SMP has been updated to reflect current regulations and is meant to aid PSPC staff in the preparation of National Master Specification (NMS) sections for, and management of, any known or potentially contaminated soil, as well as for imported backfill material to EGD.

This work was completed in accordance with SLR's workplan titled "Update of the Soil Management Plan and Development of an Internal Standard Operating Procedure for Soil Management at the Esquimalt Graving Dock, 825 Admirals Road, Esquimalt, BC" (Work Plan No. C00.05113.000PP) dated December 3, 2019 and was issued under the PSPC Environmental Site Characterization Contract with Task Authorizations (CTA) #EZ897-191444/001/VAN and Task Authorization #700490404.

Projects such as utility replacement and facility upgrades often require earthworks that occur within known or suspected contaminated area within the EGD. Soil contamination encountered during site works in the past has been managed through a site-specific risk management plan (RMP) where most soils were managed on-site, often involving reuse. These management practices have been amended and most, if not all, soil is taken off-site for disposal. This SMP is structured to meet onsite federal government guidelines as well as provincial disposal standards for any soil requiring removal from the property.

The Canadian Council of Ministers of the Environment (CCME) soil quality guidelines for industrial land (IL) use as well as the Canada Wide Standards (CWS) for petroleum hydrocarbons (PHCs) for IL apply to soil at the site. The BC Contaminated Sites Regulation (CSR) soil standards for IL are referenced for comparative purposes, although these standards are not directly applicable to soil on federally administered lands.

Off-site soil disposal in BC is regulated by the CSR, which lists soil standards based on land use (e.g., agricultural, low and high density residential, commercial and industrial). Laboratory analytical results of soil characterization samples must be compared to the CSR standards to determine an appropriate disposal facility. Based on the analytical results, the BC Hazardous Waste Regulation (HWR) may also be applicable.

This SMP is intended to be applied prior to and during any EGD operations or construction where ground is disturbed and/or excavations are required. This will require that, as much as possible, soil and groundwater analytical results be reviewed prior to initiating work so that health and safety plans can address any potential risks. Potential risks will, in most cases, be addressed via wearing of appropriate personnel protective equipment.

Excavated material will generally be temporarily stockpiled while awaiting analytical testing to classify it for offsite disposal. If the analytical results indicate the material exceeds regional background concentrations and the CCME IL guidelines (or CSR standards, where applicable), the material will be transported for offsite disposal using appropriately licensed vehicles at licensed treatment / permitted disposal facilities, or at sites meeting specific acceptance requirements. If the results indicate the material can remain onsite, it may be reused, providing it meets geotechnical requirements.

Post-excavation sampling is recommended to be conducted at the excavation limits (i.e., walls and floor) for all excavations occurring at EGD to help determine residual soil quality, which is important information for the ongoing risk management of the site.

Backfill material brought to the EGD is required to be characterized as per BC Ministry of Environment & Climate Strategy Technical Guidance 1 on Contaminated Sites – Site Characterization and Confirmation Testing. It is recommended that the backfill material be sampled within the previous three months prior to being imported to the EGD and must be compliant with the applicable CCME residential land (RL) soil quality guidelines.

TABLE OF CONTENTS

EXECUTIVE SUMMARY I
1.0 INTRODUCTION 1
2.0 BACKGROUND 1
3.0 SITE INFORMATION 1
3.1 Site Location 1
3.2 Site Description 2
3.3 Site Areas and Layout 3
3.3.1 Site Quadrants 3
3.3.2 Federal Contaminated Sites 3
3.3.3 Areas of Environmental Concern and Contaminants of Concern 4
3.4 Archaeology/Heritage Aspects 5
4.0 REGULATORY CONSIDERATIONS 6
4.1 Regulatory Considerations 6
4.1.1 Federal Guidelines and Standards 7
4.1.1.1 Canadian Council of Ministers of the Environment 7
4.1.1.2 Transportation of Dangerous Goods 8
4.1.2 Provincial Guidelines and Standards 8
4.1.2.1 Contaminated Sites Regulation 9
4.1.2.2 Hazardous Waste Regulation 10
4.1.3 Soil Relocation 10
4.2 Summary of Applicable Guidelines and Standards 11
4.2.1 Onsite Soil Management at EGD 11
4.2.2 Offsite Disposal 11
4.2.3 Imported Material to EGD 12
5.0 SOIL CHARACTERIZATION 12
5.1 Use of Historic Data (Method #1) 13
5.2 In-Situ Characterization Prior to Excavation (Method #2) 13
5.3 Ex-Situ Characterization Post Excavation (Method #3) 15
5.4 BC Background Soil Concentrations 16
5.5 Soil Leachate Testing Triggers 16
5.6 Stockpiled Soil Management 17
5.7 Off-Site Disposal 17
5.8 Soil Trucking Requirements 18
5.9 Post-Excavation Sampling 19
6.0 IMPORTED MATERIAL 19
7.0 MONITORING WELL DECOMMISSIONING 20
8.0 DATA MANAGEMENT PROCEDURE 20
9.0 HEALTH AND SAFETY REQUIREMENTS 21
10.0 EXCAVATION SPECIFICATION SECTIONS 22
11.0 STATEMENT OF LIMITATIONS 23
12.0 REFERENCES 24

TABLES in TEXT

Table A: FCSI Sites within the EGD 3
Table B: AECs and COCs at EGD 4
Table C: Stockpile Size and Sampling Requirements 16

TABLES after TEXT

Table 1: **Minimum Soil Concentrations that Trigger TCLP Test and Leachate Quality Standards**

Table 2: **Vancouver Island Regional Estimates for Background Concentrations in Soil for Inorganic Substances**

DRAWINGS

Drawing 1: **Site Location Map**

Drawing 2: **Site Plan**

Drawing 3: **FCSI Sites**

Drawing 4: **Archaeological Sites**

APPENDICES

Appendix A: **Preliminary Hazard Assessment Form**

Appendix B: **NMS Reference Table**

Appendix C: **Modified NMS**

1.0 INTRODUCTION

SLR Consulting (Canada) Ltd. (SLR) was retained by Public Services and Procurement Canada (PSPC) to update the Soil Management Plan (SMP) for the Esquimalt Graving Dock (EGD) located at 825 Admirals Road in Esquimalt, British Columbia (BC) (the "site"). The previous SMP for EGD was completed in March 2014. This SMP has been updated to reflect current regulations and is meant to aid PSPC staff in the preparation of National Master Specification (NMS) sections for, and management of, any known or potentially contaminated soil, as well as for imported backfill material to EGD.

This work was completed in accordance with SLR's workplan titled "Update of the Soil Management Plan and Development of an Internal Standard Operating Procedure for Soil Management at the Esquimalt Graving Dock, 825 Admirals Road, Esquimalt, BC" (Work Plan No. C00.05113.000PP) dated December 3, 2019 and was issued under the PSPC Environmental Site Characterization Contract with Task Authorizations (CTA) #EZ897-191444/001/VAN and Task Authorization #700490404.

2.0 BACKGROUND

The EGD was constructed between 1921 and 1926 and is owned by the Federal Government (Crown) with PSPC as its federal custodian. PSPC and its predecessors have operated the EGD since 1926, which has been in almost continual use as a naval and commercial vessel maintenance, repair and building facility.

Projects such as utility replacement and facility upgrades often require earthworks that occur within known or suspected contaminated areas within EGD. Soil contamination encountered during site works in the past have been managed through a site-specific risk management plan (RMP) where most soils were managed on-site, often involving reuse. These management practices have been amended and most, if not all, soil is now taken off-site for disposal. This SMP is intended to be applied prior to and during any EGD operations or construction where ground is disturbed and/or excavations are required and is structured to meet the current onsite federal government guidelines as well as provincial disposal standards for any soil requiring removal from the site.

3.0 SITE INFORMATION

The following sections provide detailed information about site including the location, description and key features applicable to this SMP.

3.1 Site Location

The EGD is situated on the north shore of Constance Cove in the southeastern portion of Esquimalt Harbour and located north of the Canadian Forces Base (CFB) Esquimalt. The civic address for the EGD is 825 Admirals Road in the Township of Esquimalt (i.e., Greater Victoria) and is bound to the north and east by the Esquimalt and Nanaimo (E&N) Railway Company line / right-of-way (ROW) and the Songhees Indian Reserve No. 1A, to the south by CFB Esquimalt and to the west by Esquimalt Harbour. The approximate geographical coordinates for EGD are:

- Degrees, Minutes, Seconds: 48° 26' 11" N and 123° 25' 37" W;
- Decimal Degrees: 48.43639 and -123.42694; and
- UTM: 468421 mE and 5364893 mN, Zone 10N.

A site location plan is presented on Drawing 1.

3.2 Site Description

The EGD is an irregular shaped property that encompasses an upland lot with an approximate size of 20.5 hectares (ha) and a water lot with an approximate size of 9.7 ha. Since 1926, it has been in almost continual use as a naval and commercial vessel maintenance, repair and building facility, with three main operational features:

- Graving Dock – A solid concrete dry dock located near the centre of the site and used for dry access repairs and maintenance of navel and commercial vessels. It is the largest solid-bottom commercial drydock on the west coast of the Americas, measuring 361.5 metres (m) long and 41.2 m wide;
- North Landing Wharf (NLW) – A 240 m long berth located immediately west of the dry dock, which serves a temporary moorage for vessels and as a repair berth. It is accessible for loading and unloading using the crane rail, which extends along the NLW and surrounds the dry dock on the north, east and south sides; and
- South Jetty – Located south of the dry dock, it is the key support facility for land-based ship repair activities and project marshalling areas. It is also critical to berthage of vessels using the dry dock or undertaking repair and retrofits while 'wet-docked' alongside the Jetty. In 2017, portions of the South Jetty were decommissioned, and the underlying sediments remediated.

The surrounding lands on the north and east slope steeply down to the dock yard, which has kept site operations focused largely around the shoreline. The ground area behind the north and south wall of the dry dock, as well as most areas across the flat lower area of EGD, is fill consisting primarily of local blast rock and imported sand and gravel. Much of the foreshore land has been reclaimed in order to construct the facility. Prior to infilling, the natural high-water mark was at the base of the slopes leading down to the NLW and the east end of the dry dock.

The sloping land in the central northern portion of EGD consists of a mix of landscaped lawns, tree stands and exposed rock outcrops. Exposed bedrock can be readily seen north of the buildings on the NLW, along the property boundary to the northeast and in the Lockley Road properties. Landscaping is evident on the steep embankment at the easternmost portion of EGD. The remainder of EGD consists of varying depths of blast rock, silt, sand, and gravel fill covered by asphalt paving, concrete or is occupied by buildings and assorted infrastructure. The NLW area was constructed on a combination of bedrock, timber cribs and granular fill.

A site plan showing the main areas of the site is presented on Drawing 2.

3.3 Site Areas and Layout

3.3.1 Site Quadrants

The EGD is divided into the following reference quadrants, which surround the Graving Dock, and are used to identify the main areas of operations at EGD:

- North – includes the areas north of the Graving Dock including the PSPC trailer, sub station, pump house and back-up generators. The north quadrant extends up to the E&N Railway ROW;
- South – includes the areas south of the Graving Dock, specifically the South Jetty;
- East – includes the areas east of the Graving Dock up to the main gate at Admirals Road, including the newly acquired Naden buildings (formerly property of the Department of National Defence (DND)). The eastern quadrant also extends to the east side of Admirals Road to the properties located on the north and south sides of Lockley Road; and
- West – incudes the areas northwest of the Graving Dock including the newly acquired Munroe Head and Canadian Forces Sailing Association (CFSA). The western quadrant includes the NLW and extends up to the E&N Railway ROW to the northeast and to the Songhees First Nation Reserve No. 1A to the northwest.

In addition to the four main quadrants, PSPC has also recently leased a 1.37 ha parcel of land known as Lot 203 from the Songhees First Nation. Lot 203 is located off of Maplebank Road, north of the western quadrant of EGD, and is primarily used for temporarily stockpiling excavated soil for characterization prior to offsite disposal.

A site plan showing the four quadrants and the leased lot is presented on Drawing 2.

3.3.2 Federal Contaminated Sites

Numerous environmental assessments have identified areas or subsites within EGD that are listed on the Federal Contaminated Sites Inventory (FCSI). Presently, the EGD has been divided into 13 FCSI sites with associated various areas of environmental concern (AECs). The FCSI sites are summarized in Table A and presented on Drawing 3.

Table A: FCSI Sites within the EGD

FCSI Number	FCSI Name
17410001	Esquimalt Graving Dock - Uplands AEC's 22,23
17410002	Esquimalt Graving Dock - Uplands AEC's 6,7,8,9,10,21
17410003	Esquimalt Graving Dock - Uplands AEC's 16,17
17410004	Esquimalt Graving Dock - Uplands AEC's 18,19
17410005	Esquimalt Graving Dock - Uplands AEC's 3,14
17410006	Esquimalt Graving Dock - Uplands AEC's 13,20
17410007	Esquimalt Graving Dock - Waterlot AEC's 11,15
17410008	Esquimalt Graving Dock - Uplands AEC's 4,5
17410010	Esquimalt Graving Dock - Uplands – Munroe Head (EGD West)
17410011	Esquimalt Graving Dock - Uplands - Naden Buildings 4, N11 and N12

FCSI Number	FCSI Name
17410012	Esquimalt Graving Dock - Uplands - 1250 Lockley Road Lot 1 and 2
17410013	Esquimalt Graving Dock - Canadian Forces Sailing Association (CFSA) Uplands
17410014	Esquimalt Graving Dock - Canadian Forces Sailing Association (CFSA) Water Lot

3.3.3 Areas of Environmental Concern and Contaminants of Concern

Areas identified as being potentially impacted by specific historic and current operations have been investigated to assess contaminant levels. Onsite contamination appears to be associated with historical fill materials and aerial deposition of contaminants from ship repair activities. As such, contamination in sloped areas is generally limited to near surface soils whereas in areas where considerably more historical fill has been imported such as the NLW, contaminants can be found several metres or more below grade.

The primary contaminants of concern (COCs) at EGD are metals, with arsenic, copper and zinc predominating, and, to a lesser extent, polycyclic aromatic hydrocarbons (PAHs). Relatively small pockets of petroleum hydrocarbon contamination have been identified

A list of the AECs and associated COCs at EGD are summarized in Table B and presented on Drawing 3.

Table B: AECs and COCs at EGD

AEC No.	General Location	Soil Contaminants of Concern	Comments
AEC 1	North parking lot near the back gate	Metals	AEC under active risk management.
AEC 3	Flat area at head of dry dock east end	Metals, PAHs	AEC was remediated in 2018-2019 and under active risk management.
AEC 4	Pump house area	Metals, PAHs and PHCs	AEC under active risk management.
AEC 5	Transformer building and garage	Metals, PAHs	AEC under active risk management.
AEC 6	Former waste oil storage area	Metals	AEC under active risk management.
AEC 7/7A	Former PCB storage	Metals and PCBs	AEC under active risk management.
AEC 8	Former rail spur unload / laydown area	Metals	AEC under active risk management.
AEC 9	Former rail spur unload / laydown area	Metals	AEC under active risk management.
AEC 10	Former burn area grit storage	Metals	AEC was remediated in 2018-2019.
AEC 11	Water Lot	Metals, PAHs, PHCs, PCBs, Dioxins/Furans, Pesticides and other organics	AEC was remediated with active risk management for sediments not feasible to remove.
AEC 13	Former machine/paint shop (Southeast side of South Jetty)	Metals, PAHs, PHCs and other organics	AEC was remediated in 2018-2019 and under active risk management.
AEC 14	Sloped land leading down to dry dock to south / southeast	Metals, PAHs	AEC was remediated in 2018-2019.

AEC No.	General Location	Soil Contaminants of Concern	Comments
AEC 15	Water Lot	Metals, PHC, PCBs, Dioxins/Furans, Pesticides and other organics	AEC was remediated with active risk management for sediments not feasible to remove.
AEC 16	Area southeast of the wastewater treatment facility	Metals	AEC was risk assessed.
AEC 17	Area south of the wastewater treatment facility	Metals	AEC was risk assessed.
AEC 18	Gravel parking areas of northern slope (lots A and B)	Metals, PAHs	Partially remediated with approx. 330 m^3 of contaminated soil remaining. AEC is risk managed.
AEC 19	Vegetated areas of northern slope	Metals, PAHs	Partially remediated with AEC 18. Approx. 2,230 m^3 of contaminated soil remaining. AEC is risk managed.
AEC 20	South Jetty	Metals, PAHs, PHCs and other organics	AEC was remediated in 2018-2019 and under active risk management.
AEC 21	North Landing Wharf	Metals, PAHs and PHCs	AEC under active risk management.
AEC 22	North parking lot	Metals	Partially remediated with approx. 83 m^3 of contaminated soil remaining. AEC is risk managed.
AEC 23	Former rail spur	Metals	AEC was remediated.

* AEC 2 and AEC 12 do not exist and were administrative placeholders at the time.

3.4 Archaeology/Heritage Aspects

The EGD falls within the traditional territories of two modern First Nations groups – the Songhees and Esquimalt Nations. Both nations are amalgamations of largely independent groups that occupied numerous villages in or near the EGD property. An Archeological Overview Assessment (AOA) was completed for EGD by Golder in 2018 (Golder, 2018). The AOA describes the six registered archaeological sites at EGD including DcRu-6, DcRu-12, DcRu-789, DcRu-790, Dc-Ru-1255 and Dc-Ru-1256. The six registered archaeological sites are summarized as follows:

- DcRu-6 is located within and adjacent to EGD on the shore of Pilgrim Cove straddling the south portion of the site (i.e. the South Jetty access road area). It was initially recorded in 1959 as DcRu-760 measuring approximately 190 m x 40 m. It consists of a habitation feature and shell midden associated with precontact burials. Nine archaeological investigations have been undertaken since the site was initially recorded resulting in the recovery of intact cultural deposits, including house floors, postholes, bone, antlers, lithic artifacts and human remains. During construction of the South Jetty access road, the remains of at least six individuals were recovered and subsequently reburied adjacent to the access road. The investigations determined that a permanent or semi-permanent village was in DcRu-6 over 2000 years ago. Excavated soils containing shell midden deposits from DcRu-6 have been screened for artifacts and generally spread in DcRu-1256, the designated area for archaeological material located near the east end of the property. According to the Provincial Heritage Register, DcRu-6 is less than 50% intact;
- DcRu-12 is in the northwest section of EGD (i.e., the parking lot and portions of the former rail spur area) extending north through the New Songhees Indian Reserve No. 1A to Ashe Head. The site measures approximately 670 m x 200 m. It was first recorded in 1959 and has since been revisited by several archaeologists conducting both research and assessment investigations. Observed in these archaeological investigations were intact

stratified shell midden deposits, artifacts, faunal remains, possible living floors, the articulated remains of a dog, and human remains. Radiocarbon dates suggest occupation from 3000 to 250 years ago;

- DcRu-789 is a shell midden site that was recorded within the EGD in 2004. The site is situated on sloping terrain overlooking the Esquimalt Harbour to the west. Prior to construction of the Graving Dock, DcRu-789 was likely situated immediately adjacent to the east shore of Esquimalt Harbour. Shovel tests and examination of natural exposures revealed midden deposits ranging between 25 centimeters (cm) and 30 cm thick directly over bedrock. Faunal remains, fire-altered rock, and a rare carved siltstone artifact shaped in the form of a phallus, have been collected from this site. Archaeologists have recommended the archaeological site and features be preserved and further impacts be avoided if possible;
- DcRu-790 is a unstratified shell midden site that was recorded on the bank northeast of the pumphouse in 2004. The site measures approximately 8 m x 5 m and is reported to be intact and unstratified. Prior to construction of EGD, DcRu-790 was likely situated immediately adjacent to the east shore of Esquimalt Harbour. It is not known if the archaeological deposits originally extended beneath a demolished building foundation located immediately adjacent to the site;
- DcRu-1255 consists of intermittent pockets of redeposited shell midden and faunal material observed over an area of 355 m x 30 m along the north side of the EGD. The site was recorded in 2011 during remediation of AEC 18, in 2015 during replacement of the EGD security fence along the E&N rail line to the north, and in 2017 during an Archaeological Impact Assessment (AIA) for the NLW Substation Relocation project. All sediments containing archaeological deposits were spread in DcRu-1256, which is the designated area for archaeological material located near the east end of the property; and
- DcRu-1256 is the designated re-burial location for archaeological materials displaced from other sites within EGD as a result of development. This area is located within the green-space at the head of the Graving Dock and overlies a portion of site DcRu-6. The site currently measures approximately 30 m x 25 m.

Archaeological deposits within the EGD property may currently be covered with pavement and/or fill and, as such, future work near any of the identified sites should be preceded by an AIA or professional archaeological oversight should be considered when working in any other areas where native soils may be disturbed.

Currently known areas within EGD with archaeological deposits are presented on Drawing 4.

4.0 REGULATORY CONSIDERATIONS

The following sections provide an overview of applicable legislation, regulations, standards and guidelines for soil assessment and management at EGD.

4.1 Regulatory Considerations

The EGD falls under federal jurisdiction and the primary regulatory framework is that of the Canadian Council of Ministers of the Environment (CCME). Environmental work onsite must comply with all applicable statutes and requirements regarding environmental management including registration, notifications and reporting; production and storage of certain materials associated with ongoing operations; identification of contamination; and, completion of

remediation. Federal and departmental policies and procedures must also be identified and addressed when defining project scopes of work and when developing cost estimates for carrying out work at EGD.

The EGD is not subject to provincial legislation and regulations, municipal by-laws, or other such requirements for on-site activities. However, soil disposal in BC is subject to Provincial standards and regulations; therefore, the BC Contaminated Site Regulation (CSR) must be considered when assessing soil disposal options. Reference to the provincial legislation, regulations and guidelines, and particularly concentrations standards and criteria, is useful in assessing the environmental condition of the property, especially where no federal criteria exists for a given parameter. The PSPC Environmental Policy (DP-074) indicates that, in accordance with the federal Code of Environmental Stewardship, PSPC shall undertake to meet or exceed all applicable federal environmental laws, codes and regulations, and where appropriate, to be compatible with provincial/territorial, international and local standards. This Environmental Policy is also applicable at EGD.

For assessment, remediation and management of contaminants, there are two key regulatory regimes:

- **Federally** – the CCME environmental quality guidelines provide guidance on acceptable concentrations of contaminants in soil, sediment, and groundwater for various land-uses and for the protection of various receptors (further described in Section 4.1.1); and
- **Provincially** – the CSR provides standards for concentrations of contaminants in soil, sediment, groundwater and vapour. The standards are also based on various land-uses and protection of various receptors (further described in Sections 4.1.2).

4.1.1 Federal Guidelines and Standards

The following subsections provide information on the federal guidelines and standards applicable at EGD.

4.1.1.1 *Canadian Council of Ministers of the Environment*

Environmental Quality Guidelines

Beginning in 1996, several CCME task groups, including the Soil Quality Guidelines Task Group (SQGTG), began working towards assembling an integrated set of national environmental quality guidelines (EQGs) for the following environmental media: soil, water, sediment, tissue residue and air. These EQGs were first published in 1999 in a document titled Canadian Environmental Quality Guidelines. This document contained updated soil quality guidelines for a further 12 substances determined according to the 1996 protocol. Since 1999, soil quality guidelines been determined for additional substances and adopted as replacements for the corresponding 1991 criteria. The most recent update of the soil quality guidelines was completed in 2018.

Derivations of the soil quality guidelines (SQGs) are based on contact, ingestion and inhalation toxicity data and SQGs have been developed for four land uses including agricultural (AL), residential/parkland (RL), commercial (CL), and industrial (IL). The EGD is an industrial site and will remain an industrial site in the foreseeable future; therefore, the **CCME IL guidelines apply**.

Guidelines for a range of inorganic (e.g., metals) and organic (e.g., petroleum hydrocarbon, phenolic, chlorinated hydrocarbon) substances are included. Guidelines for PAHs are also

included and were updated in 2010 to include Total Potency Equivalent (TPE) for human health exposure in surface soils as well as an Index of Additive Cancer Risk (IACR) for evaluating impacts to potable water.

Canada Wide Standards – Petroleum Hydrocarbons

The Canada-Wide Standards (CWS) for Petroleum Hydrocarbons (PHCs) were established pursuant to the 1998 Canada-wide Accord on Environmental Harmonization of the CCME and its Canada-wide Environmental Standards Sub-Agreement in soil. The CWS provide remedial standards that specify consistent methods and outcomes for assessment and management of sites contaminated by PHCs. The CWS were endorsed by CCME in May 2001 and revised in January 2008 after an extensive review.

The CWS include standards for surface soil and subsurface soil occurring in the four land use categories. The standards are grounded in the science of risk assessment and can be applied at any of three "Tiers": Tier 1 – generic numerical level, Tier 2 – adjustments to Tier 1 levels based on site-specific information, and Tier 3 – site-specific risk assessment. The same high level of environmental and human health protection is required at the three tiers. Because the CWS are tiered and risk-based there is necessarily some complexity in the development and application of the standards.

The PHC results are compared to CWS guidelines for surface soils from ground surface to 1.5 metres below grade (mbg) and subsurface soils greater than 3.0 mbg. For soil at depths between 1.5 mbg and 3.0 mbg a Management Limit factor applies since the Eco Soil Contact pathway is not applied at these depths.

Comparison to the CWS is further refined based on soil type; either fine grained (greater than 50% of a sample passing a 75-micron sieve) or coarse grained (less than 50% of a sample passing a 75-micron sieve).

4.1.1.2 *Transportation of Dangerous Goods*

The Transportation of Dangerous Goods Act (TDGA) and Regulations (TDGR) applies to dangerous goods leaving EGD, which includes soil with elevated concentrations of certain contaminants. Dangerous goods are required to be properly packaged, labelled and have the appropriate documentation. Provisions apply to waste management and solid waste management activities, permits, spill control and emergency response as well as on-site use of chemicals and hazardous materials.

4.1.2 Provincial Guidelines and Standards

The *Environmental Management Act* (EMA) is the province's principal pollution control statute. The EMA prohibits the introduction of waste to the environment unless the introduction of that waste is conducted in accordance with a permit, approval, order, regulation or Code of Practice. As federal legislation has no effluent permitting system, federal agencies (e.g., Environment Canada and Fisheries and Oceans Canada) rely on the provincial permit process to communicate federal requirements to a proponent. Moreover, although provincial regulations are not applicable at federal sites, they are usually referred to for comparison purposes only, especially where no federal criteria or national guidelines exist for a given substance.

4.1.2.1 *Contaminated Sites Regulation*

The CSR under the EMA is the principal regulatory document defining requirements for contaminated sites management in BC. The CSR came into effect on April 1, 1997 and was amended most recently on January 24, 2019. The Hazardous Waste Regulation (HWR) may also apply where contaminated media are transported and managed or disposed of offsite. Director's interim standards under section 63.1 of EMA and protocols under section 64 of EMA are also legally binding.

The EMA and CSR have provisions for incorporating both numerical and risk-based standard approaches to managing site contamination. The legislation outlines the procedures for site assessment, remediation and application for environmental closure for a property. Numerical standards are an essential component of the requirements in the CSR, as they define whether a site is contaminated or has been satisfactorily remediated when the numerical standards approach has been used.

Technical Guidance, Administrative Guidance, Procedure and Policy documents, and website Questions and Answers issued by the BC Ministry of Environment & Climate Change Strategy (ENV) clarify the interpretation of regulatory standards and requirements and provide information regarding their application. Provisions in these documents are not legally binding but indicate the expectations of the ENV.

Contaminated Sites Regulation Standards

Numerical standards for investigating and remediating soils are presented in CSR Schedule 3.1, which is divided into matrix standards and generic numerical standards as described in the following paragraphs.

Matrix Numerical Soil Standards are presented in Part 1 of Schedule 3.1 for a subset of inorganic and organic substances, where they are based on both land use and exposure pathways. Matrix standards are presented for eight classes of land use: Wildlands – Natural, Wildlands – Reverted, Agricultural (AL), Urban Park, Residential – Low Density (RLld), Residential – High Density (RLhd), Commercial (CL), and Industrial (IL). At EGD, environmental data would be screened against the **CSR IL standards** for comparison purposes only.

Several mandatory and potentially applicable site-specific factors are used to indicate potential exposure to contaminants and to define applicable standards. Mandatory site-specific factors under CSR section 12(8) include: human intake of contaminated soil; and, toxicity to soil invertebrates and plants. Commonly applicable site-specific factors include "groundwater used for drinking water", and "groundwater flow to surface water used by aquatic life (freshwater or marine)". Other site-specific factors may apply, depending on land and water use, and include: "livestock ingesting soil and fodder", "major microbial functional impairment" and "groundwater used for livestock watering" on agricultural lands; and, "groundwater used for irrigation" on agricultural, urban park or residential lands.

Generic Numerical Soil Standards for a variety of inorganic and organic substances are presented in Parts 2 and 3 of Schedule 3.1, which are protective of human health and ecological health, respectively. As with the matrix standards, the generic numerical standards are listed under the same eight classes of land use.

Provision exists in the CSR (section 11(3)) for considering background concentrations for soils. Requirements have been specified in the ENV Protocol 4 for using local and regional background soils concentrations as an alternative to the numerical standards prescribed in the CSR.

Numerical standards for contaminated sites are additionally defined in Protocols pursuant to Section 64 of the EMA, as well as in several directives and ENV documents, including:

- Protocol 2 for Contaminated Sites: Site-Specific Numerical Soil Standards; and
- Protocol 4 for Contaminated Sites: Establishing Background Concentrations in Soil.

4.1.2.2 *Hazardous Waste Regulation*

The presence/absence of hazardous waste soil at a site is determined by reference to standards in the HWR. Soil may qualify as hazardous waste, for example, if it has leachate concentrations of various inorganic or organic substances exceeding specified standards; has PAHs concentration greater than 100 milligrams per kilogram (mg/kg) measured as PAH toxicity equivalency quotient (TEQ); or has a waste oil content greater than 3%. The HWR is applicable to soil at the EGD for disposal purposes.

Where contaminated soil is to be transported and managed or disposed of offsite, the presence/absence of hazardous waste soil is determined by reference to definitions in the HWR. Hazardous waste soils are defined by criteria for Federal TDGR Classes 2, 3, 4, 5, 6, 8 or 9 and HWR definitions for: polychlorinated biphenyl (PCB) waste; wastes containing dioxin; waste oil; leachable toxic waste (HWR Schedule 4, Table 1); waste containing tetrachloroethylene; and, waste containing PAHs.

4.1.3 Soil Relocation

As described in Section 55 of the EMA, a contaminated soil relocation agreement (CSRA) is required whenever soil is relocated from a contaminated site, subject to specific exemptions. A common exemption to a CSRA requirement is when soil is transported to a permitted facility authorized to receive contaminated soils, though many facilities have restrictions on the quality and source locations of the soil they accept.

Soils may be relocated from a contaminated site to another property without a CSRA if the soil and associated vapour quality meet the most stringent land use standards applicable for the receiving site (i.e., considering applicable pathways for soil, water, sediment and/or vapour for both the current and probable/reasonable future land uses). This may, however, require satisfying one or more of the following conditions, showing that:

- The soil meets site-specific standards or background concentrations for the receiving site;
- Leachate test results are protective of groundwater for the receiving site; and/or
- The soil and vapour quality meet interim standards established by ENV or prescribed risk-based standards for the receiving site.

4.2 Summary of Applicable Guidelines and Standards

4.2.1 Onsite Soil Management at EGD.

For in-situ soil and/or for soil remaining onsite, analytical results are to be screened against the following federal guidelines:

- CCME Canadian Environmental Quality Guidelines (EQG), Canadian SQGs for the Protection of Environmental and Human Health, IL:
    - Site-specific factors include both fine- and coarse-grained soils, where applicable;
    - Site-specific pathways include direct contact, soil ingestion, vapour inhalation, eco soil contact, offsite migration, management limit, interim criterion and provisional values, where applicable; and
    - Benzo(a)pyrene (B[a]P) TPE for the protection of direct contact with contaminated soil. Per CCME (2010), TPE is calculated as the sum of the concentrations of individual potentially carcinogenic unsubstituted PAHs multiplied by their estimated cancer potencies relative to B[a]P, which is included in the summation. The TPE summation was compared against the CCME SQG for the Protection of Human Health of 5.3 B[a]P TPE ($1x10^{-5}$ incremental lifetime cancer risk guideline).
- CCME Canadian SQGs for Benzene, toluene, ethylbenzene and xylenes (BTEX), $1x10^{-5}$ incremental risk guideline, IL:
    - Site-specific factors include both fine- and coarse-grained surface soils, and fine- and coarse-grained subsurface soils, where applicable; and
    - Site-specific pathways include dermal contact, eco soil contact, ingestion of soil, vapour inhalation (slab-on-grade), and the interim soil criterion.
- CCME CWS for PHC in soil, Tier 2 levels for PHC Fractions F1-F4, IL:
    - Site-specific factors include both fine- and coarse-grained surface soils, and fine- and coarse-grained subsurface soils, where applicable; and
    - Site-specific pathways include direct contact, eco soil contact, protection of groundwater for aquatic life, vapour inhalation (indoor), offsite migration and management limit.
- BC CSR IL: Matrix Numerical Soil Standards for site-specific factors including groundwater flow to surface water used by aquatic life, AWM (Schedule 3.1, Part 1 – used in lieu of CCME EQGs, which are not protective of marine aquatic life).

4.2.2 Offsite Disposal

Offsite soil disposal is regulated by the CSR, which contains soil standards based on land use. Because the disposal site is not known, laboratory analytical results must be compared to the most stringent standards for the following land uses AL, RLld, RLhd, CL, and IL (Schedule 3.1, Parts 1, 2 and 3). When a disposal site is chosen, it should be evaluated so that the appropriate site-specific factors may be taken into consideration for soil classification (as described in Section 4.1.2.1).

Depending on the concentrations of various inorganic or organic substances, additional leachability analysis via the toxicity characteristic leaching procedure (TCLP) may be necessary. The leachability results are compared to the HWR leachate quality standards for leachable

metals, leachable PAHs and leachable BTEX (Schedule 4, Table 1). In addition, PAH soil data is compared to the HWR PAH TEQ (calculated per the PAH toxicity equivalency factors in Schedule 1.1 of the HWR).

4.2.3 Imported Material to EGD

For imported material, analytical results are to be screened against the following federal guidelines:

- CCME Canadian EQGs, Canadian SQGs for the Protection of Environmental and Human Health, RL:
    - Site-specific factors include both fine- and coarse-grained soils, where applicable;
    - Site-specific pathways include direct contact, soil ingestion, vapour inhalation, eco soil contact, offsite migration, management limit, interim criterion and provisional values, where applicable; and
    - B[a]P TPE for the protection of direct contact with contaminated soil. Per CCME (2010), TPE is calculated as the sum of the concentrations of individual potentially carcinogenic unsubstituted PAHs multiplied by their estimated cancer potencies relative to B[a]P, which is included in the summation. The TPE summation was compared against the CCME SQG for the Protection of Human Health of 5.3 B[a]P TPE ($1x10^{-5}$ incremental lifetime cancer risk guideline).
- CCME Canadian SQGs for BTEX, $1x10^{-5}$ incremental risk guideline, RL:
    - Site-specific factors include both fine- and coarse-grained surface soils, and fine- and coarse-grained subsurface soils, where applicable; and
    - Site-specific pathways include dermal contact, eco soil contact, ingestion of soil, vapour inhalation (basement and slab-on-grade), and the interim soil criterion.
- CCME CWS for PHC in soil, Tier 2 levels for PHC Fractions F1-F4, RL:
    - Site-specific factors include both fine- and coarse-grained surface soils, and fine- and coarse-grained subsurface soils, where applicable; and
    - Site-specific pathways include direct contact, eco soil contact, protection of groundwater for aquatic life, vapour inhalation and management limit.
- BC CSR RL: Matrix Numerical Soil Standards for site-specific factors including groundwater flow to surface water used by aquatic life, AWM (Schedule 3.1, Part 1 – used in lieu of CCME EQGs, which are not protective of marine aquatic life).

5.0 SOIL CHARACTERIZATION

Soil at the EGD can be characterized through three different methods:

1. Existing historic chemical data, if sufficient for excavation and disposal purposes;
2. In-situ soil characterization prior to excavation; and
3. Ex-situ characterization in stockpiles after excavation.

For Methods #2 and #3, the type and number of laboratory analyses should be determined prior to the work being conducted. The type of laboratory analysis should be based on current and historical activities and any surrounding data, where available. Field screening (visual and

equipment) of in-situ and ex-situ soil should be conducted to further refine the sample analysis. For example, if there are elevated field measurements of volatiles (by RKI Eagle®, GasTechtor® or Photoionization Detector (PID)), laboratory analysis should be conducted for one or more of PHC F1-F4; light/heavy extractable petroleum hydrocarbons (LEPH/HEPH); BTEX, and/or volatile organic compounds (VOC). The analysis will be dictated by the probable type of contaminant based on historic and current land usage.

Testing of the soil is to be completed at a Canadian Association for Laboratory Accreditation Inc. (CALA) certified laboratory. Analytical results, along with the certificates of analysis (COAs), should be submitted to the EGD in a report, with data compared to applicable CCME IL guidelines presented in table format.

5.1 Use of Historic Data (Method #1)

If adequate chemical characterization of an area to be excavated has been previously conducted (i.e., historical data is sufficient to satisfy current federal and provincial legislation in the opinion of a qualified environmental professional (QEP)), the soil within the proposed excavation area can be removed, stockpiled and/or hot-loaded for transport, and disposed of at a site meeting the requirements in Section 4.1.3 or permitted facility based on the results of the existing data. A QEP refers to an applied scientist or technologist, including a registered professional Biologist, Agrologist, Forester, Geoscientist, Engineer or Technologist, who must provide services within their registered area of expertise.

EGD staff must be careful to review historic data against the current federal and provincial regulations prior to excavation of contaminated material. Both the federal and provincial regulations change based on current science on the toxicological effects of substances to human and ecological receptors.

For example, British Columbia added sodium and chloride, analysed by the saturated paste method, to the list of CSR regulated substances in 2008 as a result of sodium and chloride being added to the Canadian Environmental Protection Act (CEPA) Priority Substances List. Any soil characterized prior to 2008 will likely not have been analyzed for sodium and chloride via the saturated paste method.

Another example is the requirement to provide leachable benzo(a)pyrene data to remedial contractors to confirm that the material would not be classified as hazardous waste under the HWR. Historic soil data would not likely be enough for disposal purposes if it contains PAHs. Minimum soil concentrations that trigger TCLP analysis are listed in Table 1.

5.2 In-Situ Characterization Prior to Excavation (Method #2)

There is little federal guidance regarding in-situ characterization (type or number of samples) that should occur for soils suspected of being contaminated. Therefore, the ENV Technical Guidance 1 on Contaminates Sites – Site Characterization and Confirmation Testing has been adopted for this SMP.

In-situ discrete samples should be collected from an area planned for excavation or removal of pavement. The ENV definitions of an in-situ discrete sample and what such samples represent is described as follows.

Definition of In-Situ Discrete Sample

An in-situ discrete sample is material:

- Collected from similar in-situ fill or soil at one location;
- Confined to collection within a contiguous volume of one cubic metre (m^3);
- Collected over a maximum depth of 0.5 m within the upper 1.0 m from the existing site surface or collected over a maximum depth of 1.0 m at depths greater than 1.0 mbg;
- Not collected from two distinct fill or soil zones;
- Not collected on two sides of an air/water interface (or unsaturated/saturated soil zone interface); and
- Not made up of a mixture of obviously contaminated material and obviously non-contaminated material as determined by field observations such as sight, smell, gas meters, etc., even if these materials have similar physical characteristics (e.g. both are silty sands).

Volume that an In-Situ Discrete Sample Represents

One in-situ discrete sample, as long as it is properly collected, prepared and analyzed, and is a part of a sampling and analysis program that is accurate and precise, is considered to represent a volume of:

- 10 m^3 of material designated as waste, industrial or commercial quality; and
- 5 m^3 of material designated as hazardous waste.

where volume = $\pi r^2 d$ and d = 0.2 m to 1.0 m of vertical depth.

SLR conservatively recommends, for lands subject to future excavation, a minimum of three discrete soil samples be collected for small excavations of less than 30 m^3 of soil. If larger excavations up to 150 m^3 are planned, then one in-situ sample should be collected per every 15 m^3 of material planned for removal. In summary, prior to future excavation the recommendation is as follows:

- Collect 1 discrete soil sample when excavating 0 m^3 to 10 m^3 soil;
- Collect 3 discrete soil samples when excavating 10 m^3 to 30 m^3 soil; and
- Collect 1 discrete soil sample per 15 m^3 when excavating 30 m^3 to 150 m^3 soil.

Sample numbers for excavations of larger than 150 m^3 should be chosen based on variability of material types and total volume to ensure a statistically significant number of samples is obtained (note: excavations of volumes greater than 150 m^3 are unlikely to occur unless substantial construction/redevelopment occurs).

The total number of soil samples required to adequately characterize in-situ soil for larger excavations should be determined by a QEP prior to excavation.

The following sampling methods are acceptable for collection of representative in-situ soil samples:

- Soil samples can be collected from test pits that have been advanced by a backhoe or excavator. Samples may be collected directly from the walls of the test pit if the test pit is shallower than 1.2 m. For safety reasons, if the test pit is greater than 1.2 m, then the soil samples are to be collected from the bucket of the backhoe or excavator;

- Soil samples can be collected using a shovel within an excavation that is shallower than 1.2 m. For safety reasons, if the excavation is greater than 1.2 m, then the soil samples are to be collected from the bucket of the backhoe or excavator; and
- Soil samples can be collected from boreholes, which have been advanced by a drill rig, hand auger or power auger, within a proposed excavation area. Samples can be collected directly from solid stem auger flights after the outer layer of soil on the flights has been removed to reduce potential for cross-contamination. If the hollow-stem auger drilling method is used, samples can be collected from a split spoon. If the sonic or other coring method is used, samples can be collected from the core generated.

Select samples exhibiting the highest concentration of volatile hydrocarbons in the field (measured using an RKI Eagle®, GasTechtor® or PID) should be analyzed for petroleum hydrocarbons. These samples should be analysed for one or more of PHC F1-F4, LEPH/HEPH, BTEX and/or VOC. The analysis will be dictated by the probable type of contaminant based on historic and current land usage.

Comparison of PHC F1-F4 analytical results to the CWS is to determine if the material meets federal regulations to remain on-site, while comparison of LEPH/HEPH analytical results to the CSR is meet provincial requirements for offsite disposal.

When adequate chemical characterization of an area to be excavated has been conducted and is sufficient to satisfy federal and provincial legislation in the opinion of a QEP, the soil within the proposed excavation area can be removed, stockpiled and/or hot-loaded for transport, and disposed of at a site meeting the requirements in Section 4.1.3 or permitted facility.

5.3 Ex-Situ Characterization Post Excavation (Method #3)

SLR recognizes that there are instances in which characterization of soils prior to excavation may not be logistically feasible or does not meet the in-situ characterization requirements. Consequently, the following guidance is provided for stockpiling soils without proper in-situ characterization and for characterizing soil stockpiles. In the absence of federal guidelines on ex-situ soil characterization, the ENV Technical Guidance 1 on Contaminated Sites is recommended to be used as a guideline.

Soils that are suspected to be hazardous waste (due to existing data for leachable concentrations of metals, hydrocarbons, or PAHs), suspect waste (concentrations greater than the CSR IL guidelines) and other soil classifications (e.g., concentrations less than the CSR IL guidelines) should, where possible, be segregated from each other during excavation and stockpiled separately.

In the absence of any data to estimate the soil quality prior to excavation it should be assumed that the soil is suspect waste and placed in a stockpile no larger than 150 m^3. Note that the presence of liquid hydrocarbon (free product) automatically classifies the material as suspect hazardous waste for disposal purposes.

Stockpile size and the number of samples required to characterize a stockpile volume depends on the suspected material quality. Table C, extracted and modified from the ENV Technical Guidance 1 on Contaminated Sites, outlines the requirements for stockpiling and sampling.

Table C: Stockpile Size and Sampling Requirements

	Suspect Hazardous Waste (SHW)	Suspect Waste (<HW and >CSR IL)	Suspect Industrial Quality Material (<CSR IL and >CSR RL)
Maximum stockpile size	50 m^3	150 m^3	250 m^3
Cell volume	10 m^3	50 m^3	125 m^3
Number of representative cell samples	5	3	2
Aliquots per representative cell sample	1	3	5
Sampling method	Collect one representative aliquot for each 10 m^3 of cell volume. Each aliquot forms one representative cell sample.	Collect three representative aliquot for each 50 m^3 of cell volume. Up to three aliquots are combined by equal volume to form one representative cell sample.	Collect five representative aliquots for each 125 m^3 of cell volume. Up to five aliquots are combined by equal volume to form one representative cell sample.

The general rule is collection of one discrete sample (which can be made up of a number of 10 m^3 aliquots) per every 50 m^3 of stockpiled volume. The exception to this will be assessment of suspect hazardous waste material, which requires analytical data for every 10 m^3 of stockpiled volume.

If the analytical data indicates contaminant concentrations that trigger the need for assessment of leachable contaminants (see Table 1, following the text, for reference) then leachable concentrations should be determined using TCLP analysis.

5.4 BC Background Soil Concentrations

Some chemicals, such as metals, occur naturally in soils at concentrations in excess of the CCME guidelines and/or CSR standards. The PSPC policy regarding background soil concentrations is stated in Annex 4 of PSPC Contaminated Sites Risk Management Best Practice (2003) as follows:

"Public Services and Procurement Canada will, to the degree possible, screen all contaminated sites against local and/or regional background soil, groundwater and surface water concentrations. Sites with natural levels of metals (and other COCs) that exceed generic guidelines will NOT be considered contaminated."

Table 2 following the text lists the regional estimates for background concentrations in soil for inorganic substances for Vancouver Island provided in ENV Protocol 4 for Contaminated Sites.

5.5 Soil Leachate Testing Triggers

Soils with high concentrations of metals may have the potential to leach metals to groundwater. Under Schedule 4 of the HWR (and Appendix 4 of the federal *Transportation of Dangerous Goods Regulations*) soil being disposed must not produce leachate exceeding the leachate quality standards using the TCLP procedure. SLR has back calculated the minimum soil concentrations capable of producing leachate exceeding standards in Table 1 of Schedule 4 of the HWR, assuming the contaminants within soils leach to the reagent water. Mathematically, based on the

TCLP method dilutions, these soil concentrations are approximately 20 times the leachate quality standards.

If the leachate produced during the test contains chemicals exceeding the leachate quality standards shown in Table 1 of Schedule 4 of the HWR, the soil is considered federally a Class 9 Dangerous Good and provincially a hazardous waste. Specifically, the soil would be given a shipping name of Environmentally Hazardous Substance, Solid, N.O.S. (UN3077) under the TDGR. In the original TDGA and TDGR these soils were called “leachable toxic waste, Classification 9.2”.

5.6 Stockpiled Soil Management

The appropriate location for temporary soil storage prior to the commencement of any excavation at the EGD will be provided by PSPC environmental personnel. The temporary soil storage area used for major construction projects is located at the adjacent Lot 203. The following provides guidelines for proper management of soil stockpiles:

- The excavated soils must be stockpiled in a protected area on EGD or within Lot 203, away from the shoreline and stormwater drains. The location must be approved by EGD Management;
- Soil stockpiles must remain within EGD boundaries or Lot 203 until complete characterization by a QEP;
- Uncharacterized soil must not be transported offsite on municipal roads. Access to Lot 203 is restricted to the back gate at EGD and on Maplebank Road as shown on Drawing 2; the front gate should not be used to transport uncharacterized soil to Lot 203;
- Stockpiled soil must be placed on and covered with a minimum 6 mil polyvinyl chloride (PVC) or plastic liner so the stockpiles are completely contained in order to minimize interaction of wind and precipitation with potentially contaminated soil;
- Filter material must be placed over any drains near stockpiled soil to ensure that no sediment or deleterious materials enter the storm water system;
- Sediment control measures, such as silt fences or sandbags must be placed in areas where there is potential surface runoff to marine receptors. All sediment control measures will be implemented in accordance with the document entitled “Land Development Guidelines for the Protection of Aquatic Habitat (DFO and MWLAP, 1993)” and the EGD Environmental Best Management Practices (BMP) (PSPC, 2016);
- Contractors will be responsible for eliminating any residual soil on equipment and roadways, and maintaining dust management where applicable or as directed by PSPC EGD personnel; and
- Once the stockpiled soil has been characterized, it must be removed as soon as reasonably possible to the appropriate storage or disposal location (as determined by a QEP).

5.7 Off-Site Disposal

Excavated material will be temporarily stockpiled at EGD or Lot 203 while awaiting analytical testing to characterize it for disposal. If the results of the characterization indicate the materials exceed regional background concentrations and CCME IL guidelines, the material will be transported by contractors for off-site disposal using appropriately licensed vehicles to licensed

treatment or permitted disposal facilities. The following three options are permitted for off-site disposal:

1. Disposal at a permitted facility;
2. Relocation to another site without a CSRA if the soil and associated vapour quality meet the most stringent land use standards applicable for the receiving site; and
3. Relocation to another site under a CSRA (i.e., using risk-based CSR standards).

Note: If analytical results indicate the material can remain on-site (i.e., does not exceed CCME IL guidelines), providing it meets geotechnical requirements, it can be reused on-site at the discretion of PSPC.

5.8 Soil Trucking Requirements

For in-situ soil characterization investigations (i.e., characterization prior to excavation), PSPC personnel should request that a drawing showing the test location, type of test (i.e., borehole or test pit) and location within the proposed excavation or Project Site be produced by the consultant or contractor. Analytical results must be included and highlighted in the drawing with the parameter(s) that exceed the appropriate regulatory standard/guidelines.

PSPC should ensure the following minimum soil tracking measures are followed for excavations and temporary soil stockpiles at EGD:

- A drawing outlining the stockpile identification and its location must be produced and updated regularly by the QEP. Stockpiles must have a number designation that will help identify the origin of the soil. The number designation is also used to track the destination of the soil (i.e., disposal site);
- Stockpiles should be characterized by a QEP based on the analytical results. The stockpile characterization results should be summarized in a report completed by the QEP indicating the quality of the soil in each stockpile (i.e., comparing the soil to the applicable CCME IL guidelines for potential onsite reuse and/or the CSR standards for offsite disposal);
- A soil disposal manifest should be generated based on each stockpile characterization sample. At minimum, each disposal manifest should include the stockpile number designation, disposal date, approximate soil volume and the disposal site;
- Analytical results should be organized by stockpile number and attached to the stockpile characterization report;
- If stockpiled soil is determined to be both geotechnically and environmentally suitable to remain onsite, the final placement location of the soil within EGD must be approved by PSPC and tracked on a drawing by the QEP. PSPC personnel must ensure that soil is placed on site in a manner consistent with the recommendations provided in this SMP;
- Excavated soil that is classified based on the analytical results as hazardous waste (under the provincial HWR) or as a hazardous substance (under the Federal TDGA) must be registered with ENV using a Waste Generator form prior to offsite disposal. Hazardous waste disposal is tracked by ENV and a specific disposal manifest must be completed prior to transport. PSPC personnel or their designate should ensure a copy of this disposal manifest is forwarded to the ENV at PO Box 9341 Stn Prov Govt, Victoria, BC, V8W 9M1;
- A soil management and disposal summary report should be completed by the QEP for each project at EGD that has a soil disposal component. The summary report should include

copies of the soil disposal certificates or manifests and laboratory reports as well as a tracking sheet with soil disposal tonnage, quality and disposal location; and

- A CSRA is required if excavated soil is to be relocated from EGD to a non-permitted site under provincial jurisdiction using risk-based standards. A common exemption to a CSRA requirement is when soil is transported to a permitted facility or to another site if the soil and associated vapour quality meet the most stringent land use (numerical) standards applicable for the receiving site

5.9 Post-Excavation Sampling

Post-excavation samples are recommended to be collected at the limits of the excavation (i.e., walls and floor) by the QEP prior to backfilling. The post excavation samples are intended to help determine residual soil quality, which is important information for the ongoing risk management of the site. The samples are not intended for extending the excavation for remedial purposes beyond the construction footprint. These samples should be collected at the discretion of PSPC personnel. Analytical results should be entered into the PSPC Esquimalt Harbour Geographic Information System (GIS) database and the EGD Contaminated Sites Environmental Site Management Tool.

Suggestions for post excavation sampling are:

- In a grid pattern on the floor of the excavation approximately 8 m to 10 m apart;
- On the horizontally plane of the wall approximately every 8 m to 10 m along the wall; and
- On the vertical plane of the wall, one sample should be collected in the first 0.5 m from the surface and one sample collected every metre below thereafter.

The final decision on frequency of post-excavation samples is to be determined by PSPC on a case-by-case basis.

Samples should be analyzed for COCs found at the site according, but not limited to, Table B.

A drawing should be produced by the QEP outlining the excavation area and sample locations, including analytical results of the samples compared to applicable CCME IL guidelines.

6.0 IMPORTED MATERIAL

The contractor must inform PSPC of the proposed source of imported material and provide necessary documentation two to four weeks minimum prior to import to the EGD. The fill material brought to the EGD should comply with the following criteria:

- Sampling of the proposed material should be carried out by a QEP prior to the import of any materials to EGD and, if necessary, for the duration of the project to confirm that the imported fill materials meet the CCME RL soil quality guidelines applicable for imported material;
- Testing of the proposed imported material should be done at a CALA certified laboratory and COAs for the imported fill materials must be provided to PSPC prior to importing backfill to the EGD. Analytical results should be submitted to the EGD in a report, prepared by a QEP, with data compared to applicable CCME RL guidelines presented in table format;

- Analytical results should be from samples collected within three months of the date the material is to be used on site;
- Environmental characterization of fill material must be conducted in accordance with ENV Technical Guidance 1 on Contaminates Sites – Site Characterization and Confirmation Testing;
- The EGD reserves the right to request additional testing of imported material at the source and at the deposit site to satisfy internal requirements. For backfill material imported by a contractor, additional testing will be completed at the contractor's cost;
- If proposed imported materials do not meet, or cannot reasonably be processed to meet, specified requirements, an alternative source must be located;
- EGD staff should be advised two to four weeks minimum in advance of a proposed change of imported material source;
- Acceptance of material does not preclude future rejection if it fails to conform to requirements specified (e.g., grain size), lacks uniformity, or if its field performance is found to be unsatisfactory; and
- Material brought to the EGD that does not meet the CCME RL soil quality guidelines applicable for imported material or does not conform to the backfill specification requirements (e.g., geotechnically suitable), must be removed from the property immediately. For backfill material imported by a contractor, the material should be removed at the contractor's cost.

7.0 MONITORING WELL DECOMMISSIONING

Monitoring wells should be constructed and installed under the guidance of a QEP. When monitoring wells no longer serve their intended purpose (i.e., completion of a site investigation or remedial monitoring) the wells should be decommissioned under the guidance of a QEP in accordance with Appendix A in the Code of Practice for Construction, Testing, Maintenance, Alteration and Closure of Wells in British Columbia, which is located in the ENV Groundwater Protection Regulation at http://www.bclaws.ca/civix/document/id/loo67/loo67/299_2004#appendixa.

8.0 DATA MANAGEMENT PROCEDURE

The PSPC Esquimalt Harbour GIS database is a Microsoft (MS) Access database that contains sampling data from projects undertaken within the Esquimalt Harbour and the EGD uplands. The purpose of the database is to maintain a record of sampling events with spatial components. In additional to the spatial components, the database contains various attributes about the individual samples such as analytical results, links to the electronic analytical files and additional electronic documents. The main use of the database is to easily integrate with GIS software to create GIS maps of areas of interest within the harbour, featuring selected attributes from the database to define the current environmental conditions of the area. Note that the MS Access Database is housed on the ExaVault File Transfer Protocol (FTP) site.

To ensure all relevant data and files are properly incorporated into the database the following procedures must be considered for data consistency:

- The consultant must obtain a copy of the sample location template (SampleLocationForm.xlt). This template is housed on the ExaVault FTP site in the

database folder. At the start of each project, EGD staff or the database administrator (contact information to be supplied by PSPC) will provide an up to date copy of the sample location template;

- The sample location template has three main sections that require data entry: site (Project), sampling location (Samples) and analytical files (Laboratory Data). These three main sections correspond with the hierarchy of the database structure. The site section contains the project information, such as report title, date and other pertinent site data. The sampling location section is where the samples are collected during the investigation as well as other attributes including geospatial information, matrix type, date and other sample information. The laboratory data section is used to list the analytical reports that are associated with the investigations. This section is mainly used to ensure that all analytical files have been uploaded into the database. The other two worksheets in the template (Locations and Type) are used as reference sections during data entry;
- The template worksheets contain helpful instructions including colour coding of columns that require data along with specific instructions and entry examples;
- Once the template is complete it should be saved as a MS Excel file and submitted to the database administrator or to the PSPC EGD project manager;
- The next step is the upload of analytical data. It is acceptable for consultants to submit analytical data exported from their in-house system if the data includes the required fields and are in an acceptable electronic data deliverable (EDD) format. If the consultant cannot provide a complete EDD file, the analytical files will be requested directly from the laboratory. The consultant and/or client is responsible for supplying the laboratory with the necessary permission to release the files. Only final laboratory reports will be uploaded to prevent any erroneous or duplicate data;
- PSPC will be responsible for providing the project data report for referencing during the upload process and providing analytical and log files that are hyperlinked in the database; and
- All users of the Esquimalt Harbour GIS database should inform the database administrator of any possible errors in the database so these errors can be immediately addressed.

9.0 HEALTH AND SAFETY REQUIREMENTS

The prime contractor will be responsible for developing a health and safety plan for any excavation, which adequately addresses potential health and safety concerns related to soil contact. The level and type of contamination, if present, in the proposed work area will be provided to the contractor by PSPC prior to initiation of any project. If the type and level of soil contamination is not known prior to soil excavation, the contractor should assume worst case scenario based on known contamination in other areas of the EGD and select personnel protective equipment (PPE) appropriately, ensuring that it complies with the governing safety legislation (e.g., Worksafe BC).

It is the responsibility of the contractor to recommend the type of PPE for the specific contaminants of concern and concentrations. At minimum the following PPE, and health and safety measures will be followed:

- Workers that will be in direct contact with excavation soils must wear latex (or equivalent) gloves;
- Workers in and around an excavation must wear coveralls;

- Workers must wear protective safety glasses;
- If dusty conditions exist, the soil should be wetted, and workers must wear a dust mask; and
- No smoking or eating will be permitted without hands first being washed.

Health and safety meetings will be conducted at the beginning of each workday and potential risks (new or old) should be highlighted. If there is any change to conditions and/or contaminant type (i.e. hydrocarbons) then PPE must be changed accordingly to meet health and safety requirements.

PSPC will verify, using the Preliminary Hazard Assessment form included in Appendix A, that the contractor has addressed all known site hazards with applicable PPE (e.g., workplace evaluation), has the required training for specific types of PPE (e.g., fall protection training), and has in place a system to inspect and subsequently replace any damaged PPE.

10.0 EXCAVATION SPECIFICATION SECTIONS

As requested by PSPC, SLR has reviewed sections of an NMS specification prepared by PSPC and dated June 2019 for a typical construction excavation at EGD to address specific environmental requirements relating to soil management, including soil segregation/stockpiling, sampling, tracking and management, disposal, and backfill requirements.

Based on the NMS specification sections provided by PSPC, SLR has created the following generic NMS sections that incorporate the requirements of the SMP:

- Section 01 35 13.43 – Special Project Procedures for Contaminated Sites;
- Section 01 35 29.14 – Health and Safety for Contaminated Sites;
- Section 01 35 43 – Environmental Procedures;
- Section 02 61 00.01 – Contaminated Sites Water Treatment;
- Section 02 61 00.02 – Contaminated Sites Excavation;
- Section 02 61 00.03 – Contaminated Sites Soil Transportation;
- Section 02 61 00.04 – Contaminated Sites Soil Treatment;
- Section 02 61 00.05 – Contaminated Sites Soil Disposal;
- Section 02 61 00.06 – Contaminated Sites Onsite Soil Treatment Facility (STF) Construction; and
- Section 02 61 00.07 – Contaminated Sites Onsite STF Operation.

The generic NMS specification sections are to be considered a starting point for creation of a project-specific NMS specification, and will require detailed review by EGD personnel to determine applicability for each specific construction project undertaken at EGD.

A reference table listing the specific environmental concerns and the applicable updated NMS specification sections is included in Appendix B.

The modified NMS Specification sections can be found in Appendix C.

11.0 STATEMENT OF LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SLR for PSPC and completed in compliance with PSPC Contaminated Sites Characterization Consultants Standing Offer EZ897-191444/001/VAN. Under the call-up PSPC Order Number 700490404, PSPC has the exclusive right to copy and redistribute this report.

Any use of, reliance on or decision made based on this report by any person other than PSPC for any purpose, or by PSPC for a purpose other than the purpose(s) set out in this report, is the sole responsibility of such other person or PSPC. PSPC and SLR make no representation or warranty to any other person with regard to this report and the work referred to in this report and they accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.

The investigation undertaken by SLR with respect to this report and any conclusions or recommendations made in this report reflect SLR's judgment based on the site conditions observed at the time of the site inspection on the date(s) set out in this report, on information available at the time of preparation of this report, on the interpretation of data collected from the field investigation, and on the results of laboratory analyses, which were limited to the quantification in select samples of those substances specifically identified in the report. This report has been prepared for specific application to this site and it is based, in part upon visual observation of the site, subsurface investigation at discrete locations and depths, and specific analysis of specific chemical parameters and materials during a specific time interval, all as described in this report. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site which were unavailable for direct investigation, subsurface locations which were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site; substances addressed by the investigation may exist in areas of the site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken. SLR expresses no warranty with respect to the accuracy of the laboratory analyses, methodologies used, or presentation of analytical results by the laboratory. Actual concentrations of the substances identified in the samples submitted may vary according to the extraction and testing procedures used.

As the evaluation and conclusions reported herein do not preclude the existence of other chemical compounds and/or that variations of conditions within the site may be possible, this report should be used for informational purposes only and should absolutely not be construed as a comprehensive hydrogeological or chemical characterization of the site. If site conditions change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

Nothing in this report is intended to constitute or provide a legal opinion. SLR makes no representation as to the requirements of or compliance with environmental laws, rules, regulations or policies established by federal, provincial or local government bodies. Revisions to the regulatory standards referred to in this report may be expected over time. As a result, modifications to the findings, conclusions and recommendations in this report may be necessary.

12.0 REFERENCES

BC CSR (British Columbia Contaminated Sites Regulation), 1997. Updated January 2019.

BC HWR (British Columbia Hazardous Waste Regulation), 1988. Updated November 2017.

BC Ministry of Environment & Climate Change Strategy. Protocol 2 for Contaminated Sites: Site-Specific Numerical Standards (Version 2.1). November 1, 2017.

BC Ministry of Environment & Climate Change Strategy. Protocol 4 for Contaminated Sites: Establishing Background Concentrations in Soil. January 9, 2019.

CCME (Canadian Council of Ministers of Environment), 1997. Recommended Canadian Soil Quality Guidelines. Updated 2008.

DFO, 1993. Land Development Guidelines for the Protection of Aquatic Habitat. Produced by the Habitat Management Division of the Department of Fisheries and Oceans and the Integrated Management Branch of the Ministry of Environment, Lands and Parks. September 1993.

Golder, 2003. Supplemental Site Investigation and Quantitative Risk Assessment at Munroe Head, Esquimalt Harbour, BC. Prepared for Public Works and Government Services Canada by Golder Associates Ltd. October 2003.

Golder, 2018. Archaeological Overview Assessment of the Esquimalt Graving Dock, Public Works and Government Services Canada, Esquimalt, BC. March 12, 2018.

PSPC (Public Works and Government Services Canada), 2016. Environmental Best Management Best Practices. Version 05. October 2016.

JR/RP/AH/at
N\Archives\Victoria\Projects\PWGSC\205.04015.00000 EGD SMP & SOP Update\Report

TABLES

Updated Soil Management Plan for Esquimalt Graving Dock
825 Admirals Rd., Victoria, BC
SLR Project No.: 205.04015.00000

Table 1. Minimum Soil Concentrations that Trigger TCLP Test and Leachate Quality Standards

Parameter	Minimum Soil Concentration To Trigger TCLP Test (mg/kg)	Leachate Quality Standard (mg/L)
Arsenic	50	2.5
Barium	2000	100
Benzene	10	0.5
Benzo(a)pyrene	0.02	0.001
Boron	10000	500
Cadmium	10	0.5
Chromium	100	5.0
Copper	2000	100
Cyanide (free)	400	20
Ethylbenzene	4.8	0.24
Fluoride	3000	150
Lead	100	5
Mercury	2	0.1
Selenium	20	1
Silver	100	5
Toluene	48	2.4
Uranium	200	10
Xylene	600	30
Zinc	10000	500

Notes:
The list does not include all parameters in the HWR but does include parameters expected at EGD
BC Environmental Management Act (BC, 2004). Hazardous Waste Regulation. Table 1 - Leachate Quality Standards
mg/kg - milligram per kilogram
mg/L - milligram per litre
TCLP - toxicity characteristic leaching procedure

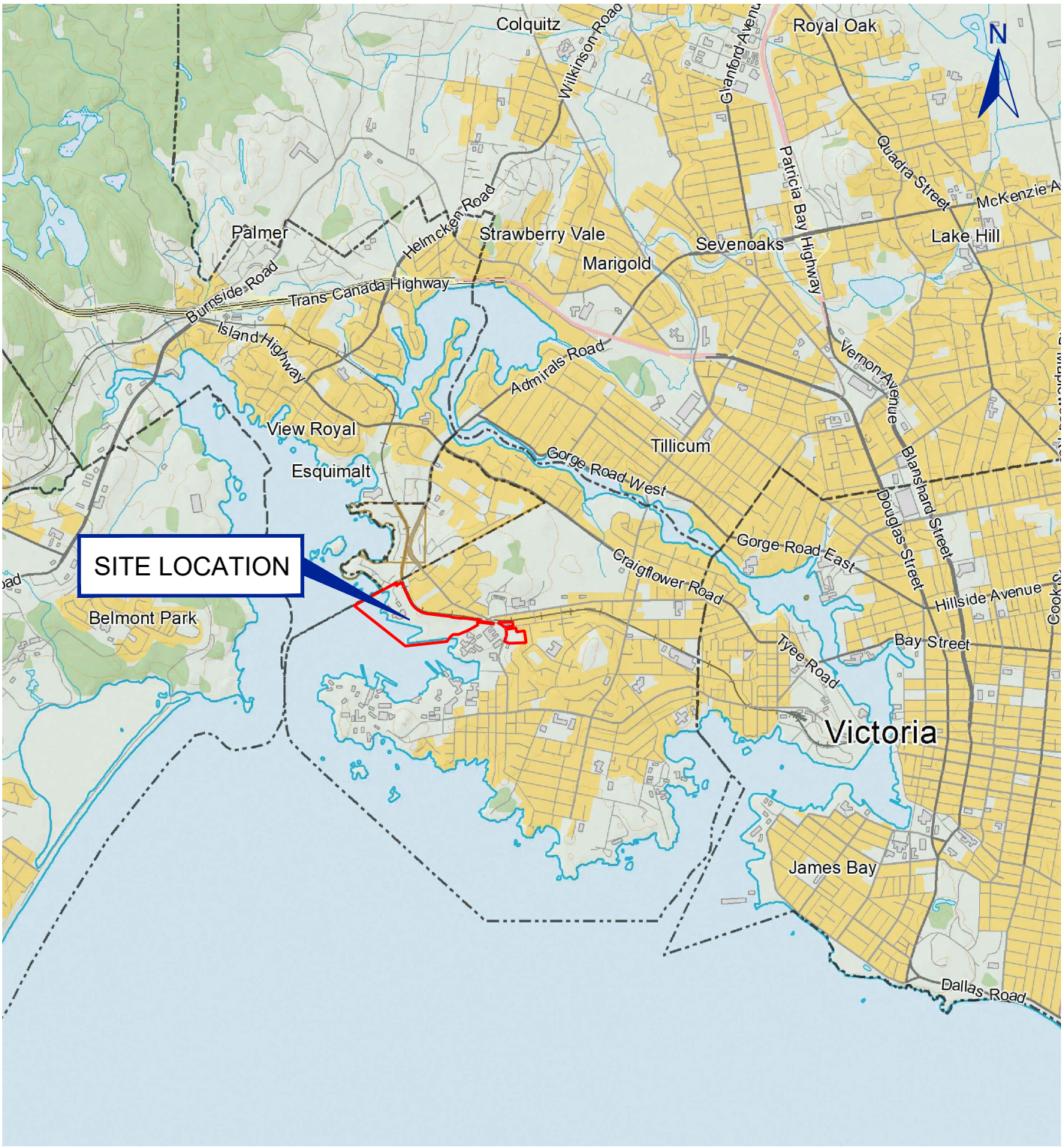
Table 2. Vancouver Island Regional Estimates for Background Concentrations in Soil for Inorganic Substances

Substance	Concentration (µg/g)	Substance	Concentration (µg/g)
Aluminum	55,000	Manganese	5,000
Antimony	4	Mercury	0.15
Arsenic	4	Molybdenum	1
Barium	250	Nickel	50
Beryllium	0.7	Selenium	4
Boron	1	Silver	1
Cadmium	0.95	Strontium	100
Chromium (total)	65	Sulfur	1,000
Cobalt	30	Tin	4
Copper	100	Vanadium	200
Iron	70,000	Zinc	150
Lead	40	-	-

Notes:
Establishing Background Concentrations in Soil. Protocol 4 for Contaminated Sites. Version 10.0, Effective January 9, 2019. BC Ministry of Environment & Climate Change Strategy
µg/g – micrograms per gram

DRAWINGS

Updated Soil Management Plan for Esquimalt Graving Dock
825 Admirals Rd., Victoria, BC
SLR Project No.: 205.04015.00000



NOTES:

- Site Location
- Rail Line
- Contour (20m)
- Municipality Boundary
- Watercourse
- Buildings
- First Nations Reservation
- Wooded Area
- Developed Area
- Expressway / Highway
- Freeway
- Arterial
- Collector
- Local / Street

BASEDATA:

0 0.5 1 2 3 km

SCALE 1:50,000

WHEN PLOTTED CORRECTLY ON A 8.5 x 11 PAGE LAYOUT

NAD 1983 UTM Zone 10N

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

SLR global environmental solutions

PUBLIC WORKS AND GOVERNMENT SERVICES
825 ADMIRALS ROAD
ESQUIMALT, BC

ESQUIMALT GRAVING DOCK -
SOIL MANAGEMENT PLAN

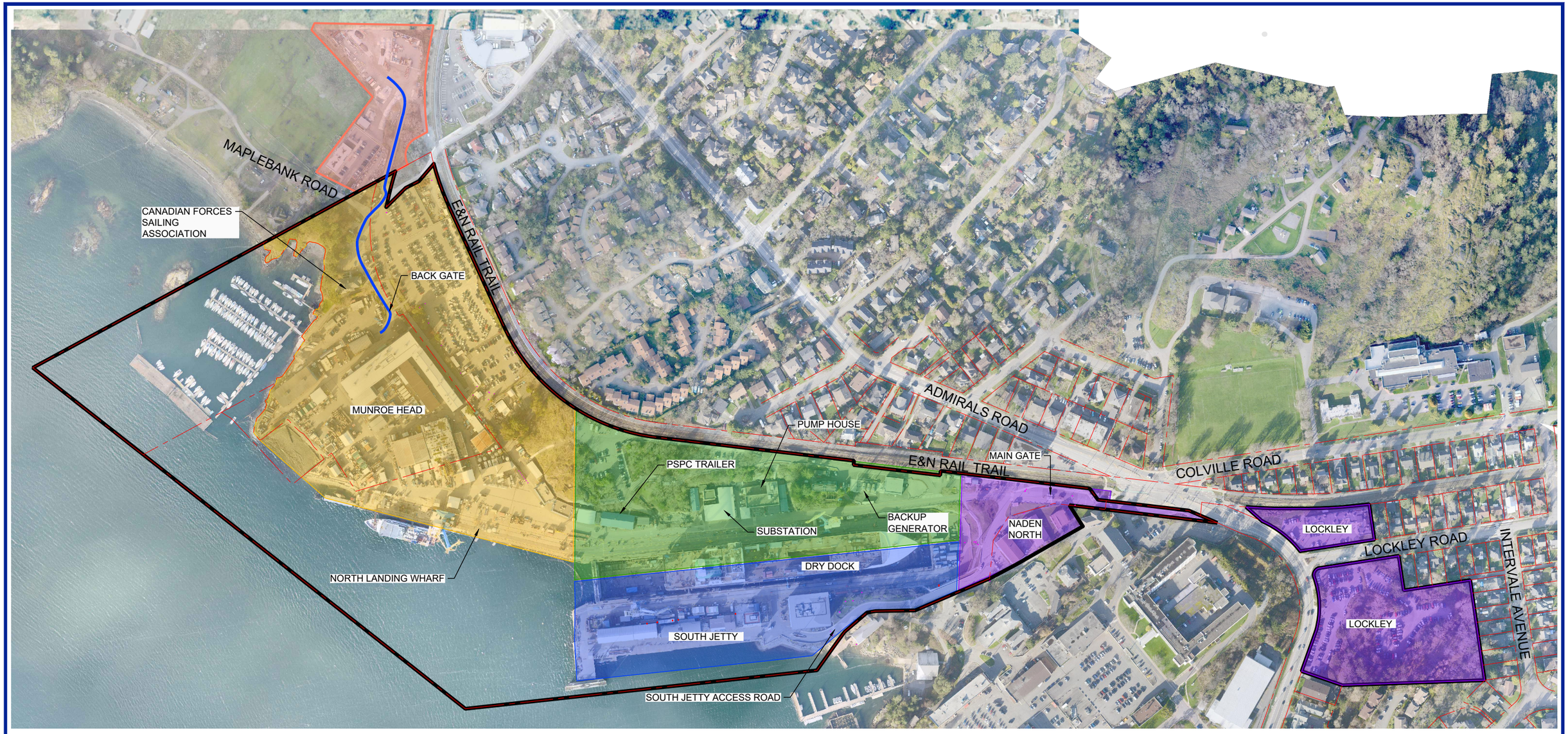
SITE LOCATION MAP

Date: March 5, 2020

Project No. 205.04015.00000

Drawing No. 1

Cadfile name: S_205-04015-00000-A1.dwg



NOTES:
NOT A LEGAL SURVEY. DO NOT USE FOR CONSTRUCTION.

BASEDATA: WORLD IMAGERY - SATELLITE AND AERIAL IMAGERY PROVIDED BY CRD

LEGEND:

- PROPERTY BOUNDARY
- SITE BOUNDARY
- TRUCK ROUTE TO LOT 203

EGD REFERENCE QUADRANTS

- NORTH
- SOUTH
- EAST
- WEST
- LOT 203 (LEASED)

0 25 50 100 150 200 250 m

SCALE 1:4,000
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM Zone 10N

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

PUBLIC WORKS AND GOVERNMENT SERVICES
825 ADMIRALS ROAD
ESQUIMALT, BC

ESQUIMALT GRAVING DOCK -
SOIL MANAGEMENT PLAN

SITE PLAN

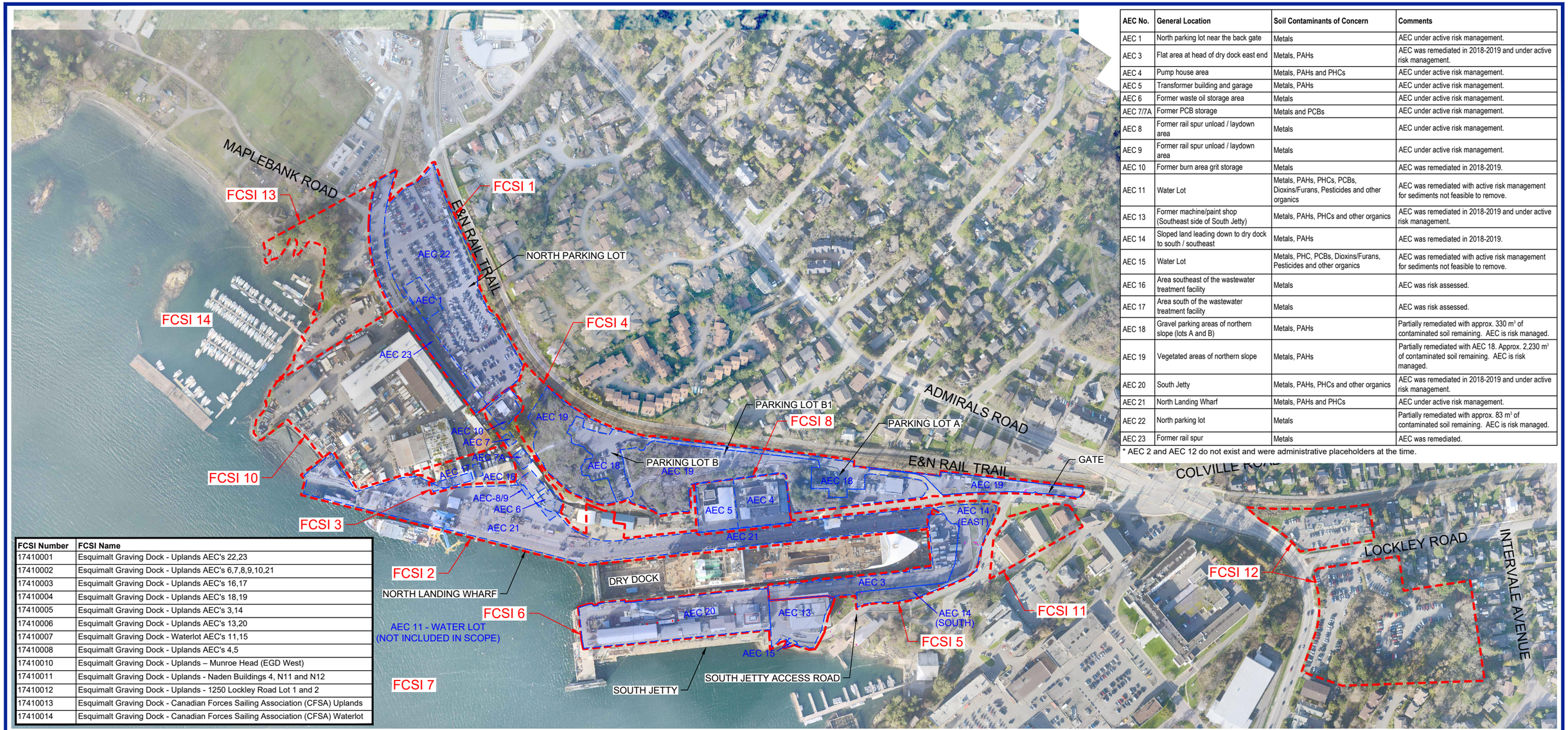
Date: March 5, 2020

Drawing No. 2

Project No. 205.04015.00000

SLR global environmental solutions

Cadfile name: S_205-04015-00000-A1.dwg



AEC No.	General Location	Soil Contaminants of Concern	Comments
AEC 1	North parking lot near the back gate	Metals	AEC under active risk management.
AEC 3	Flat area at head of dry dock east end	Metals, PAHs	AEC was remediated in 2018-2019 and under active risk management.
AEC 4	Pump house area	Metals, PAHs and PHCs	AEC under active risk management.
AEC 5	Transformer building and garage	Metals, PAHs	AEC under active risk management.
AEC 6	Former waste oil storage area	Metals	AEC under active risk management.
AEC 7/7A	Former PCB storage	Metals and PCBs	AEC under active risk management.
AEC 8	Former rail spur unload / laydown area	Metals	AEC under active risk management.
AEC 9	Former rail spur unload / laydown area	Metals	AEC under active risk management.
AEC 10	Former burn area grit storage	Metals	AEC was remediated in 2018-2019.
AEC 11	Water Lot	Metals, PAHs, PHCs, PCBs, Dioxins/Furans, Pesticides and other organics	AEC was remediated with active risk management for sediments not feasible to remove.
AEC 13	Former machine/paint shop (Southeast side of South Jetty)	Metals, PAHs, PHCs and other organics	AEC was remediated in 2018-2019 and under active risk management.
AEC 14	Sloped land leading down to dry dock to south / southeast	Metals, PAHs	AEC was remediated in 2018-2019.
AEC 15	Water Lot	Metals, PHC, PCBs, Dioxins/Furans, Pesticides and other organics	AEC was remediated with active risk management for sediments not feasible to remove.
AEC 16	Area southeast of the wastewater treatment facility	Metals	AEC was risk assessed.
AEC 17	Area south of the wastewater treatment facility	Metals	AEC was risk assessed.
AEC 18	Gravel parking areas of northern slope (lots A and B)	Metals, PAHs	Partially remediated with approx. 330 m^3 of contaminated soil remaining. AEC is risk managed.
AEC 19	Vegetated areas of northern slope	Metals, PAHs	Partially remediated with AEC 18. Approx. 2,230 m^3 of contaminated soil remaining. AEC is risk managed.
AEC 20	South Jetty	Metals, PAHs, PHCs and other organics	AEC was remediated in 2018-2019 and under active risk management.
AEC 21	North Landing Wharf	Metals, PAHs and PHCs	AEC under active risk management.
AEC 22	North parking lot	Metals	Partially remediated with approx. 83 m^3 of contaminated soil remaining. AEC is risk managed.
AEC 23	Former rail spur	Metals	AEC was remediated.

* AEC 2 and AEC 12 do not exist and were administrative placeholders at the time.

FCSI Number	FCSI Name
17410001	Esquimalt Graving Dock - Uplands AEC's 22,23
17410002	Esquimalt Graving Dock - Uplands AEC's 6,7,8,9,10,21
17410003	Esquimalt Graving Dock - Uplands AEC's 16,17
17410004	Esquimalt Graving Dock - Uplands AEC's 18,19
17410005	Esquimalt Graving Dock - Uplands AEC's 3,14
17410006	Esquimalt Graving Dock - Uplands AEC's 13,20
17410007	Esquimalt Graving Dock - Waterlot AEC's 11,15
17410008	Esquimalt Graving Dock - Uplands AEC's 4,5
17410010	Esquimalt Graving Dock - Uplands – Munroe Head (EGD West)
17410011	Esquimalt Graving Dock - Uplands - Naden Buildings 4, N11 and N12
17410012	Esquimalt Graving Dock - Uplands - 1250 Lockley Road Lot 1 and 2
17410013	Esquimalt Graving Dock - Canadian Forces Sailing Association (CFSA) Uplands
17410014	Esquimalt Graving Dock - Canadian Forces Sailing Association (CFSA) Waterlot

NOTES:
NOT A LEGAL SURVEY. DO NOT USE FOR CONSTRUCTION.

BASEDATA: WORLD IMAGERY - SATELLITE AND AERIAL IMAGERY PROVIDED BY CRD

LEGEND:
- CONTAMINATED SITE BOUNDARY
- FCSI — FEDERAL CONTAMINATED SITES INVENTORY
- AREA OF ENVIRONMENTAL CONCERN (AEC)

0 25 50 100 150 200 250 m

SCALE 1:4,000
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM Zone 10N

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

PUBLIC WORKS AND GOVERNMENT SERVICES
825 ADMIRALS ROAD
ESQUIMALT, BC

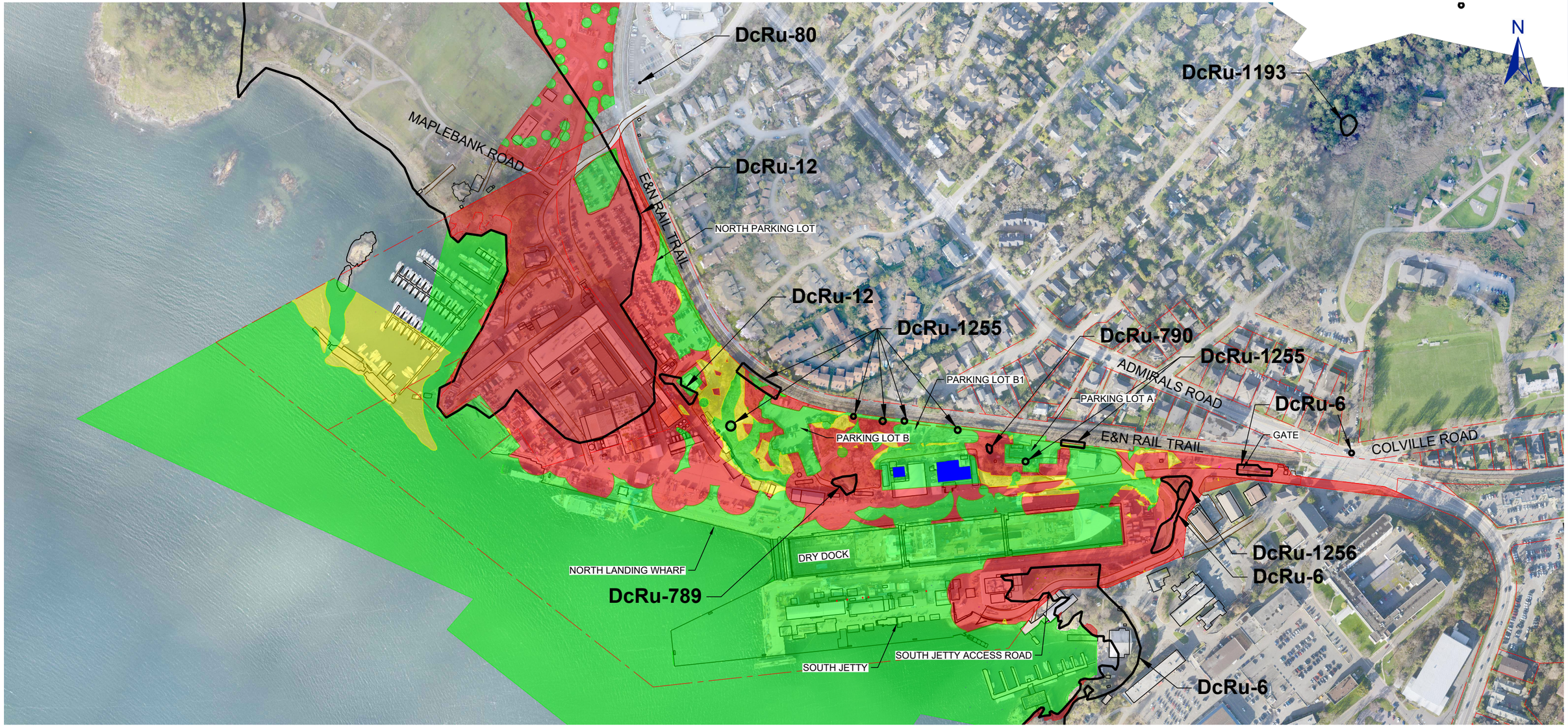
ESQUIMALT GRAVING DOCK -
SOIL MANAGEMENT PLAN

FCSI SITES

Date: March 5, 2020
Project No. 205.04015.00000
Drawing No. 3

SLR global environmental solutions

Cadfile name: S_205-04015-00000-A1.dwg



NOTES:

REFERENCED FROM: GOLDER ASSOCIATES ARCHAEOLOGICAL OVERVIEW ASSESSMENT REPORT, PROJECT No. 09-1477-0012 FIGURE 5, DATE 28 MARCH 2012.

LEGEND:

- PROPERTY BOUNDARY
- SHORELINE
- BUILDINGS
- ROADS
- REGISTERED ARCHAEOLOGICAL SITE
- HERITAGE BUILDING

ARCHAEOLOGICAL POTENTIAL MODEL

- HIGH
- MODERATE
- LOW

0 25 50 100 150 200 250 m

SCALE 1:4,000
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM Zone 10N

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

PUBLIC WORKS AND GOVERNMENT SERVICES
825 ADMIRALS ROAD
ESQUIMALT, BC

ESQUIMALT GRAVING DOCK -
SOIL MANAGEMENT PLAN

ARCHAEOLOGICAL SITES

Date: March 5, 2020

Project No. 205.04015.00000

Drawing No. 4

SLR global environmental solutions

Cadfile name: S_205-04015-00000-A1.dwg

APPENDIX A
Preliminary Hazard Assessment Form

Updated Soil Management Plan for Esquimalt Graving Dock
825 Admirals Rd., Victoria, BC
SLR Project No.: 205.04015.00000

PRELIMINARY HAZARD ASSESSMENT FORM
PROCEDURE CHECKLIST

PRE CONSTRUCTION HAZARD ASSESSMENT PROCEDURE CHECKLIST:		
TYPICAL CONSTRUCTION HAZARDS		
Procedures		✓
1.	**Concealed/Buried Services** Hazards associated with impacting buried services include, but are not limited to the following: • Electrical cables/Duct Banks; • Gas pipes; • Water and sewers lines; • Telecommunication cables; and • Underground storage tanks. Verify – when required –BC One Call has been contacted and that the area has been scanned for any concealed/buried electrical/piping/underground storage tanks. Upon completion **locate drawing** must be submitted. • Ensure that the Locator Contractor has verified all concealed/buried services, by properly marking it off on both the site and on the locate drawing. ***Typical Document(s) Addressing Hazard: Locate Drawing***	☐
2.	**Slip Hazards or Unsound Footing** Verify inherent site hazards that could cause possible slip, or unsound footing. Potential site hazard include but are not limited to the following: • **Pre-Project** o Wet or oily surfaces; o Weather hazards (more likely to occur depending on the season, e.g. fall, winter); o Uneven grounding; o Obstructed views on pathways; o Poor lighting; • **During Project** o Housekeeping (tools, storage); o Machinery; o Equipment; All site hazard assessments and/or any formally scheduled inspection sheet are to be updated on an ongoing basis. ***Typical Document(s) Addressing Hazard: Site Safety Orientation, Safety Inspection Sheet***	☐
3.	**Working at Heights** Fall hazards are generally identified where falls of greater than 10 ft or the risk of a fall of less than 10 ft could lead to a severe injury (e.g. landing on a sharp/blunt object). Identify suspected areas where these could occur. Potential areas of concern are as follows: • Unguarded edges within incomplete building structures; • Scaffolds; • Stairs; • Ladders; and • Mobile lifts (e.g. scissor lifts, man lifts, etc.) Verify that the contractor has properly trained employees where they may be working at heights. Also note that a fall protection plan is required where falls from heights of greater than 25 ft exist. ***Typical Document(s) Addressing Hazard: Fall Protection Training Certificates, Fall Protection Plan***	☐
4.	**Working Over or Around Water** If workers are required to work adjacent to bodies of water, and are not protected by guardrails or other means of fall protection, fall into water could result in severe/fatal injuries, including the following; • Swept away by tide (rapid flow of water); • Caught by strainers and entrapments; • Struck by hazards (stationary objects in the water);	☐

PRE CONSTRUCTION HAZARD ASSESSMENT PROCEDURE CHECKLIST:		
	• Struck by debris; • Drowning; • Pollution (e.g. sewage, chemical, water-borne illness); and • Cold water hazards (e.g. cold shock, hypothermia, etc.). Verify the contractor has ensured the following control measures: • A suitable rescue boat, equipped with a boat hook, available at the site and capable of being used for rescue at all times; • A buoyant apparatus attached to a nylon rope not less than 3/8 in in diameter, and not less than 50 ft in length; and • A sufficient number of workers who are available when work are underway to implement rescue procedures and who are properly equipped and instructed in those procedures. o Verify that the workers who are to conduct rescue procedures have the proper personal protective equipment to complete any rescue tasks. ***Typical Document(s) Addressing Hazard: Site Safety Orientation, Rescue Procedure(s)***	
5.	**Heavy Overhead Lifting Operations, Mobile Cranes** Three general hazards associated with cranes are as follows: • Electrical hazards associated with impact to adjacent power lines. • Crane overloading hazards, leading to damage to the equipment, load, and/or adjacent personnel. • Falling materials hazards, where suspended loads get inadvertently dropped due to mechanical failure, or workers standing directly below the load Verify that the contractor has implemented the following controls: • Contractor is to provide a site plan/layout on how they will conduct controls (e.g. insulated barriers/fences/tape) in order to prevent cranes electrical hazards • Contractor is to provide training certificates for all equipment operators and riggers • Contractor to have maintenance checks on the crane on a scheduled basis; • All workers are made aware of not to work below suspended loads, and to be equipped with all required PPE (e.g. hard hats) ***Typical Document(s) Addressing Hazard: Site plans/layouts of where "Danger Areas" for Electrical Hazards Exist, Mobile Crane/Equipment Training Certificates, and Site Safety Orientation***	☐
6.	**Traffic** Two types of traffic hazards within construction sites – • Onsite traffic (mobile equipment within the site); and/or • Traffic from public roadways. Contractor expected to address onsite traffic through control measures such as site safe orientation, designated walkways, and/or personal protective equipment (e.g. high visibility vests). Public traffic hazards exist when site extends to public roadways. Contractor to implement controls such as traffic barriers, signage, and/or traffic control persons ***Typical Document(s) Addressing Hazard: Site Safety Orientation, Traffic Management Plan***	☐
7.	**Fire and Explosion Hazards** These types of hazards exist on sites either via objects on site (e.g. underground storage tanks), but more through equipment/machinery/chemicals brought on site to conduct work. Some of the hazards are generated by various activities/products, as per the following: • Welding activities; • Flammable and Combustible chemical products; • Underground storage tanks/pipes that contain a flammable/combustible product (e.g. fuel); • Static electricity from varying equipment (e.g. vacuum trucks); • Power line contact or any other high voltage equipment on site; Typically for welding work, a hot work permit is required. For work with flammable/combustible chemical products, both	☐

PRE CONSTRUCTION HAZARD ASSESSMENT PROCEDURE CHECKLIST:		
	WHMIS training and safe work practice/procedure documentation is required prior to use of said product. ***Typical Document(s) Addressing Hazard: Hot Work Permits, WHMIS Training Certificates***	
8.	**High Noise Levels** Typical noise hazards on construction sites are generally brought upon machinery/equipment/tools on site. The noise daily exposure levels are at 85dBA while there is a ceiling limit of 140dBA. The following are examples of what the aforementioned levels would sound like: • 85 dBA ~ sounds like a food blender or a garbage disposal; • 140dBA ~ sounds like a jet take off at 25 meters; • Impact/power tools (e.g. rivet guns, jack hammers, etc.); • Pneumatic tools (e.g. compressed air); and • Mobile equipment, transport vehicles (e.g. trucks); In the event machinery/equipment/tools that generate excessive levels of noise are brought onto site, the contractors must ensure that the operators of their machinery/equipment/tools and all workers adjacent are equipped with the appropriate hearing protection devices (HPD). Verify that contractors have hearing conservations plans as well. ***Typical Document(s) Addressing Hazard: Site Safety Orientation, Hearing Conservation Program, Audiometric tests***	☐
9.	**Excavations** The definition of a trench is an excavation less than 3.7 m (12 ft) wide at the bottom, over 1.2 m (4 ft) deep, and of any length. The following list are typical hazards associated with excavations: • Falls into trenches or excavations; • Excavated material or other objects falling onto workers; • Exposure to underground services or overhead electrical cables; • Unstable adjacent structures; • Mishandled or poorly placed materials; • Hazardous atmospheres (noxious gases/lack of oxygen); • Toxic, irritating or flammable explosive gases; and • Incidents involving vehicles and other mobile equipment. Contractors are expected to pre-determine excavation measurements prior to commencing the work, with the assistance of a professional engineer if the trench meets the following criteria: • the excavation is more than 6 m (20 ft) deep; • an improvement or structure is adjacent to the excavation; • the excavation is subject to vibration or hydrostatic pressure likely to result in ground movement hazardous to workers; or • the ground slopes away from the edge of the excavation at an angle steeper than a ratio of 3 horizontal to 1 vertical. In addition, if the trench requires/uses support structures.The written instructions should be verified by the PWGSC representative. ***Typical Document(s) Addressing Hazard: Excavation Written Instructions, Engineer Documented Inspection of the Excavation***	☐
10.	**Blasting** There are several hazards associated with blasting, which include but are not limited to the following: • Conducting blasting activities; • Exposure to various dust/particulate after blasting activities • Handling and storing explosive materials; Verify with the contractor that the blaster has been trained/certified, with not only blasting certification course, but also in any safe work procedures written for the storing/handling/use of the explosive materials. The contractor must also have a site specific written emergency procedures on hand. ***Typical Document(s) Addressing Hazard: Blaster's Certificate, WHIMS Training, Blasting Log, and Site Specific Written Emergency Procedures, Work Procedures***	☐

PRE CONSTRUCTION HAZARD ASSESSMENT PROCEDURE CHECKLIST:		
11.	**Construction Equipment** There are several hazards associated with construction equipment that include but are not limited to the following: • Training and supervisor of equipment operators; • Following manufacturer's instruction for operation of equipment; and • Roll over protection systems and use of seat belts in mobile equipment. Verify with contractor that the construction equipment has been maintained as per manufacturer's instructions (via contractor inspection sheet, and third party inspection sheet (where required)). ***Typical Document(s) Addressing Hazard: Training Certificate (where required), Inspection Sheets of Mobile Equipment***	☐
12.	**Pedestrian Traffic** In the event that the worksite adjacent to the public and/or where site personnel must walk through the site, the following hazards exist: • Inadequate traffic controls; • Weather; • Inadequate illumination; • Lack of communication between pedestrians and mobile equipment operators; and • Lack of training for both pedestrians and mobile equipment operators. Verify that the contractor has developed a written orientation plan that addresses the above noted. In addition, to address the public from entering the site, barriers (e.g. fences, hoarding, etc) should be erected in order to cordon of the work site. Personnel should be positioned at access points to ensure that the public doesn't inadvertently enter the site. ***Typical Document(s) Addressing Hazard: Site Safety Orientation, Site Security Plan (if available), Traffic Management Plan***	☐
13.	**Multiple Employer Worksite** Prime contractor/Principal Contractor/Constructor/Contractor Role – Full responsibility for ensuring health and safety compliance and the health and safety of all contractors and subcontractors that are retained by PWGSC. Verify that the Prime Contractor agreement document has been signed ***Typical Document(s) Addressing Hazard: Prime Contractor Agreement***	☐
14.	**Electrical Hazards** In addition to Part 1 of this documents, there are several additional hazards associated with electrical on construction sites: • Working close to overhead electrical hazards (e.g. power lines); • Mobile equipment maintenance; • Damaged tools/equipment; • Improper grounding; • Damaged insulation; and • Wet conditions Verify that contractor has proper lockout-tagout program/specific procedures to address areas where working with live power. Verify where applicable where any de-energization of power lines need to occur in order to facilitate construction activities. Limits of approach awareness/training should be to given to affected staff. ***Typical Document(s) Addressing Hazard: Lockout/tagout program, Documents from Owner of Power Line (where line has been de-energized), Limits of Approach Notification***	☐
15.	**Emergency Response** Typical site emergencies to be addressed: • Fire, explosion; • Earthquake; • Tsunami; • Avalanche; • Forest fires; • Violence in the workplace/public interference; and	☐

PRE CONSTRUCTION HAZARD ASSESSMENT PROCEDURE CHECKLIST:		
	• Inclement weather. Site contractor is to have emergency response procedures that would address all of the above. Emergency procedures to include the following but not limited to: locations of required first aiders, fire extinguishers, air horns, windsocks, muster stations, drills, designated emergency exits, and nearest hospital. ***Typical Document(s) Addressing Hazard: Site/emergency specific procedures, First Aid Protocols/Training***	
16.	**Confined Spaces** Typical confined spaces found within worksites • Piping (e.g. concrete or steel); • Crawlspaces; • Manholes (e.g. storm drains, sanitary, etc.); • Lift stations; • Tanks; • Boilers; • Storage bins; • Pits, sumps; • Pumping stations; • Vessels; • Water reservoirs; • Vats The following must be addressed: • Documentation identifying of all confined spaces on site (e.g. hazard assessment per space, or group of spaces); o All hazard assessments to be completed by a qualified person; and • Up to date, relevant entry and rescue procedures. ***Typical Document(s) Addressing Hazard: Emergency procedures (where required), confined space program, confined space hazard assessment, entry procedure and rescue Procedures, documents confirming that all equipment has been calibrated, training certificates***	☐
17.	**Chemical Hazards** Typical building chemical hazards: • Asbestos-containing materials (e.g. walls, ceilings, floors, structural components, piping, ducting, mechanical equipment, etc.) • Lead-containing materials (e.g. paints, sheeting, glaze off of ceramic tiling, etc.); • Polychlorinated Biphenyls (PCBs) (e.g. ballasts, hydraulic oil, etc.); • Mercury (e.g. thermostats, switches, fluorescent light tubes, high intensity discharge lighting, etc.); • Silica (e.g. any concrete/ceramic materials); Typical site chemical hazards: • Stored chemicals (e.g. varied chemicals left on site, compressed gas tanks, etc.); and • Contaminated site chemicals (e.g. hydrocarbons on soil, etc.) ***Typical Document(s) Addressing Hazard: Hazardous materials survey report, contaminated site report, chemical specific exposure control plan.WHMIS Program and Training***	☐
18.	**Biological Hazards** • Refer to specific hazards as listed on the Pre-Construction Hazard Form Note for specific biological hazards, there are specific controls (e.g. handling procedures, personal protective equipment, etc.) that are required for specific hazards. Confirm with contractor they have the required exposure control plans, safe work procedures, and/or risk assessments. ***Typical Document(s) Addressing Hazard: Exposure control plans, safe work procedures, risk assessments, training***	☐
19.	**Working Alone/Working in Isolation** When working alone/isolation, the risk potential of the above noted hazards occurring listed from 1-18 could be heightened. As such some of the following must be taken into consideration if it is a working along/isolation hazard: • Length of time employee will be working alone; • Are there any forms of communications (e.g. cell phones, radios, etc.); • What is the approximate location of work? Is it in a remote area?	☐

PRE CONSTRUCTION HAZARD ASSESSMENT PROCEDURE CHECKLIST:		
	• What is the nature of work? Confirmation of any of the above would verify whether there exists a working alone hazard. ***Typical Document(s) Addressing Hazard: Working alone procedure/check in process***	
20.	**Personal Protective Equipment (PPE)** Verify that the contractor has addressed the following for PPE: • Addressed all known site hazards with applicable PPE (e.g. workplace evaluation); • Verified all required training has been provided for with regards to PPE (e.g. fall protection training); • Verify that a system has been developed with regards to inspection of PPE and a subsequent system for discarding of any damaged PPE; ***Typical Document(s) Addressing Hazard: PPE Program***	☐

APPENDIX B
NMS Reference Table

Updated Soil Management Plan for Esquimalt Graving Dock
825 Admirals Rd., Victoria, BC
SLR Project No.: 205.04015.00000

Environmental Reference	Specification Section
Project Planning	**013515 – Special Project Procedures for Contaminated Sites**
- Potential contaminants in soil	5.1
- Obtaining soil data for proposed excavation area	5.2
- EGD Environmental BMPs	6.1
- Environmental Protection Plan requirements	6.2
- Environmental mitigation / protection measures	6.3
Topsoil Removal	**311413 – Soil Stripping and Stockpiling**
- Stripping and handling of topsoil	3.2
Soil Stockpiling	**310000 – Earthwork**
- Location	3.4.1
- Segregation	3.4.2
- Placement on poly	3.4.3
- Height	3.4.4
- Volume	3.4.5
- Covering with poly	3.4.6
- Securing poly	3.4.7
- Water diversion	3.4.8
Soil Stockpile Characterization	**310000 – Earthwork**
- Sampling	3.5.1
- Sample rate for suspect contaminated soil	3.5.2
- Sample rate for suspect hazardous waste	3.5.3
- Laboratory requirements	3.5.4
- Reporting requirements	3.5.5
Soil Disposal	**310000 – Earthwork**
- Disposal documentation	3.6.1
- Characterization requirements	3.6.2
Excavation Limit Sampling	**310000 – Earthwork**
- Sampling of construction excavation limits	3.7.1
- Confirmatory sampling of remedial excavation limits	3.7.2
- Floor sample requirements and spacing	3.7.3
- Wall sample requirements and spacing	3.7.4
- Laboratory requirements	3.7.5
- Reporting requirements	3.7.6
Importing Backfill Material	**310516 – Aggregate Materials**
- Lead time required for source documentation	2.2.1
- Applicable CCME guidelines for imported backfill	22.2
- Characterization requirements	2.2.3

- Laboratory requirements	2.2.4
- Reporting requirements	2.2.5
- Characterization timing	2.2.6
- Additional testing	2.2.7
- Alternate sourcing	2.2.8
- Lead time required for change of source	2.2.9
- Future rejection of material that fails to meet requirements	2.2.10
- Removal of material not meeting requirements	2.2.12
- Manifests and/or truck scale documents	2.2.13
Contaminated Soil Definitions	**312311 – Excavation and Handling of Contaminated Material**
- Uncontaminated soil	1.4.1
- Known contaminated soil	1.4.2
- Confirmed contaminated soil	1.4.3
- Confirmed Hazardous Waste	1.4.4
- Waste Manifest (tracking form)	1.4.5
Contaminated Material Excavation and Handling	**312311 – Excavation and Handling of Contaminated Material**
- Soil segregation, stockpiling, and sampling	3.2.1
- Mixing contaminated and uncontaminated soils	3.2.3
- Excavation log of visible contamination	3.2.1.4
- Dewatering	3.2.2

APPENDIX C
Modified NMS

Updated Soil Management Plan for Esquimalt Graving Dock
825 Admirals Rd., Victoria, BC
SLR Project No.: 205.04015.00000

1. SECTION INCLUDES

.1 Special procedures required during the work due to the presence of contaminated soil beneath the site.

2. RELATED SECTIONS

.1 Section 017419 – Waste Management and Disposal.
.2 Section 310000 – Earthwork.
.3 Section 311413 – Soil Stripping and Stockpiling.
.4 Section 312311 – Excavation and Handling of Contaminated Material.

3. REFERENCES

.1 Canadian General Standards Board (CGSB)
  .1 CGSB 51-GP-51M-81, Polyethylene Sheet for Use in Building Construction.
.2 Transportation and Dangerous Goods Act.
.3 CCME (Canadian Council of Ministers of Environment) Canadian Soil Quality Guidelines
  .1 Canadian Soil Quality Guidelines for PAH, Industrial, Environmental Health Guidelines, Environmental Health (**CCME IL**).
  .2 Canadian Soil Quality Guidelines for PAH, Industrial, Environmental Health Guidelines, Environmental Health (**CCME ILsc**).
  .3 Canadian Soil Quality Guidelines for PAH, Industrial, Environmental Health Guidelines, Environmental Health (**CCME ILe**).
  .4 Canadian Soil Quality Guidelines for PAH, Industrial, Environmental Health Guidelines, Interim Soil Quality Criteria (CCME 1991) (**CCME ILi**).
  .5 Soil Quality Guidelines for the Protection of Human Health (10^{-5}) (CCME (SQGhh).
.4 BC environmental Management Act and Contaminated Sites Regulation (CSR) most recent updates related to soil standards and waste soil disposal.
.5 BC Ministry of Environmental (MOE) Technical Guidance Document 1, Site Characterization and Confirmation Testing.
.6 Department of Fisheries and Oceans Land Development Guidelines.

4. REGULATORY REQUIREMENTS

.1 Provide erosion and sediment control in accordance with the following documents:
  .1 Federal Fisheries Act 1970 (and applicable updates).
  .2 BC Ministry of Environment Lands and Parks

Approved and Working Criteria for Water Quality – 1998 (and applicable updates).

.3 BC Water Act 1988 Section 9 Changes in and about a Stream (and applicable updates).

.4 Land Development Guidelines for the Protection of Aquatic Habitat, Fisheries and Oceans Canada, and BC Ministry of Environment, Lands and Parks, 1993 (and applicable updates).

.2 Characterize excavated soil as per CCME IL guidelines as described in Section 3.3 to determine whether it can stay onsite.
Characterize excavated soil as per BC Ministry of Environmental (MOE) Technical Guidance Document 1, Site Characterization and Confirmation Testing to determine offsite disposal requirements.

.3 Ensure that water which falls upon or drains across the work site is collected, treated, and released in accordance with the above referenced documents and regulations.

.4 Comply with federal, provincial, municipal and local anti-pollution laws, ordinances, codes, and regulations when disposing of waste materials, water, soil, debris, and rubbish.

5. POTENTIALLY CONTAMINATED MATERIALS

.1 The soils at Esquimalt Graving Dock are known potentially to contain contaminants including hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), metals, and sodium and chloride. Depending on the area, other potential contaminants of concern may also be present in soil. Contractor shall follow appropriate steps as described in this and other sections of the Specifications when performing excavation and removal of soils.

.2 Prior to excavation, obtain any existing soil quality data for the proposed excavation area from EGD personnel.

.3 Do not commence Work involving contact with potentially contaminated materials until decontamination facilities are operational and approved by the Departmental Representative.

6. ENVIRONMENTAL PROTECTION

.1 Contractor must adhere to Esquimalt Graving Dock's Environmental Best Management Practices.

.2 Contractor must submit Environmental Management Plan

that should include:

.1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.

.2 Names and qualifications of persons responsible for manifesting any hazardous waste to be removed from site.

.3 Names and qualifications of persons responsible for training site personnel.

.4 Descriptions of environmental protection personnel training program.

.5 Erosion and Sediment Control Plan which identifies type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan.

.6 Drawings showing locations of proposed excavation, haul roads, material storage areas, structures, and soil stockpile storage areas including methods to control runoff and to contain materials on-site.

.7 Traffic Control Plan, including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather.

.8 Spill Control Plan: including procedures, instructions, and reports to be used in event of unforeseen spill of regulated substance.

.10 Non-Hazardous Solid Waste Disposal Plan identifying methods and locations for solid waste disposal including clearing debris.

.11 Air Pollution Control Plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off the project site.

.12 Contaminant Prevention Plan that:

- .1 Identifies potentially hazardous substances to be used on job site;
- .2 Identifies intended actions to prevent introduction of such materials into air, water, or ground; and
- .3 Details provisions for compliance with Federal, laws and regulations for storage and handling of these materials.

.13 Wastewater Management Plan that identifies methods and procedures for management and/or discharge of any excavation water or wastewaters which are directly derived from excavation and construction activities, such as concrete curing water, clean-up water, dewatering of ground water, disinfection water, hydrostatic test water, and water

used in flushing of lines.

.14 Historical, Archaeological, Cultural Resources, Biological Resources, and Wetlands Plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

.3 Contractor shall adhere to the following environmental mitigation/protection measures:

.1 Spill response materials must be on site at all times and must be sufficient to handle potential spills.

.2 All machinery and equipment must be in good working order and have drip pans placed beneath them at the end of each work day.

.3 Fuelling operations/hazardous materials storage must be done in a protected area away from the marine environment and the drainage system.

.4 No waste materials or wastewater is to be allowed to enter the drainage system or the marine environment. Construction runoff into the marine environment is a contravention of the Fisheries Act. This includes raw concrete and concrete silt. Drains in the vicinity of the project must be covered with filter media.

.5 Excavated soils must be placed on and covered with a minimum 6 mil thick PVC or plastic liner so they are completely contained and stockpiled in an area designated by the Departmental Representative or EGD Environmental Services staff and in accordance with section 310000 – Earthwork, Part 3.4 Soil Stockpiling.

7. VEHICULAR ACCESS AND PARKING

.1 Maintenance and Use:

.1 Prevent contamination of access roads. Immediately scrape up debris or material on access roads which is suspected to be contaminated as determined by Departmental Representative; transport and dispose of in appropriate off-site disposal facility. Clean access roads and any roads used by trucks or equipment at least once per shift using a street sweeper.

.2 The Departmental Representative may collect soil samples for chemical analyses from the traveling surfaces of constructed and existing access routes prior to, during, and upon completion of Work.

Excavate and dispose of clean soil contaminated by Contractor's activities at no additional cost to the Departmental Representative.

8. DUST AND PARTICULATE CONTROL

.1 Execute work by methods to minimize raising dust from construction operations.

.2 Implement and maintain dust and particulate control measures immediately during construction and in accordance with Province of British Columbia regulations.

.3 Provide positive means to prevent airborne dust from dispersing into atmosphere. Use potable water for dust and particulate control.

.4 Recover and treat any runoff from water applied to the roads or excavation. Prevent any water applied to the roads or excavation from discharging directly to the storm sewer or offsite.

.5 Use chemical means for water misting system for dust and particulate control only with Departmental Representative's prior written approval.

.6 As a minimum, use appropriate covers on trucks hauling fine or dusty material. Use watertight vehicles to haul wet materials.

.7 Prevent dust from spreading to adjacent property sites.

.8 Departmental Representative may stop work at any time when Contractor's control of dust and particulate is inadequate for wind conditions present at site, or when air quality monitoring indicates that release of fugitive dusts and particulate into atmosphere equals or exceeds specified levels in the Contractors Health and Safety Plan and by British Columbia Workers Compensation Board. Cost of such work stoppage shall be borne by the Contractor.

.9 If Contractor's dust and particulate control is not sufficient for controlling dust and particulate into atmosphere, stop work. Contractor must prepare and discuss procedures to resolve the problem. Make all necessary changes to operations prior to resuming any excavation, handling, processing, or any other work that may cause release of dusts or particulate.

9. POLLUTION CONTROL

.1 Provide methods, means, and facilities to prevent contamination soil, water, and atmosphere from discharge of noxious toxic substances and pollutants produced by

construction operations

.2 Be prepared to intercept, clean up, and dispose of spills or releases that may occur whether on land or water. Maintain materials and equipment required for cleanup of spills or releases readily accessible on site.

.3 Promptly report spills and releases potentially causing damage to the environment to:

.1 Authority having jurisdiction or interest in spill or release including any conservation authority, water supply authorities, drainage authority, road authority, and fire department.

.2 Owner of pollutant, if known.

.3 Person having control over pollutant, if known.

.4 EGD Environmental Services staff.

.5 Departmental Representative.

.4 Contact manufacturer of pollutant if known and ascertain hazards involved, precautions required, and measure used in cleanup or mitigating action.

.5 Take immediate action using available resources to contain and mitigate effects on environment and persons from spill or release.

.6 Volatile Organic Compounds (VOC) Control:

.1 In addition to requirements of Section 013533, monitor air quality for volatile organics at the Contractor's work zone during contaminated materials excavation and management activities, and maintain a log of air quality readings. Report the readings to the Departmental Representative.

.2 If air quality monitoring indicates that release of volatile organic in air at site boundary exceeds Level C of Personnel Protective Equipment threshold for air quality, implement corrective actions to control volatile organics.

.3 If actions are not sufficient to control release of volatile organics within an hour of identification of air quality problem, suspend work resulting in excessive volatile organic emissions. Contractor and Contractor's Environmental Engineer to prepare and discuss additional methods that Contractor proposes to control the release of volatile organics with the Departmental Representative.

.4 Make all necessary changes at no additional cost to the Owner and Departmental Representative prior to resuming Work.

.7 In addition, if Departmental Representative's monitoring of ambient air at site perimeter indicated that concentration

of contaminants in air exceed WorkSafe BC specified limits, modify operations to keep volatile organic contaminants below acceptable limits.

10. WATER CONTROL

.1 Maintain work areas relatively free of water such that the presence of water in the excavation does not interfere with the progress of the work.

.2 Protect site from puddles or running water. Grade site to drain. Provide berm as necessary to protect the slopes of the excavation from soil erosion.

.3 Prevent surface water runoff from leaving work areas.

.4 Do not discharge decontaminated water, or surface water runoff, or groundwater which may have come in contact with potentially contaminated material, off the site or to municipal sewers.

.5 Prevent precipitation from infiltrating or from directly running off stockpiled or exposed material surfaces. Cover stockpiled or exposed material surfaces at all times with an impermeable liner.

.6 Direct surface waters outside of the excavation that has not contacted potentially contaminated materials to existing surface drainage systems.

.7 Control surface drainage ensuring that gutters are kept open, water is not directed across or over pavements or sidewalks except through approved pipes or properly constructed troughs, and runoff from unstabilized areas is intercepted and diverted to suitable outlet.

.8 Dispose of water in manner not injurious to public health or safety, to property, or to any part of Work completed or under construction.

.9 Provide, operate, and maintain necessary equipment appropriately sized to keep excavations, staging pads, and other work areas free from water.

.10 Contain water from stockpiled materials. Transfer all potentially contaminated surface waters to the designated waste water storage tanks.

.11 Have on hand sufficient pumping equipment, machinery and tankage in good working condition for ordinary emergencies, including power outage, and competent workers for operation of pumping equipment.

.12 Contain and collect surface and decontaminations water and transfer such collected water to the waste water storage tanks.

11. PROGRESS CLEANING

.1 Maintain cleanliness of Work and surrounding site to comply with federal, provincial, and local fire and safety laws, ordinances, codes, and regulations.

.2 Co-ordinate cleaning operations with disposal operations to prevent accumulation of dust, dirt, debris, rubbish, and waste materials.

12. FINAL DECONTAMINATION

.1 Perform final decontamination of construction facilities, equipment, and materials which may have come in contact with potentially contaminated materials prior to removal from site.

.2 Perform decontamination as specified to satisfaction of the Departmental Representative. The Departmental Representative will require the Contractor to perform additional decontamination if required.

13. REMOVAL AND DISPOSAL

.1 Remove surplus materials and temporary facilities from site.

.2 Dispose of all non-contaminated waste materials, litter, debris, and rubbish off site.

.3 Do not burn or bury rubbish and waste materials on site.

.4 Do not dispose of volatile or hazardous wastes such as mineral spirits, oil, paint thinner etc., in storm or sanitary drains.

.5 Do not discharge wastes into streams or waterways.

.6 Dispose of the following materials at appropriate off-site facility identified by Contractor and approved by Departmental Representative. Debris including excess construction material, non-contaminated matter and rubbish; disposable PPE worn during final cleaning; wastewater removed from wastewater storage tank, wastewater generated from final decontamination operations including wastewater storage tank cleaning; and lumber from decontamination pads.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 310516 – Aggregate Materials
.2 Section 312316 – Rock Removal
.3 Section 321119 – Granular Sub Base
.4 Section 321123 – Granular Base

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
  .1 ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft^3) (600kN-m/m^3).

.2 Department of Justice Canada
  .1 Explosives Act, R.S., c. E-15, s. 1 (updated September 27th, 2005).

.3 Fisheries and Oceans Canada Land Development Guidelines

1.3 QUALITY ASSURANCE/REGULATORY REQUIREMENTS

.1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial regulations.

.2 Comply with Explosives Act of Canada.

.3 Perform blasting in accordance with Municipal regulations: repair damage as directed by Departmental Representative.

.4 Do not blast within 3 m of building and where damage would result.

.5 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 013533 - Health and Safety Requirements.

.6 Comply with Esquimalt Graving Dock - Environmental Best Management Practices.

Part 2 Products

2.1 MATERIALS

.1 Type 3 Fill (Pit Run): well graded granular material, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials meeting the requirements in the table below. Native material – meeting the requirements of Type 3 Fill may be used.

.2 Type 4 Fill (Granular Base): Refer to Section 321123 Granular Base.

.3 Table

Sieve Designation	% Passing Type 1	Type 2	Type 3
75 mm	-	100	100
50 mm	-	-	70-100
37.5 mm	-	60-100	-
25 mm	-	40-80	50-100
19 mm	-	30-60	-
12.5 mm	-	20-45	-
9.5 mm	100	15-35	-
4.75 mm	50-100	10-25	22-100
2.00 mm	30-90	4-16	10-85
0.425	10-50	-	-
0.075	0-3	2-9	2-8

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PREPARATION/PROTECTION

.1 Protect excavations from freezing.

.2 Keep excavations clean, free of standing water, and loose soil.

3.3 EXCAVATION

.1 Excavate as required to carry out work.
  .1 Do not disturb soil or rock below bearing surfaces.
.2 Notify Departmental Representative when excavations are complete.
.2 Excavating of potentially-contaminated material.
  .1 If material being excavated is suspect contaminated or known contaminated follow procedures under Section 312311 – Excavation and Handling of Contaminated Material.

.3 Excavate for paving to subgrade levels.
  .1 In addition, remove all topsoil, organic matter, debris and other loose and harmful matter encountered at subgrade level.

3.4 EXCAVATED SOIL SEGREGATION AND STOCKPILING

.1 Stockpile material in locations as directed by Departmental Representative or EGD Environmental Services staff.
.2 Soil should be segregated into separate stockpiles of inferred quality as directed by Departmental Representative.
.3 Stockpiles to be placed on 6 mil polyethylene sheeting to prevent contact between stockpile material and ground.
.4 Stockpile height not to exceed 3 m.
.5 Stockpile volume to be less than 50 cubic meters for each pile, or as directed by Departmental Representative.
.6 Stockpiles to be covered with 6 mil polyethylene sheeting at the end of each work day to prevent run-off and wind-borne dust.
.7 Polyethylene sheeting covering stockpiles must be secured down and regularly inspected until stockpile is removed. If sheeting is damaged it must be replaced.
.8 Stockpiles should be placed in areas that are graded to divert water away from the stockpiles.

3.5 STOCKPILE CHARACTERIZATION

.1 Sampling of stockpiled soil will be performed by the Departmental Representative.
.2 Stockpiles will be sampled for analysis testing at a rate of one representative sample per 50 cubic meters for suspect contaminated soil.
.3 Stockpiles will be sampled for analysis testing at a rate of one representative sample per 10 cubic meters for suspect hazardous waste soil.
.4 Stockpile soil samples will be submitted for analysis of potential

contaminants of concern by the Departmental Representative to a Canadian Association for Laboratory Accreditation Inc. (CALA) certified laboratory for analytical testing

.5 The Departmental Representative shall prepare a report of the results of the stockpile soil testing, including the data presented in table format, a drawing showing stockpile locations and quality, a summary of results compared to appropriate CCME guidelines and CSR standards, the original laboratory report, and recommendations on soil disposal.

3.6

SOIL DISPOSAL

.1 A copy of all manifests and/or truck weigh scale documents for material removed from site, including disposal locations, are to be provided to the Departmental Representative.

3.7

.2 In no case will the material be transported off-site before laboratory analysis has been received and excavated materials have been appropriately characterized for disposal.

EXCAVATION LIMIT SAMPLING

.1 For construction excavation projects, collection of excavation limit samples for soil characterization will be conducted at the request of EGD Environmental Services staff.

.2 For soil remediation projects, excavation limit confirmatory soil samples should be collected by the Departmental Representative at the limits of a remedial excavation to confirm that all contaminated soil has been removed.

.3 Confirmatory samples should be collected in a grid pattern on the floor of the excavation approximately 8 m apart.

.4 Samples should be collected on the walls of the excavation

.1 Horizontally samples should be collected approximately every 8 m along the wall.

.2 Vertically on the wall one sample should be collected in the first 0.5 m and one sample collected every 1 m thereafter.

.5 Soil samples will be submitted by the Departmental Representative to a Canadian Association for Laboratory Accreditation Inc. (CALA) certified laboratory for analytical testing.

.6 Test results should be submitted to EGD Environmental Services staff in a report with data presented in table format and compared to appropriate CCME IL guidelines (applicable at the site) and BC CSR standards (for offsite disposal) as described in Section 013515 – Special Procedures for Contaminated Sites, Part 3 References.

3.8 BACKFILLING

.1 Inspection: do not commence backfilling until fill material and spaces to be filled have been inspected and approved by Departmental Representative.

.2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.

.3 Compaction of subgrade: compact existing subgrade under paving to same compaction as specified for fill.

.1 Fill excavated areas with gravel compacted as specified for fill.

.4 Placing:

.1 Place backfill, fill and base course material in 150 mm lifts: add water as required to achieve specified density.

.5 Environmental Quality:

.1 Prior to import to the site, proposed imported backfill must be characterized and meet the requirements of Section 310516 – Aggregate Materials, Part 2.2 Source Quality Control.

.6 Compaction: compact each layer of material to following densities for material to ASTM D 698:

.1 To underside of base courses: 95%.
.2 Base courses: 100%.
.3 Elsewhere: 90%.

.7 Under paving:

.1 Use pit run up to bottom of granular base courses.
.2 Use crushed gravel for base courses.

.8 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material

3.9 GRADING

.1 Grade so that water will drain away from paved areas, to catch basins and other disposal areas approved by the Departmental Representative.

.1 Grade to be gradual between finished spot elevations shown on drawings.

3.10 FIELD QUALITY CONTROL

.1 Testing of materials and compaction of backfill will be carried out by testing laboratory designated by Departmental Representative.

.2 Do not begin backfilling or filling operations until material has been approved for use by Departmental Representative.

.3 Not later than 48 hours before backfilling or filling with approved material, notify Departmental Representative so that compaction tests can be carried out by designated testing agency.

3.11 SHORTAGE AND SURPLUS

1 Supply necessary fill to meet backfilling and grading requirements and with minimum and maximum rough grade variance.

.2 Dispose of surplus material off site.

3.12 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 310000 – Earthwork.

.2 Section 321119 – Granular Sub-Base.

.3 Section 321123 – Granular Base.

1.2 REFERENCES

.1 ASTM International

.1 ASTM D4791-[10], Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

.2 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

Part 2 Products

2.1 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.1 Greatest dimension to exceed 5 times least dimension.

.3 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:

.1 Crushed rock.

.2 Gravel and crushed gravel composed of naturally formed particles of stone.

.3 Light weight aggregate, including slag and expanded shale.

.4 Blast rock.

2.2 SOURCE QUALITY CONTROL

.1 Inform Departmental Representative of proposed source of aggregates and provide source and contaminant testing documentation 2 - 4 weeks minimum before starting production.

.2 Provide confirmation of "clean" of backfill material, including analytical results demonstrating source material meets requirements for the site including:

.1 CCME Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health, Residential/Parkland (**CCME RL**) (metals).

.2 CCME Canadian Soil Quality Guidelines for polycyclic aromatic hydrocarbons (PAH), Residential/Parkland, Environmental Health Guidelines, Interim Soil Quality Criteria (**CCME RLi**).

.3 CCME Canadian Soil Quality Guidelines for PAH, Residential/Parkland, Environmental Health Guidelines, Environmental Health (**CCME RLe**).

.4 CCME Canadian Soil Quality Guidelines for PAH, Residential/Parkland, Environmental Health Guidelines, Soil Contact (**CCME RLsc**).

.5 CCME Soil Quality Guidelines for the Protection of Human Health (10^{-5}) (**CCME SQGhh**).

.3 Retain services of a Qualified Environmental Professional to carry out characterization of the proposed imported material as per BC British Columbia Ministry of Environment, Technical Guidance Document #1 – Site Characterization and Confirmation Testing prior to the importation of any materials to the site and for the duration of the project to confirm that all imported fill materials meet the acceptable soil quality classes listed in Part 2.2.2.

.4 Submit test results and Certificates of Analysis from a Canadian Association for Laboratory Accreditation Inc. (CALA) certified laboratory to the Departmental Representative for all imported fill materials certifying that the materials meet the acceptable soil quality classes listed in Part 2.2.2 above.

.5 Test results should be submitted to the Departmental Representative in a report with data presented in table format and compared to appropriate CCME RL guidelines listed in Part 2.2.2, above.

.6 Analytical results should be from samples collected within three months of the date the material is to be used as backfill.

.7 The Departmental Representative reserves the right to request additional testing of imported material at the source and at the deposit site to satisfy their requirements. All testing will be done at the Contractor's cost.

.8 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate an alternative source.

.9 Advise Departmental Representative 2 - 4 weeks minimum in advance of proposed change of material source.

.10 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

.11 All material brought to the site that does not meet the acceptable environmental soil quality classes listed in clause 2.2.2 above, or does not perform to backfill specification requirements, will be removed from the property immediately at the Contractors cost.

.12 A copy of all manifests and/or truck weigh scale documents for material brought on site or removed from site are to be provided to the Departmental Representative.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions are acceptable for topsoil stripping.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with topsoil stripping only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

.1 Processing:

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.2 Blend aggregates, as required, including reclaimed materials that meet physical requirements of specification is permitted in order to satisfy gradation requirements for material and, percentage of crushed particles, or particle shapes specified.

.1 Use methods and equipment approved in writing by Departmental Representative.

.2 Stockpiling:

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Departmental Representative. Do not stockpile on completed pavement surfaces.

.2 Stockpile aggregates in sufficient quantities to meet project schedules.

.3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 hours of rejection.

.5 Stockpile materials in uniform layers of thickness as follows:

.1 Maximum 1.5 m for coarse aggregate and base course materials.

.6 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.7 Do not cone piles or spill material over edges of piles.

.8 Do not use conveying stackers.

.9 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.3 CLEANING

.1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.2 Leave any unused aggregates in neat compact stockpiles as directed by Departmental Representative.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 013515 – Special Project Procedures for Contaminated Sites.

.2 Section 310000 – Earthwork.

.3 Section 311100 – Clearing and Grubbing.

.4 Section 312311 – Excavation and Handling of Contaminated Material.

.5 Section 312316 – Rock Removal.

1.2 REFERENCES

.1 Fisheries and Oceans Canada Land Development Guidelines for the Protection of Aquatic Habitat (1993).

.2 Esquimalt Graving Dock Best Management Practices.

.3 U.S. Environmental Protection Agency (EPA)/Office of Water

.1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the Environmental Protection Plan for the project as per Section 013515- Special Project Procedures for Contaminated Sites, Section 6.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 At the conclusion of the project, remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 STRIPPING OF TOPSOIL

.1 Ensure that procedures are conducted in accordance with PWGSC Environmental Services Representative at EGD and adhere to *Esquimalt Graving Dock Environmental Best Management Practices.*

.2 Remove topsoil before construction procedures commence to avoid compaction of topsoil.

.3 Handle topsoil only when it is dry and warm.

.4 Remove brush from targeted area by non-chemical means and dispose of through mulching.

.5 Strip topsoil to depths to expose rock surface as directed by Departmental Representative.

.6 Segregate and stockpile topsoil as per Section 310000 – Earthwork, Part 3.4 Excavated Soil Segregation and Stockpiling. Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 The work shall consist of excavation and stockpiling of suspect contaminated material on site.

1.2 RELATED SECTIONS

.1 Section 013300 – Shop Drawings, Product Data and Samples.

.2 Section 013515 – Special Project Procedures for Contaminated Sites.

.3 Section 310000 – Earthwork.

.4 Section 311413 – Soil Stripping and Stockpiling.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM D 2487 (2000), Classification of Soils for Engineering Purposes (Unified Soil Classification System)

.2 ASTM D 5434 (1997), Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock.

.3 BC Ministry of Environment Technical Guidance Document 1, Site Characterization and Confirmation Testing.

1.4 DEFINITIONS

.1 Uncontaminated Soil – Materials that have been sampled, tested and determined by the Departmental Representative to contain concentrations of potential contaminants of concern (PCOCs) at concentrations less than the BC CSR RL standards and/or the CCME RL guidelines.

.2 Known Contaminated Soil – Materials that have been sampled, tested and determined by the Departmental Representative to contain concentrations of PCOCs greater than the BC CSR IL Standards and/or CCME IL guidelines based on site investigations.

.3 Confirmed Contaminated Soil – Materials that have been excavated, segregated and stockpiled by the Contractor and; sampled and tested by the Departmental Representative according to BC Environment "*Guidance on Contaminated Site, Site Characterization and Confirmation Testing*" and determined to contain concentrations of PCOCs greater

than the BC CSR IL Standards and/or CCME IL Guidelines.

.4 Confirmed Hazardous Waste – Materials that have been excavated, segregated and stockpiled by the Contractor and; sampled and tested by the Departmental Representative and found to contain concentrations of PCOCs greater than the standards defined in the BC Hazardous Waste Regulation.

.5 Waste Manifest (Tracking Form): A document that will allow tracking of individual truck loads of confirmed contaminated soil leaving the site. The Waste Manifest must be signed upon transfer of the materials and at the final disposal location. The Departmental Representative is to be provided with a copy of all Waste Manifests and weight scale receipts.

1.5 POTENTIALLY CONTAMINATED SOIL

.1 The soils at Esquimalt Graving Dock are known potentially to contain contaminants such as hydrocarbons, metals, and sodium and chloride. Contractor is to take appropriate measures as per Section 013515 – Special Procedures for Contaminated Sites and 310000 – Earthwork.

.2 All excavated soil under this contract shall be treated as potentially contaminated soil. Excavate, handle and store excavated soil as per this Section and all related sections outlined in Section 1.2, above.

1.6 SUBMITTALS

.1 Submit an Environmental Protection Plan as required in Section 013515 – Special Project Procedures for Contaminated Sites.

1.7 SCHEDULING

.1 The Contractor shall notify the Departmental Representative two (2) calendar days prior to the start of excavation of known or suspect contaminated material.

Part 2 Products

2.1 MATERIALS

.1 Furnish all necessary materials, at a minimum furnish:

.1 6 mil minimum plastic sheeting for base of any stockpiles;

.2 6 mil plastic sheeting for covering of contaminated soil in any stockpiles.

Part 3 Execution

3.1 EXISTING STRUCTURES AND UTILITIES

.1 No excavation shall be performed until site utilities have been field located. The Contractor shall take the necessary precautions to ensure no damage occurs to existing structures and utilities. Damage to existing structures and utilities resulting from the Contractor's operations shall be repaired at no additional cost. Utilities encountered that were not previously shown or otherwise located shall not be disturbed without approval from the Departmental Representative.

3.2 CONTAMINATED MATERIAL REMOVAL

.1 Excavation

.1 Excavated soils shall be segregated, stockpiled, and sampled as per Section 310000 – Earthwork, Part 3.4 Soil Stockpiling and Part 3.5 Stockpile Soil Testing.

.2 If topsoil is present, follow procedures in Section 311413 – Soil Stripping and Stockpiling.

.3 Excavation shall be performed in a manner that will limit the potential for contaminated material to be mixed with uncontaminated material.

.4 An excavation log describing visible signs of contamination encountered shall be maintained by the Departmental Representative for each area of excavation. Excavation logs shall be prepared in accordance with ASTM D 5434.

.2 Dewatering

.1 Surface water shall be diverted to prevent entry into the excavation. Dewatering shall be limited to that necessary to assure adequate access, a safe excavation, prevent the spread of contamination, and to ensure that backfill compaction requirements can be met.

.2 Any water pumped from the excavation shall be stored, sampled and analyzed for PCOCs, and treated (if necessary) prior to disposal based on the analytical results.

.3 Soil Disposal

Disposal documentation of soil volumes, characterization results and disposal locations must be provided to the Departmental Representative as per Section 310000 – Earthwork, Part 3.6 Soil Disposal.

3.3 CONTAMINATED SOIL HANDLING

.1 Soil Stockpiling

.1 Stockpile material as per the requirements of Section 310000 – Earthwork, Part 3.4, Excavated Soil Segregation and Stockpiling.

.2 Soil Testing

.1 Sampling and analysis stockpiled excavated soil will be performed as per the requirements of Section 310000 – Earthwork, Part 3.5 Soil Testing.

3.4 EXCAVTAION LIMIT SAMPLING

.1 Excavation Limit Sampling

.1 Excavation limit sampling will be performed as per the requirements of Section 310000 – Earthwork, Section 3.7 Excavation Sampling.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies requirements for supplying, producing and placing gravel as a granular sub-base to lines as indicated. All References to these Specifications shall be understood to refer to the latest adopted revision, including all amendments.

1.2 RELATED SECTIONS

.1 Section 310000 – Earthwork.
.2 Section 321123 – Granular Base.
.3 Section 310516 – Aggregate Materials

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM):

.1 ASTM C117-95, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C131-96, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136-96a, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D422-63 (1998), Standard Test Method for Particle-Size Analysis of Soils.

.5 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m^3).

.6 ASTM D1557-00, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3) (2,700 kN-m/m^3).

.7 ASTM D1883-99, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.8 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing Woven Wire, Metric.

1.4 QUALITY CONTROL

.1 Moisture density curves: to ASTM-D698.

.2 Sieve Analysis: to ASTM-C136

.3 Field Densities: to ASTM-D2167 or to ASTM-D2922.

.4 The contractor shall perform as many density tests as are necessary to ensure that the work confirms to the requirements specified regardless of minimum number required.

.5 The contractor shall perform the minimum number of density tests required, however if in the opinion of the Departmental Representative the work is not being performed as required the Departmental Representative may require additional testing.

.6 Field Densities:

.1 Type 3 fill – pit run gravel – as directed by the Departmental Representative.
.2 Type 4 fill – granular base – as directed by the Departmental Representative.

.7 In addition to the above, the Contractor shall demonstrate the level of effort required to achieve compaction results specified for each condition. Where this level of effort in the opinion of the Departmental Representative is not being met, the Departmental Representative may direct the Contractor to provide additional compaction tests at no cost to the Owner.

.8 Quality Assurance work does not relieve the Contractor from the responsibility for proper installation of the work or supply of materials.

Part 2 Products

2.1 MATERIALS

.1 Granular sub-base material to Section 310516 – Aggregate Materials and following requirements:
.1 Crushed, pit run or screened stone, gravel or sand.
.2 Type 3 Fill and Type 4 Fill in accordance with Section 310000 – Earthwork.

.2 Provide confirmation of “clean” of backfill material, as per Section 310516 – Aggregate Materials, Part 2.2 Source Quality Control.

Part 3 Execution

3.1 PLACING

.1 Place granular sub-base after subgrade is inspected and approved by Departmental Representative.

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

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

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

3.2 COMPACTION

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

.2 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Departmental Representative before use.

.3 Equipped with device that records hours of actual work, not motor running hours.

.4 Compact to density as directed by Geotechnical Engineer retained by Departmental Representative.

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

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

.7 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.

.8 Correct surface irregularities by loosening and adding or removing material

until surface is within specified tolerance.

3.3 PROOF ROLLING

.1 For proof rolling using fully loaded single or dual axle dump truck.

.2 Proof roll at level in sub-base as indicated. If non standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.

.3 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.4 Where proof rolling reveals areas of defective subgrade:

- .1 Remove sub-base and subgrade material to depth and extent as directed by Departmental Representative.
- .2 Backfill excavated subgrade sub-base material and compact in accordance with this section.
- .3 Replace sub-base material and compact.

.5 Where proof rolling reveals areas of defective sub-base, remove and replace in accordance with this section at no extra cost.

3.4 SITE TOLERANCES

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

3.5 PROTECTION

.1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 This section specifies requirements for supplying, producing and placing crushed gravel or quarried stone as a granular base to lines, grades and typical cross sections.

1.2 RELATED SECTIONS

.1 Section 310000 – Earthwork.
.2 Section 321119 – Granular Sub-Base.
.3 Section 310516 – Aggregate Materials.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM).

.1 ASTM C 117-95, Standard Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
.2 ASTM C 131-96, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
.3 ASTM C 136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
.4 ASTM D 698-00a, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m).
.5 ASTM D 1557-00, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/m).
.6 ASTM D 1883-99, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
.7 ASTM D 4318-00, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian Standards Board (CGSB)

.1 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver and store products as directed by Departmental Representative.

1.5 QUALITY CONTROL

.1 Moisture density curves: to ASTM-D698.
.2 Sieve Analyses: to ASTM-C136.

.3 Field Densities: to ASTM-D2167 or to ASTM-D2922.

Part 2 Products

2.1 MATERIALS

.1 Type 4 (Granular base): material to Section 310517 – Aggregate Materials and following requirements:

.1 Crushed stone or gravel.
.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.2M.

Gradation to:

Sieve Designation	% Passing
19 mm	100
12.5 m	75-100
9.5 m	-
4.75 mm	40-70
2.00 mm	25-30
0.425 mm	7-25
0.180 mm	-
0.075 mm	3-8

.3 Material to level surface depressions to meet gradation limits in accordance with 2.1.1.2.1.
.4 Liquid limit: to ASTM D 4318, maximum 25
.5 Plasticity index: to ASTM D 4318, maximum 6
.6 Los Angeles degradation: to ASTM C 131. Max. % loss by weight: 45
.7 Crushed particles: at least 60% of particles by mass within each of following sieve designation ranges to have at least one freshly fractured face. Material to be divided into ranges using methods of ASTM C 136.
.8 Soaked CBR: to ASTM D 1883, min 80 when placed under a Portland cement concrete and 100% when placed under an asphalt concrete, when compacted to 100% of ASTM D 1557.

.2 Provide confirmation of “clean” of backfill material as per Section 310516 – Aggregate Materials, Part 2.2 Source Quality Control.

Part 3 Execution

3.1 SEQUENCES OF OPERATION

.1 Place granular base after sub-base surface is inspected and approved by Departmental Representative.

.2 Placing

.1 Construct granular base to depth and grade in areas indicated.
.2 Ensure no frozen material is placed.
.3 Place material only on clean unfrozen surface, free from snow and ice.
.4 Begin spreading base material on crown line or on high side of one-way slope.
.5 Place material using methods which do not lead to segregation or degradation of aggregate.
.6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
.7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness. Departmental Representative may authorize thicker lifts (layers) if specified compaction can be achieved.
.8 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
.9 Remove and replace that portion of layer in which material becomes segregated during spreading.

.3 Compaction Equipment

.1 Compaction equipment to be capable of obtaining required material densities.
.2 Equipped with device that records hours of actual work, not motor running hours.

.4 Compacting

.1 Compact to density as directed by Geotechnical Engineer retained by Departmental Representative.
.2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
.3 Apply water as necessary during compacting to obtain specified density.
.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.
.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.5 Proof rolling

.1 Proof roll area using fully loaded single or dual axle dump truck.
.2 Departmental Representative may authorize use of other acceptable proof rolling equipment.
.3 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.4 Where proof rolling reveals areas of unsuitable subgrade:

.1 Remove unsuitable embankment material to depth.
.2 Replace with approved embankment material and compact in accordance with this section.

3.2 SITE TOLERANCES

.1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.3 PROTECTION

.1 Maintain finished base in condition conforming to this section until succeeding material is applied.

END OF SECTION

SLR

global environmental solutions

Calgary, AB
200 - 708 11th Avenue SW
Calgary, AB T2R 0E4
Canada
Tel: (403) 266-2030
Fax: (403) 263-7906

Edmonton, AB
6940 Roper Road NW
Edmonton, AB T6B 3H9
Canada
Tel: (780) 490-7893
Fax: (780) 490-7819

Grande Prairie, AB
9905 97 Avenue
Grande Prairie, AB T8V 0N2
Canada
Tel: (780) 513-6819
Fax: (780) 513-6821

Guelph, ON
105 - 150 Research Lane
Guelph, ON N1G 4T2
Canada
Tel: (226) 706-8080
Fax: (226) 706-8081

Kamloops, BC
8 St. Paul Street West
Kamloops, BC V2C 1G1
Canada
Tel: (250) 374-8749
Fax: (250) 374-8656

Kelowna, BC
107 - 1726 Dolphin Avenue
Kelowna, BC V1Y 9R9
Canada
Tel: (250) 762-7202
Fax: (250) 763-7303

Markham, ON
200 - 300 Town Centre Blvd
Markham, ON L3R 5Z6
Canada
Tel: (905) 415-7248
Fax: (905) 415-1019

Nanaimo, BC
9 - 6421 Applecross Road
Nanaimo, BC V9V 1N1
Canada
Tel: (250) 390-5050
Fax: (250) 390-5042

Ottawa, ON
400 - 2301 St. Laurent Blvd.
Ottawa, ON K1G 4J7
Canada
Tel: (613) 725-1777

Prince George, BC
1586 Ogilvie Street S.
Prince George, BC V2N 1W9
Canada
Tel: (250) 562-4452

Regina, SK
1048 Winnipeg Street
Regina, SK S4R 8P8
Canada
Tel: (306) 525-4690

Saskatoon, SK
620 - 3530 Millar Avenue
Saskatoon, SK S7P 0B6
Canada
Tel: (306) 374-6800

Toronto, ON
4th Floor, 36 King Street E.
Toronto, ON M5C 1E5
Canada
Tel: (905) 415-7248
Fax: (905) 415-1019

Vancouver, BC (Head Office)
200 - 1620 West 8th Avenue
Vancouver, BC V6J 1V4
Canada
Tel: (604) 738-2500
Fax: (604) 738-2508

Victoria, BC
303 - 3960 Quadra Street
Victoria, BC V8X 4A3
Canada
Tel: (250) 475-9595
Fax: (250) 475-9596

Whitehorse, YT
6131 6th Avenue
Whitehorse, YT Y1A 1N2
Canada
Tel: (867) 689-8957

Winnipeg, MB
1353 Kenaston Boulevard
Winnipeg, MB R3P 2P2
Canada
Tel: (204) 477-1848

Yellowknife, NT
1B Coronation Drive
Yellowknife, NT X1A 0G5
Canada
Tel: (867) 689-8957

SLR

global environmental solutions

Calgary, AB
1185-10201 Southport Rd SW
Calgary, AB T2W 4X9
Canada
Tel: (403) 266-2030
Fax: (403) 263-7906

Edmonton, AB
6940 Roper Road
Edmonton, AB T6B 3H9
Canada
Tel: (780) 490-7893
Fax: (780) 490-7819

Grande Prairie, AB
9905 97 Avenue
Grande Prairie, AB T8V 0N2
Canada
Tel: (780) 513-6819
Fax: (780) 513-6821

Guelph, ON
105 – 150 Research Lane
Guelph, ON N1G 4T2
Canada
Tel: (226) 706-8080

Kamloops, BC
8 West St. Paul Street
Kamloops, BC V2C 1G1
Canada
Tel: (250) 374-8749
Fax: (250) 374-8656

Kelowna, BC
200-1475 Ellis Street
Kelowna, BC V1Y 2A3
Canada
Tel: (250) 762-7202
Fax: (250) 763-7303

Markham, ON
200 - 300 Town Centre Blvd
Markham, ON L3R 5Z6
Canada
Tel: (905) 415-7248
Fax: (905) 415-1019

Nanaimo, BC
9-6421 Applecross Road
Nanaimo, BC V9V 1N1
Canada
Tel: (250) 390-5050
Fax: (250) 390-5042

Ottawa, ON
400 – 2301 St. Laurent Blvd.
Ottawa, ON K1G 4J7
Canada
Tel: (613) 725-1777
Fax: (905) 415-1019

Prince George, BC
1586 Ogilvie Street
Prince George, BC V2N 1W9
Canada
Tel: (250) 562-4452
Fax: (250) 562-4458

Regina, SK
1048 Winnipeg Street
Regina, SK S4R 8P8
Canada
Tel: (306) 525-4690
Fax (306) 525-4691

Saskatoon, SK
620-3530 Millar Avenue
Saskatoon, SK S7P 0B6
Canada
Tel: (306) 374-6800
Fax: (306) 374-6077

Toronto, ON
36 King Street East, 4th Floor
Toronto, ON M5C 3B2
Canada
Tel: (905) 415-7248
Fax: (905) 415-1019

Vancouver, BC (Head Office)
200-1620 West 8th Avenue
Vancouver, BC V6J 1V4
Canada
Tel: (604) 738-2500
Fax: (604) 738-2508

Victoria, BC
Unit 303 – 3960 Quadra Street
Victoria, BC V8X 4A3
Canada
Tel: (250) 475-9595
Fax: (250) 475-9596

Whitehorse, YT
6131 6th Avenue
Whitehorse, YT Y1A 1N2
Canada
Tel: (867) 689-2021

Winnipeg, MB
1353 Kenaston Boulevard
Winnipeg, MB R3P 2P2
Canada
Tel: (204) 477-1848
Fax: (204) 475-1649

Yellowknife, NT
Unit 44, 5022 49 Street
Yellowknife, NT X1A 3R8
Canada
Tel: (867) 765-5695

ESQUIMALT GRAVING DOCK EAST END EXTENSION

Geotechnical Summary Report

WSP Canada Inc
760 Enterprise Crescent
Victoria, BC, Canada V8Z 6R4
T +1 250 475-1000
wsp.com

31 August 2020

WSP File No.: 201-00771-00

Public Works and Government Services Canada
12th Floor, 800 Burrard Street
Vancouver BC V6Z 2V8
V6Z 2V8

Attention: **George Strazicich, P.Eng., Struct. Eng.**

Subject: **Geotechnical Assessment Report**
East End Extension of the Esquimalt Dry Dock
825 Admirals Road, Esquimalt BC

Dear Sir:

WSP Canada Inc. is pleased to submit a PDF copy of the Geotechnical Assessment report for the above-referenced project. This is the final report and incorporates comments on the draft report of June 22, 2020, received from Herold Engineering.

We trust that the enclosed report meets your current requirements. If you have questions regarding this project, the enclosed report, or our services, please do not hesitate to call the undersigned at (250) 475-1000.

Thank you for using our professional services. We look forward to serving your future environmental and engineering needs.

Yours Sincerely,

WSP Canada Inc.

Stewart Dolan, P.Eng.
Geotechnical Engineer

Table of Contents

1. Introduction 1
2. Scope of Work 1
3. Background Information 2
   - 3.1 Site Description 2
   - 3.2 Geological Mapping 3
   - 3.3 Historical Information 3
   - 3.4 Proposed Development 4
   - 3.5 Seismic Hazard 4
4. Assessment Work 5
   - 4.1 Summary of Fieldwork 5
   - 4.2 Subsurface stratigraphy 6
   - 4.3 Groundwater depths 7
   - 4.4 In situ testing 7
   - 4.5 Laboratory Testing 8
   - 4.6 Geological Cross Sections 11
5. Geotechnical Recommendations 11
   - 5.1 General 11
   - 5.2 Seismic Site Class 12
   - 5.3 Site Preparation 13
   - 5.4 Temporary WOrks 13
   - 5.5 Dock Wall Foundations and Dock Floor 14
   - 5.6 Dock Walls 15
   - 5.7 Permanent Rock Anchors 16
   - 5.8 Existing Upper Slope Above EAst Retaining Wall 17
6. Future Geotechnical Work 18
7. Closing and Terms 19

LIST OF APPENDICES

Appendix A – Figures
Appendix B – Borehole Logs
Appendix C – Photo Table
Appendix D – Particle Size Distribution
Appendix E – Geological Cross Sections
Appendix F – Wall Pressure Diagrams
Appendix G – Standard Limitations

1. INTRODUCTION

WSP Canada Inc. (WSP) was engaged by Public Works and Government Services Canada (PWGSC) to provide geotechnical engineering services for the proposed East End Extension of the Esquimalt Graving Dock. The original design for the east end extension was completed by Klohn Crippen Berger (KCB) in 2013 but the project did not proceed at that time to tender or construction. The scope of WSP's involvement in this project was to support the updated design by Herold Engineering Ltd. (HEL) to reflect current code requirements. We understand that the structure will be designed in accordance with the provisions of the 2019 Canadian Highway Bridge Design Code CSA S6:19.

This geotechnical report was prepared in accordance with our geotechnical proposal dated 21 November 2019 (WSP Proposal #P19-11004-03 revision 4). Authorization to proceed was given via the fully executed call-up EZ108-202302.

This report summarises our geotechnical site assessment and provides geotechnical discussion and recommendations for the proposed dry dock extension.

2. SCOPE OF WORK

The scope of geotechnical work set out in our accepted proposal consisted of:

- Conduct a review of existing geotechnical reports previously prepared for the East End Dock Extension project. Review available surficial geological mapping and local geotechnical setting at the site location. Provide recommendations for additional geotechnical investigation to complete the design.
- Carry out additional required geotechnical investigation and provide this report sealed by Professional Geotechnical Engineers registered to the province of BC with findings including geotechnical design parameters in accordance with 2015 NBC for the following:
    - Lateral pressures for the design of new dock walls including static, dynamic, and hydrostatic load conditions;
    - Bearing capacities for dock wall foundations and dock floor;
    - Review the stability of the existing upper east end retaining wall adjacent to the proposed excavation during construction (however, we note that the shoring design, temporary works and wall stability during construction will be the responsibility of the Contractor);
    - Rock anchor embedment design including group effects and recommendations for installation such as casing requirements for new dock walls and dock floor; and
    - Review the stability of the existing upper slopes.

We understand that the site is known to have historic contamination, and this was assessed and reported by SLR Consulting Ltd. (SLR) separately from this document. We further understand that EGD was aware of midden materials placed across the slope to the east of the dock and these were reviewed by Millenia Research.

3. BACKGROUND INFORMATION

3.1 SITE DESCRIPTION

The site is located at 825 Admirals Road in Esquimalt BC. The site is bounded to the north by Admirals Road and to the south by the Esquimalt Harbour. A site location plan is included in Appendix A.

From the PWGSC website[1], the Esquimalt Graving Dock was built from 1921 to 1926 to meet the increasing demands of the shipping industry in Canada. The dock is 357.5m long, 38.4m wide and 14.93m high.

Figure 1: Completed dock looking east, taken 1925 (source: PWGSC website)

Based on our review of the CRD Regional Map[2], the base of the existing dry dock sits approximately 12 m below mean sea level. A paved area to the east, north and south of the dock sits roughly at 3m above mean sea level (approximately 1.1m above high water level). A retaining wall is located approximately 43m to the east of the existing dock wall. Above this retaining wall is a slope, which is inclined down to the west at around 20˚ from approximately EL.14m to approximately EL.10m near the crest of the wall.

[1] PWGSC Official Website. (2020). Accessed on 26 March 2020 at https://www.tpsgc-pwgsc.gc.ca/biens-property/cse-egd/propos-about-esquimalt-eng.html#c4

[2] Capital Regional District. (2020). *CRD Regional Map.* Accessed on 26 February 2020 at https://maps.crd.bc.ca/Html5Viewer/?viewer=public

At the time of writing this report, the site was occupied by several large and small buildings, trailers, cranes, and equipment owned and/or operated by PWGSC, EGD and their contractors on site. The site is accessed via Admirals road to the north.

3.2 GEOLOGICAL MAPPING

Surficial geological mapping[3] notes the site as unit 'FC2' which is assigned to areas where fill overlies unit 'C2' (thick soft Victoria clay). In shoreline settings, fill may overlie soft Holocene marine mud that in turn overlies the Victoria clay.

The geological mapping for the area[4] records the bedrock in this area to comprise andesite, amygdaloid, porphyry tuff etc. rocks that are collectively known as the Vancouver Volcanics of lower Jurassic age.

Structural geological mapping available on iMap BC[5] shows the closest fault is approximately 3.2km southwest of the site.

3.3 HISTORICAL INFORMATION

The following documents were made available to WSP:

- Report titled 'Phase I Geotechnical Investigation – Data Report' by Klohn Crippen Berger dated 05 September 2008.
- Report titled 'East Slope Stability Investigation – Data Report' by Klohn Crippen Berger dated 17 September 2008.
- Report titled 'East End Extension – Geotechnical Data Report' by Klohn Crippen Berger dated 25 February 2009.
- Report titled 'EGD East End Extension – Concept Study and Investigation' by Klohn Crippen Berger dated 7 April 2009.
- Drawing set titled 'Esquimalt Graving Dock Dry Dock Extension' by Klohn Crippen Berger (undated).

A number of investigative techniques were employed as part of the above site investigations, including ground penetrating radar, hydraulic (air track) boreholes, Becker hammer boreholes and mud rotary boreholes with HQ3 rotary core follow-on. The borehole logs typically indicate that the ground conditions in the area of the proposed widening (around EL.4.6m) comprise:

- Fills (gravel and cobbles with sandy clay) to 1.5 to 6.1m below ground level (bgl); over
- Metadiorite bedrock, with approximately the upper 1m weathered and variable between strong rock with persistent discontinuities, and highly fractured zones.

[3] British Columbia Geological Survey Branch. *Quaternary Geological Map of Greater Victoria.* Geoscience Map 2000-2, Scale 1:25,000
[4] Canada Geological Survey. (1914). *Victoria Sheet Vancouver Island.* Map 70A, Scale 1:62,500
[5] Government of British Columbia. (2020). *iMap BC [website].* Accessed on 19 June 2020 via https://maps.gov.bc.ca/ess/hm/imap4m/

Boreholes advanced through the upper slope to the east (around EL.10 to 14.5m) typically recorded:

- Silt/clay to 8.3 to 9.8m bgl;
- Dense sand and gravel to 8.7 to 10.5m bgl; over
- Refusal on inferred bedrock.

We note that the boreholes advanced through the upper slope predate the construction of the existing east retaining wall.

Historic photographs were presented in the KCB reports and design drawings. The photos show the dock area blasted into the bedrock in 1922 and the dock being constructed with large volumes of mass concrete in 1924. The east retaining wall design drawings, record drawings and photographs note the wall is founded on mass concrete over bedrock with three rows of rock anchors that secure the wall to the underlying bedrock.

3.4 PROPOSED DEVELOPMENT

It is our understanding that the plan is to extend the length of the current Graving Dock by 30 m at the east end. Drawings, specifications and a geotechnical report for the East End Extension were completed by Klohn Crippen Berger (KCB) Consultants in 2013. However, the project did not advance to construction tender or construction at that time. It is understood that the design now being undertaken by HEL will refine the KCB design to comply with the current Bridge Code CSA S6:19.

Preliminary design drawings provided by HEL show the proposed dock footprint extending 30m to the east, with a small section in the centre extending a further 6m to the east. The structure comprises reinforced concrete walls and slab approximately 750 mm thick. Lateral anchors are shown spaced 1.5m horizontally, 3m vertically and 8.75m long through the retaining walls. Vertical uplift anchors through the floor slab are shown spaced 1.5m laterally in both directions, with alternating rows staggered, and 7m long.

3.5 SEISMIC HAZARD

The 2018 BC Building Code peak ground acceleration (PGA) for the site was taken from the seismic design tool for engineers[6] and is presented in Table 1 below. We note that the proposed design ground accelerations for the 2020 NBC were not available at this time of preparing this report; however, the new code may be in effect whilst the design is ongoing.

[6] Government of Canada. (2020). *Seismic Design Tool for Engineers.* Accessed on 27 February 2020 at http://www.earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/index-en.php

Table 1: 2018 BC Building Code Design PGA Values

DESIGN EARTHQUAKE	1 IN 2475	1 IN 475
PGA	0.586g	0.307g

4. ASSESSMENT WORK

4.1 SUMMARY OF FIELDWORK

WSP attended site from 03 to 12 March 2020 to advance six geotechnical boreholes to investigate the subsurface ground conditions and install two standpipe piezometers to measure groundwater levels. Boreholes were advanced using a multi-drill rotary track rig supplied and operated by Mud Bay Drilling of Surrey BC. Before drilling, WSP submitted a BC 1 Call and engaged the services of a private utility locator, GeoScan Subsurface Surveys, to locate buried utilities and clear proposed borehole locations on 18 February 2020 and 03 March 2020. SLR Consulting also attended site to advance environmental boreholes using the same drill crew, and these boreholes were logged and will be presented in a separate environmental report by SLR.

Two diamond cored drill holes were located on the flat paved area at dock level and advanced to depths of 30.6m and 31.1m bgl. The boreholes were located within the footprint of the new dock extension to assess the nature of the bedrock and collect information pertinent to evaluating the seismic rock performance and rock anchor embedment. Three mud rotary drill holes were located on the upper soil slope to the west of the dock and advanced to depths ranging from 15.5m to 20m bgl. These boreholes were intended to evaluate the overburden soils behind the upper east end retaining wall and slope. Two standpipe piezometers were installed into overburden and bedrock for groundwater monitoring in Boreholes BH20-01 and BH20-02). The borehole locations are shown on Figure 2 included in Appendix A.

All boreholes were advanced to scheduled target depths ranging from 15.5m to 31.1m below ground level (bgl). BH20-01A was advanced to 4.1m bgl, directly adjacent to BH20-01 in order to verify the bedrock elevation, as the drilling method used to clear an obstruction in BH20-01 could not accurately determine the bedrock elevation. WSP was on site during drilling to log the subsurface conditions and collect samples from all geotechnical boreholes. Sampling methods included standard penetration testing (SPT) split spoon sample recovery, rock core extractions, and remoulded sample recovery. Boreholes were advanced using a combination of mud-rotary (soils) and ODEX (rock fill) drilling with SPT and HQ3 (diamond tip rock coring).

WSP returned to site on 12 March and 01 April 2020 to record water levels in the standpipe piezometers.

4.2 SUBSURFACE STRATIGRAPHY

The ground conditions encountered around the area of the dock extension typically comprised rock fills over bedrock (BH20-04 and BH20-07). Across the upper slope, the soils encountered consisted of rock fills, over Victoria clay, over dense sand and gravel, over bedrock. The bedrock was classified as medium strong slightly to moderately weathered metadiorite (wark gneiss) with closely spaced discontinuities dipping at 15° and 50° and some sections of fractured core.

The borehole logs are included in Appendix B. The subsurface varied across the site and are summarized in Table 2 below.

Table 2: General soil stratigraphy across the site

	BH20-01 & 01A	BH20-02	BH20-03	BH20-04	BH20-07
	Depth to top of stratum (m bgl)				
Ground surface elevation (approximate)	EL.13m	EL.14m	EL.14m	EL.4.6m	EL.4.6m
ASPHALT				0	0
Rock FILL	0	0	0	0.3	0.2
Stiff to hard CLAY		4	6.1		
Firm to stiff CLAY		9.1			
Soft to firm CLAY			12.2		
Dense SAND & GRVEL		11.6	13.2		
BEDROCK	3.5	12.2	15.0	1.2	3.3

Highly Fractured BEDROCK Zones	(15.3 - 15.4) (18.0 – 18.3)	(14.8 – 15.5)	(15.0 – 19.3)	(2.4 – 3.0) (19.1 – 20.3) (23.6 – 24.0) (29.5 – 30.6)	(5.85 – 5.87) (11.7 - 11.71) (13.7 – 18.7) (29.4 – 29.6)

4.3 GROUNDWATER DEPTHS

Measured groundwater levels are presented in Table 3 below, and are also presented on the borehole logs in Appendix B. Groundwater levels are expected to vary tidally and seasonally, and ongoing monitoring is recommended throughout the design phase to better understand the groundwater regime at the site.

Additional groundwater monitoring was being undertaken at the time of writing and the results will be issued in a follow up technical memo.

Table 3: Recorded groundwater levels

DATE OF READING	TIDE EL. (APPROXIMATE)	BH20-01	BH20-02	BH20-07
12 March 2020 12:20	2.5m	5.36m bgl		1.55m bgl
01 April 2020 16:30	0.74m	5.46m bgl	8.24m bgl	1.52m bgl
28 August 2020 11:00	1m	5.17m bgl	7.73m bgl	1.59m bgl

4.4 IN SITU TESTING

Standard penetration testing (SPT) was performed in the rock fills, clay and sand and gravel layers in the upper bench in boreholes BH20-01A, BH20-02 and BH20-03. SPT blow counts (N values) are presented on the borehole logs and ranged from 35 to >50 in the fills, 2 to 13 in the clay and >50 in the sand and gravel.

Field vane testing (FV) was performed in clay in BH20-02 and BH20-03. Pocket penetrometer testing was performed on recovered samples of clay from BH20-02 and BH20-03. Photographs taken during the fieldwork are included in Appendix C.

The recorded torque values from the shear vane performed in BH20-02 & BH20-03 were converted for the vane size in accordance with ASTM D2573 and corrected for plasticity index and the interpreted results are presented in Table 4 below.

Table 4: Converted & interpreted shear vane test results

	BH20-02 7.0m bgl	BH20-02 10.1m bgl	BH20-03 9.5m bgl
Vane size	Large	Small	Small
Peak torque (m.kg)	30	4	3
Residual torque (m.kg)	2	0.8	1
Plasticity index	23.5	29.3	23.4
Corrected peak shear strength (kPa)	155.0	67.5	52.3
Corrected residual shear strength (kPa)	6.0	11.3	15.1

4.5 LABORATORY TESTING

Laboratory testing comprised moisture content on all recovered soil samples, Atterberg limit testing was completed on three samples of clay and particle size distribution testing (also called gradation analysis) undertaken on three samples of sand and gravel. Soil descriptions and strata depths, collected samples, in situ testing results (uncorrected) and laboratory testing results are presented on the borehole logs included in Appendix B. The particle size distribution curves are included in Appendix D.

Point load (PL) testing and unconfined compressive strength (UCS) testing was performed on samples of recovered rock core and the results are presented in Table 5.

Table 5: Point load (PL) testing results

Borehole	Depth (m bgl)	Test Type	W (mm)	D (mm)	D_e (mm)	D_e^2 (mm^2)	Load, P (kN)	Uncorrected Point Load, I_s (MPa)	Size Correction, F	Corrected Point Load, $I_{s(50)}$ (MPa)	Comment
20-01	10.4	Axial	58	61	67	4505	4.112	0.913	1.14	1.042	
20-01	10.5	Diam		61	61	3721	15.57	4.183	1.09	4.575	
20-01	11.5	Axial	47	61	60	3650	24.28	6.651	1.09	7.242	
20-01	11.6	Diam		61	61	3721	15.2	4.085	1.09	4.467	
20-01	11.6	Diam		61	61	3721	19.85	5.336	1.09	5.835	
20-01	15.1	Diam		61	61	3721	27.48	7.386	1.09	8.077	
20-01	15.3	Axial	60	61	68	4660	40.94	8.784	1.15	10.106	
20-01	18	Axial	52	61	64	4039	33.55	8.308	1.11	9.255	
20-01	18.2	Diam		61	61	3721	30.53	8.205	1.09	8.973	
20-02	12.9	Axial	58	61	67	4505	19.85	4.407	1.14	5.032	Invalid
20-02	13	Diam		61	61	3721	9.94	2.671	1.09	2.921	
20-03	16.6	Axial	60	61	68	4660	3.096	0.664	1.15	0.764	
20-03	19	Diam		61	61	3721	4.12	1.107	1.09	1.211	
20-04	3.1	Axial	58	61	67	4505	3.714	0.824	1.14	0.941	
20-04	3.5	Diam		61	61	3721	5.118	1.375	1.09	1.504	
20-04	9.4	Axial	50	61	62	3883	7.792	2.006	1.10	2.216	
20-04	9.6	Diam		61	61	3721	12.5	3.360	1.09	3.675	
20-04	15	Diam		61	61	3721	11.81	3.174	1.09	3.472	Invalid
20-04	15.8	Axial	57	61	67	4427	5.5	1.242	1.14	1.413	Invalid
20-04	16.6	Axial	31	61	49	2408	1.416	0.588	0.99	0.583	Alternate
20-04	16.7	Diam		61	61	3721	17.17	4.614	1.09	5.046	Alternate
20-04	22.4	Diam		61	61	3721	5.566	1.496	1.09	1.636	
20-04	22.6	Axial	49	61	62	3806	18.16	4.772	1.10	5.245	Invalid
20-04	22.9	Axial	33	61	51	2563	11.69	4.560	1.01	4.586	Alternate
20-04	27.9	Diam		61	61	3721	27.3	7.337	1.09	8.024	
20-04	28.1	Axial	60	61	68	4660	26.48	5.683	1.15	6.538	

Borehole	Depth (m bgl)	Test Type	W (mm)	D (mm)	D_e (mm)	D_e^2 (mm^2)	Load, P (kN)	Uncorrected Point Load, I_s (MPa)	Size Correction, F	Corrected Point Load, $I_{s(50)}$ (MPa)	Comment
20-07	4.2	Diam		61	61	3721	12.67	3.404	1.09	3.723	Invalid
20-07	4.2	Axial	31	61	49	2408	17.81	7.395	0.99	7.333	
20-07	5.5	Diam		61	61	3721	15.02	4.037	1.09	4.414	Alternate
20-07	10.4	Diam		61	61	3721	21.63	5.812	1.09	6.356	
20-07	10.5	Axial	45	61	59	3495	18.78	5.374	1.08	5.795	
20-07	18.7	Axial	49	61	62	3806	5.162	1.356	1.10	1.491	Invalid
20-07	18.9	Diam		61	61	3721	17.11	4.597	1.09	5.027	
20-07	24.4	Diam		61	61	3721	18.66	5.016	1.09	5.485	
20-07	25.4	Diam		61	61	3721	15	4.032	1.09	4.409	
20-07	25.5	Axial	49	61	62	3806	8.836	2.322	1.10	2.552	
20-07	30	Axial	38	61	54	2951	9.914	3.359	1.04	3.487	
20-07	30.5	Diam		61	61	3721	2.31	0.621	1.09	0.679	

*Invalid test indicates that the break did not pass through both loading points as per ASTM D5731.

Table 6: Unconfined compressive strength (UCS) testing results

Borehole	Depth (m bgl)	UCS (MPa)
BH20-04	4.1	34.8
BH20-04	8.8	61
BH20-04	15.2	44.7
BH20-04	22.5	28.5
BH20-04	28.9	56.2
BH20-07	6	34.7
BH20-07	9.6	57
BH20-07	19.2	39.3
BH20-07	25.4	31.6
BH20-07	30.2	21.5

4.6 GEOLOGICAL CROSS SECTIONS

Inferred generalized geological cross sections indicating the surface of the bedrock and zones of closely spaced fracturing have been developed using the historical boreholes, WSP's 2020 boreholes and the preliminary design details provided by HEL. The geological sections are included in Appendix E.

5. GEOTECHNICAL RECOMMENDATIONS

5.1 GENERAL

Based on the findings of our site investigation, the extension to the graving dock is considered geotechnically feasible provided the following recommendations are followed. The input that is provided below has been based on the preliminary information provided in our draft report dated June 22, 2020 and updated based upon HEL's 99% design drawings provided to WSP in August 2020. Follow up confirmatory field reviews must be conducted by WSP during construction to review the actual rock mass condition to verify that our assumptions and recommendations remain valid.

The anticipated ground conditions in the area of the proposed east dock extension are expected to comprise shallow rock fills of cobble and gravel sized particles, to depths of up to 3m bgl, over medium strong wark gneiss bedrock. From our review of the recovered rock cores, some sections of the rock appear strong with a stability that will be controlled through the discontinuities (fractures), whereas some zones at surface and at depth are fractured and will develop more of a continuum (soil) type failure. The rock appears to be more consistently fractured below the elevation of the dock floor and the UCS of the rock was also found to be lower below this grade than the rock behind the proposed dock walls. This observation has implications in terms of resisting uplift on the floor slab. We also note that fractured zones were encountered behind the proposed dock walls and the bond zones of the horizontal anchors are expected to be located through these zones, either partly or wholly depending on the orientation of the features observed.

Based on our review of the available existing information and the findings from the WSP 2020 boreholes, the upper slope appears to have been constructed with engineered fill following construction of the existing east retaining wall. The retaining wall itself appears to have been founded on mass concrete over bedrock, with both vertical and raking anchors tying the structure to the underlying bedrock. The natural soils behind the wall appear to consist of Victoria clay that was likely cut temporarily to allow construction of the retaining wall. The slope above the wall appears to have then been reconstructed using shotrock fills. Victoria clay is a normally consolidated marine clay with a stiff desiccated upper crust up to around 3 to 5m in thickness. Below the stiff crust the material becomes firm to soft with depth. From our review of the boreholes this material appears to be retained entirely by the east retaining wall and all soils above appear to comprise only engineered fill. A layer of dense sand and gravel was also encountered below the clay, directly over bedrock. This deposit is considered to be an older glacial deposit this is typically found between the newer Victoria clay deposits and the underlying bedrock.

Challenges in terms of design and construction will include high degree of variability in the rock mass, aggressive conditions (tidal seawater), high groundwater and fractured rock conditions, as described in further detail below.

5.2 SEISMIC SITE CLASS

The ground conditions under the proposed dock wall footings and floor slab are expected to be moderately weathered bedrock with multiple fractured zones. We recommend that the site should be considered Site Class B '*Rock*' in accordance with Table 4.1 of the 2019 Canadian Highway Bridge Design Code.

Based on the results of the Atterberg testing, the Victoria clay retained behind the existing east retaining wall is not expected to be susceptible to liquefaction or cyclic softening.

5.3 SITE PREPARATION

Site preparation should involve the removal of all asphalt and fills down to the bedrock surface. We expect that the majority of the excavation will require rock removal and note that metamorphic rock of this nature can be slow to excavate. Any blasting should be carried out with a methodology to limit vibrations affecting nearby structures and buried infrastructure including the existing east retaining wall. We would suggest that it is in the Owner's interest to have independent pre-condition survey(s) of the surrounding structures completed before beginning work. Vibration monitoring should be considered to mitigate damage to surrounding facilities and structures. We also recommend that the Contractor monitor the existing east retaining wall for movement throughout the works.

The footprint of the dock extension should be a controlled shearline blasted to leave a clean rock face. This should help reduce the need for remedial work to mitigate the risk of rockfall to workers during the temporary works during construction, as well as work necessary to re-establish the design profile. The Contractor should exercise care to minimize over-blasting, particularly along the east side of the excavation which will be below the east retaining wall. We recommended that the contract specifications identify the remedial measures necessary in the event of over-blast, either behind the proposed walls or below the dock floor slab.

WSP should be retained to review all exposed rock cuts and subgrades prior to placement of any engineered fills or concrete, to verify that our assumptions on the rock mass condition used in determining the following recommendations remain valid.

WSP recommends that any engineered fill comprises clean, well graded, 75 mm minus crushed gravel, placed and compacted to at least 95% modified Proctor maximum dry density. WSP should conduct in place density testing to verify the material has been properly compacted, alternatively a method specification could be developed with WSP at the time of construction and monitored for compliance throughout backfilling.

5.4 TEMPORARY WORKS

Temporary support of the upper fill soils will be required until the dock walls are constructed. Temporary works should be designed by the Contractor to suit their work methods and must comply with WorkSafeBC regulations. Temporary works will need to include a temporary groundwater control plan and an erosion and sediment control plan, which should be in place before work starts and monitored throughout construction for effectiveness. A groundwater monitoring plan should be prepared by an experienced dewatering contractor.

Temporary rock cuts should be assumed at 0.25H:1V wherever possible. However, this may not be possible along the east wall due to the retaining wall above. Depending on the nature of the cut rock face, temporary protection measures may be required to protect workers whilst in the excavation. We recommend that the cut be control shearline blasted to reduce the risk of a heavily fractured rock cut which may create a significant rockfall hazard and remedial work.

From our review of the drawings and photographs provided to WSP it appears that the existing retaining wall (designed by others) is founded on and anchored to bedrock. Based on this, the proposed rock excavation for the dock extension is considered unlikely to destabilise the wall in the short or long term. We would recommend that the Contractor be responsible for monitoring the wall during the excavation. Should unfavourable joints or discontinuities be observed in the rock mass that could undermine the wall, it may be necessary to implement temporary shoring or underpinning of the structure to prevent excessive movements. Careful construction sequencing could allow for the anchor installation to proceed as the rock is excavated, and to allow the anchors to also be used as temporary support of the excavation until the permanent dock walls are cast.

Any over blast beyond the design allowance for the excavation should be backfilled with concrete. The use of engineered fill behind the new dock walls is not recommended.

5.5 DOCK WALL FOUNDATIONS AND DOCK FLOOR

Foundations of the dock walls are expected to comprise a reinforced concrete foundation system of shallow strip footings founded on bedrock, which based on the recovered rock core is expected to be fractured at the likely depth of footings (below 15m bgl). Given the nature of the bedrock, long term settlements are not considered likely. Bedrock surfaces shall be prepared flat or level and changes in elevation along the foundation should be addressed by cutting horizontal steps into the bedrock of no more than about 300mm in height. WSP must review the exposed and prepared subgrade before placement of foundation concrete.

The dock wall Foundations below 5m bgl can be designed for factored ultimate limit state (ULS) and serviceability limit state (SLS) bearing capacities of 750kPa and 500kPa respectively.

A factored coefficient against sliding of 0.5 can be used for the concrete rock interface, provided concrete is cast directly against the prepared rock surface. If engineered fill or precast concrete is to be used, WSP must be notified to revise this parameter.

The following Hoek-Brown parameters can be used for the design of the dock floor slab.

Table 7: Rock design parameters for dock slab

Rock Type	UCS	Geological strength index (GSI)	Hoek Brown Constant (m_i)	Unfactored Ultimate Average Bond Stress
Wark gneiss	21.5 MPa	30-40	20±5	2150kPa

We note that hydrostatic uplift forces on the dock floor slab are to be resisted via a grid of double corrosion protected rock anchors, as discussed below.

In addition to the above, we note that the site is an aggressive environment due to the tidal effects of seawater. Reinforced concrete should be designed to meet the requirements of CSA A23.1-19 Exposure Classes C-1 and S-3. Depending on the durability and service life requirements, Exposure Classes C-XL and S-3 will be required.

5.6 DOCK WALLS

Design loads on the dock walls will be due to a combination of hydrostatic pressures from the high groundwater elevation, surcharge loading distributed through the soils (fills in the upper 3m), and also from the retained rock mass. Under seismic conditions the loads on the walls from the rock mass may be associated with a large planar slide along the observed steeply inclined discontinuities or, alternatively, from a continuum type failure involving the more fractured zones. For the purpose of design, the force from planar sliding along a steeply inclined discontinuity is considered to apply only a horizontal resultant to the back of the wall, with the vertical component considered to be transferred only to the rock mass below.

Groundwater elevations were typically measured 1.5m bgl and the top of wall design elevation. However, we note that groundwater levels vary seasonally and recommend that additional groundwater monitoring be carried out to develop a larger data set. In the interim, we recommend a conservative groundwater elevation be considered at the top of the dock wall. The design should consider an unbalanced hydraulic pressure on the back of the wall i.e. the loading case when the dock is empty. Design tsunami conditions may result in higher hydrostatic pressures but are outside of this scope. We note that the Bridge Code recommends using the high-water level with a design factor of 1.1; however, we advise that if this water elevation would exceed the top of the apron then this water level could not be achieved in practice (i.e. if the water level exceeds the top of wall then the water overtopping would reduce the differential water pressure).

The determination of the 'earth pressure' parameters for use in lateral load calculations is influenced by the wall design and in particular if the wall is considered to be yielding or non-yielding. To apply the yielding case the wall must be able to deflect or rotate a sufficient amount to mobilise the active condition in the soil. We have assumed that the wall cannot deflect sufficiently to allow permanent deflection of the rock and have used the full PGA for the 1 in 2475 design earthquake in determining the seismic loads. We have also assumed that for the upper sections of the wall the backfill will comprise engineered fill as recommended in Section 5.3 above. Use of different fill materials would result in a change in earth pressure distribution and must be reviewed by WSP if different backfill is to be considered. Surcharge loadings provided by HEL were used in determining the horizontal characteristic 'earth' pressures as per CSA S6:19; however, hydrostatic pressures will be in addition to the lateral 'earth' pressures.

Characteristic (unfactored) horizontal pressures acting on the dock walls are presented on the lateral pressure diagrams included in Appendix F. Characteristic lateral pressure distributions have been provided for the self weight of the soil/rock and as a result of the live load surcharges, for both the static and seismic cases. WSP reviewed the various loading scenarios presented in the design criteria on drawing number S001 and found the 48kPa UDL gives the most critical lateral earth pressure and this is presented on our

diagram (unfactored). The wall designer will need to apply the various load factors for each design scenario as set out in CSA S6:19.

5.7 PERMANENT ROCK ANCHORS

Permanent rock anchors should be designed in accordance with PTI DC35.1-14. From the 99% design drawings the anchor holes will be 146 mm in diameter. We recommend that all anchors have a minimum free stressing length of 3m to locate the anchor bond beyond the critical failure plane and to locate the bond at a sufficient depth to provide the necessary rock wedge stability (note this applies to both lateral and uplift anchors). Anchors should be spaced no closer than 1.5m, although larger spacing could provide some geotechnical efficiencies if it can be accommodated by the structure. For lateral anchors in the dock wall, we recommend the bottom row of anchors have a minimum bond length of 5m to mitigate the risk of a large planar slide occurring along a steeply inclined plane in the rock mass.

Anchor group effects should be suitably mitigated by ensuring the minimum spacing and free tendon lengths above are met. The hole diameter is an important aspect of the anchor design and changes in diameter will be reflected in changes in the length of free stressing length to ensure the pullout cone is not the dominant failure mode, as this introduces significant anchor group effects. WSP will need to be advised if changes in hole diameter are contemplated.

Permanent anchors should be designed with a Class I double corrosion protection system (Section 5.3 PTI DC35.1-14). Following completion of anchor testing, the free stressing length shall be fully grouted around the bond breaker. Spacers shall be used to ensure a minimum and even grout coverage around the tendon bond length.

The following parameters in Table 8 can be used in the preliminary design of the rock anchors. We recommend that it is appropriate to use these values for preliminary sizing of both horizontal anchors. As previously noted, there are fractured zones recorded in the upslope boreholes (BH20-01, 02 and 03) and these zones could be steeply dipping (to the zones in BH20-04 and 07) in which case the horizontal anchors would therefore be bonded in these fractured zones. We recommend that destructive anchor testing be performed prior to, or during, construction to develop a site-specific pullout capacity for the anchors (both horizontal and vertical). This may also allow us to use a less conservative geotechnical resistance factor (see below).

Table 8: Preliminary rock anchor design parameters

Average ultimate grout/rock bond stress	21.5 MPa
Hole diameter	146 mm
Ultimate pullout resistance per metre run of anchor	986 kN/m

Geotechnical resistance factor ϕ_{gu} (Table 6.2 CSA S6:19)	0.35
Factored pullout resistance per metre run of anchor	345 kN/m

As indicated above, if the hole diameter changes WSP must be notified to revise the capacities given above. Our calculated pull out resistance is based on a grout to rock bond strength developed from a review of published literature, laboratory testing of recovered rock core samples and local experience. While the unit bond strength is considered to be moderately conservative for intact rock, the logs indicate a wide variation in the rock mass, both laterally and with depth, which could result in a different anchor capacity. A site-specific anchor capacity can be determined by performing pre-production testing during detailed design or at the time of construction. Given the large number of anchors, this may offer design efficiencies by verifying a higher anchor capacity, thus requiring a reduced bond length and also allowing the use of a less conservative geotechnical resistance factor (CSA S6:19 Table 6.2). We recommend conducting three pre-production tests on both the dock walls and floor (i.e. six tests in total), to give a low, typical or high understanding of the pullout capacity as defined in CSA S6:19 Table 6.2. Depending on the number of tests performed, this could potentially lead to a geotechnical resistance factor being used, instead of the current 0.35. We propose to discuss this further with the design team and client following the submission of this report.

All anchor testing (pre-production, performance and proof testing) shall be performed in accordance with PTI DC35.1-14 Section 8.3. We recommend that performance testing be performed on the first two anchors installed on both the dock wall and floor (four in total) and then 5% of anchors thereafter. Proof testing should be performed on all other production anchors.

5.8 EXISTING UPPER SLOPE ABOVE EAST RETAINING WALL

As previously noted, the existing upper slope above the east retaining wall appears to be constructed from engineered fill, designed and installed by others. No survey information was made available to WSP to verify the actual slope geometry; however, based on visual site observations, the slope appears to be terraced at an overall 2H:1V slope or shallower. Some shallow seismic movements of these soils could be anticipated under seismic loadings.

The deeper soils comprise soft to firm Victoria clay and based on our liquefaction potential screening analysis these do not appear to be subject to cyclic strain softening effects. We also note that these soils are confined entirely behind the existing east retaining wall, which appears to be founded on rock. The global stability of this slope is therefore controlled by this retaining wall, which was designed and installed by others.

We note that there is a large steel lighting column located part way up the slope. From review of the KCB design drawings and construction photographs, the foundation of this column predates the east retaining wall and appears to have been left untouched during the construction (the column itself appears to have been temporarily removed and reinstated following completion of the work). The bearing conditions of this column are unknown. We noted that a modular concrete block retaining wall is located immediately behind this column.

We do not anticipate this slope likely to be negatively impacted by the long-term effects of the works currently envisaged under our agreed scope of work. However, some shallow surficial movement of the soils could be expected under seismic loading which may include the bearing soils below the column and the block wall immediately behind the column. These deformations could potentially affect the lighting column during a large earthquake, depending on its foundation design and proximity to the block wall. A more detailed review of this column and slope could be conducted if required by PWGSC.

6. FUTURE GEOTECHNICAL WORK

As set out in our scope of work we anticipate the following future geotechnical work, following the issuance of this report:

- Interaction with the structural engineers during detailed design of the dock walls and anchors;
- Review of the geotechnical aspects of the drawings and specifications to verify that our recommendations are reflected in the contract documents; and
- Field reviews and materials testing during construction to verify the assumptions made in this report remain valid, and that our recommendations are being followed in the field. This may include testing rock anchor installation prior to or during the early construction stage.

7. CLOSING AND TERMS

This report was prepared in accordance with our service contract with Public Works and Government Services Canada for this project.

This document represents an electronic version of the original hard copy document, sealed, signed and dated by Stewart Dolan, P.Eng. and retained on file. The content of the electronically transmitted document can be confirmed by referring to the original hard copy on file.

Yours sincerely,

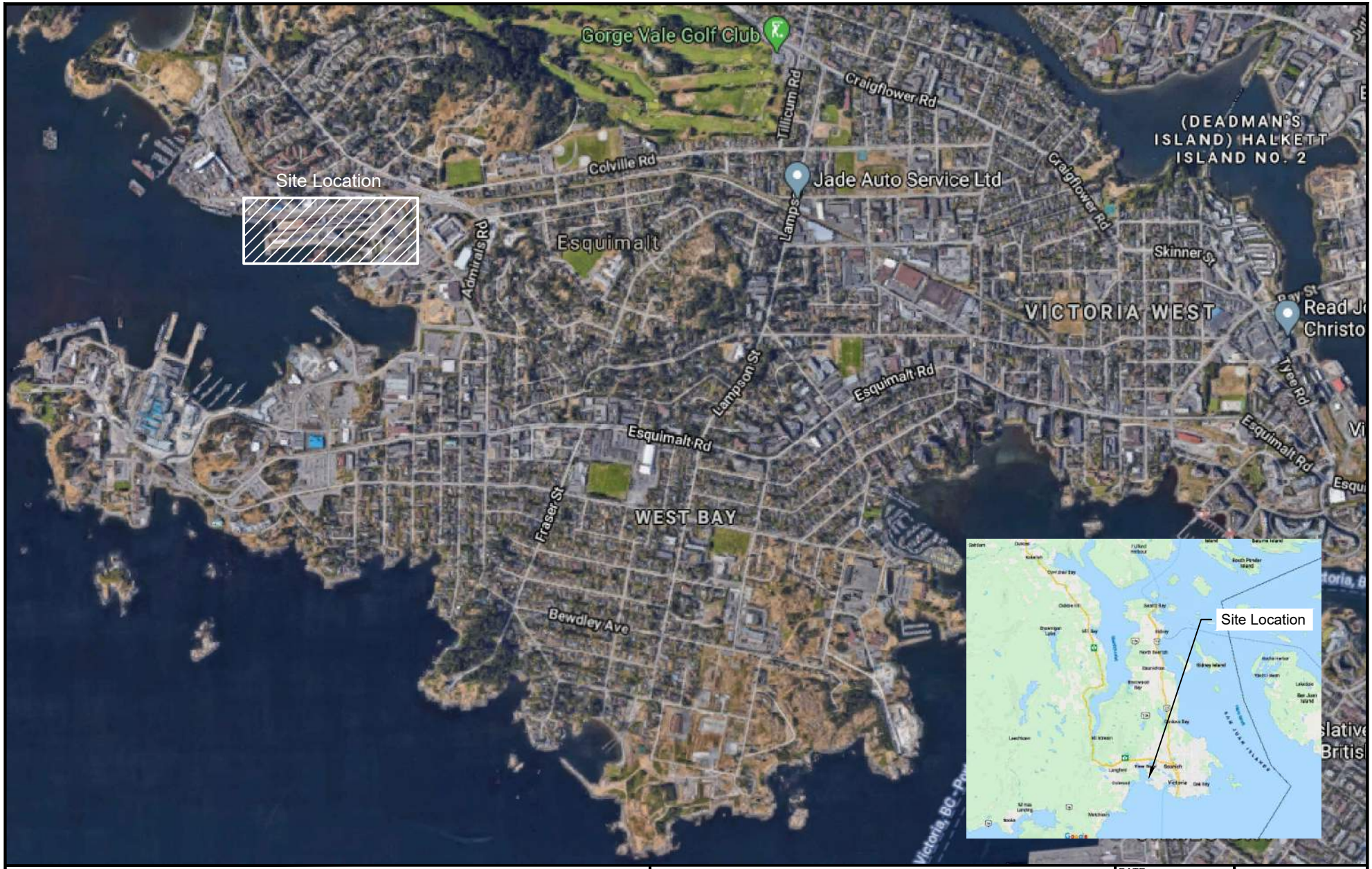
WSP Canada Inc.

Per: Stewart Dolan, M.Eng., P.Eng.
Geotechnical Engineer

Reviewed by: Carl Miller, M.Sc., P.Eng.
Senior Geotechnical Engineer

APPENDIX

A FIGURES



Base Map accessed via Google Maps https://www.google.com/maps on 15 April 2020

PROJECT:
Esquimalt Graving Dock
East End Extension

CLIENT:
Public Works and Government Services Canada (PWGSC)

TITLE:
Site Location Plan

DATE: APR 2020
DESIGN BY: RS
DRAWN BY: AB
CHECKED BY: ???
SCALE: NTS
PROJECT No.: 201-00771-00
FIGURE NO.: 1

WSP Canada Inc.
760 Enterprise Cres.,
Victoria, B.C. V8Z 6R4
P: 250.475.1000
www.wsp.com

LEGEND:

- GEOTECHNCIAL BOREHOLE
- ENVIRONMENTAL BOREHOLE
- GEOTECH / ENVIRO BOREHOLE

PROJECT:
EGD EAST END EXTENSION
825 ADMIRALS ROAD, VICTORIA BC

CLIENT:
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

TITLE:
BOREHOLE LOCATION PLAN

DATE: APR 2020
DESIGN BY: RDS
DRAWN BY: BPK
CHECKED BY: SKD
SCALE: AS SHOWN
PROJECT No.: 201-00771-00
FIGURE NO.: 2

WSP Canada Inc.
760 Enterprise Cres.,
Victoria, B.C. V8Z 6R4
P: 250.475.1000
www.wsp.com

APPENDIX

B BOREHOLE LOGS

BOREHOLE RECORD: **BH20-01**

Prepared by: **Ben Killion** Date (Start): **2020-03-08**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-10**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 °W
Y = 48.44 °N
Surface Elevation: 13 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth : 20 m
Length : 12.4 m
Opening : #10
WATER Elevation: m
WATER Date: 2020-04-01
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
		Ground surface.					RQD (%) PLASTIC LIMIT w (%) LIQUID LIMIT 20 40 60 80; Shear strength - Vane Torvane Remolded - Vane PENTEST SPT DCPT/BPT R; Shear (kPa) 30 60 90 120			
0.10 *12.90*		TOPSOIL.								
		FILL - Light greyish brown sandy gravelly fine to coarse subangular to angular cobbles, moist								
		Borehole progressed to 2.1m below grade using hydrovac								
2.10 *10.90*		... Obstruction at 2.1m								
		Switch to ODEX open hole drilling to clear obstruction. No recovery due to drilling method. Cuttings comprised light brown angular gravel. ... At 2.4m rock cuttings becoming blue/grey								
7.30 *5.70*		... Switched to HQ3 drill								
		METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess] ... Highly fractured from 7.3m to 10.4m, joint spacing close (core recovered as fine to coarse gravel, rounded to sub-angular)	RC1		67 (11)		11			
			RC2		87 (12)		12			

Water (2020-04-01) Depth: 5.46 m Elev.: m Diam.: 25.4 mm

Notes:

BOREHOLE RECORD: **BH20-01**

Prepared by: **Ben Killion** Date (Start): **2020-03-08**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-10**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 °W
Y = 48.44 °N
Surface Elevation: 13 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth : 20 m
Length : 12.4 m
Opening : #10
WATER Elevation: m
WATER Date: 2020-04-01
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
9.5		METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess]								30
10.0			RC3		100 (32)					33
10.5										34
11.0		... As above, joint spacing close, fractures inclined 10° to 25°								36
11.5			RC4		100 (84)					38
12.0										39
12.5		... As above, joint spacing close, fractures inclined 10° to 50°								41
13.0			RC5		100 (49)					43
13.5										44
14.0		... As above, joint spacing moderately close, fractures inclined 10° to 50°								46
14.5			RC6		96 (80)					48
15.0										49
15.5		... Highly fractured from 15.3 - 15.4m (core recovered as fine to coarse sandy gravel, subangular to angular) ... As above, joint spacing moderately close, fractures inclined 10° to 30°								51
16.0			RC7		100 (91)					53
16.5										54
17.0										56
17.5			RC8		100 (84)					58
18.0										59

Notes:

BOREHOLE RECORD: **BH20-01**

Prepared by: **Ben Killion** Date (Start): **2020-03-08**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-10**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 °W
Y = 48.44 °N
Surface Elevation: 13 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth : 20 m
Length : 12.4 m
Opening : #10
WATER Elevation: m
WATER Date: 2020-04-01
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
18.5										60
19.0										61
19.5										62
20.0		METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess] ... Highly fractured from 18.0 - 18.3m (core recovered as fine to coarse sandy gravel, subangular to angular)	RC9		100 (84)		84			63
										64
										65
20.00										66
-7.00		Borehole terminated at scheduled depth End of borehole at 20.00 m.								67
20.5										68
21.0										69
21.5										70
22.0										71
22.5										72
23.0										73
23.5										74
24.0										75
24.5										76
25.0										77
25.5										78
26.0										79
26.5										80
27.0										81
										82
										83
										84
										85
										86
										87
										88

Notes:

BOREHOLE RECORD: **BH20-01A**

Prepared by: **Ben Killion** Date (Start): **2020-03-10**
Reviewed by: **Stewart Dolan** Date (End): **2020-01-10**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 °W
Y = 48.44 °N
Surface Elevation: 13 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
13.00		Ground surface.					RQD (%) PLASTIC LIMIT w (%) LIQUID LIMIT 20 40 60 80; Shear strength - Vane Torvane Remolded - Vane PENTEST SPT DCPT/BPT; Shear (kPa) 30 60 90 120			
0.80 / 12.20		FILL - Light brown sand and gravel, some organics and midden, moist Hand excavated to 0.8m below grade								
		FILL - Light greyish brown sandy gravelly fine to coarse subangular to angular cobbles, moist								
3.00 / 10.00		FILL - Light brown sandy gravelly fine to coarse subangular to angular cobbles, moist (possible weathered bedrock, highly fractured)	BH20-01A @ 3.0m RC1		59 (0)	7 13 22 44 35 0				
3.50 / 9.50										
4.10 / 8.90		METADIORITE, medium to coarse grained, dark greenish grey, highly oxidized, highly weathered [Wark Gniess], highly fractured, joint spacing close (core recovered as fine to coarse gravel, rounded to angular)								
		Borehole terminated at scheduled depth End of borehole at 4.10 m.								

Notes:

BOREHOLE RECORD: **BH20-02**

Prepared by: **Ben Killion** Date (Start): **2020-03-11**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-12**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 °W
Y = 48.44 °N
Surface Elevation: 14 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth : 10 m
Length : 6 m
Opening : #10
WATER Elevation: m
WATER Date: 2020-04-01
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
		Ground surface.					RQD (%) PLASTIC LIMIT w (%) LIQUID LIMIT 20 40 60 80; Shear strength - Vane Torvane Remolded - Vane PENTEST SPT DCPT/BPT; Shear (kPa) 30 60 90 120			
14.00		FILL - Light greyish brown sandy gravelly fine to coarse subangular to angular cobbles, moist.								1
0.5										2
1.0										3
1.5		Borehole progressed to 2.0m below grade using hydrovac								4
2.0										5
2.5										6
3.0		... ODEX Drill through fills								7
3.5										8
4.00										9
10.00		Very stiff brown CLAY, trace organics, moist	BH20-02 @ 3.9m			2 3 4 5 — 7				10
4.5		PP = 1.75 kg/cm^2								11
5.0			BH20-02 @ 4.9m			4 5 8 11 — 13				12
5.5		PP = 4.6 kg/cm^2 ... Switched to mud rotary drill								13
6.0										14
6.5		PP = 1.3 kg/cm^2	BH20-02 @ 6.1m			2 4 5 6 — 9				15
7.0		Shear vane @ 7.0m (Large vane used) Peak = 30 m.kg Residual = 2 m.kg								16
7.5										17
8.0			BH20-02 @ 7.6m							18
8.5										19
9.0										20
										21
										22
										23
										24
										25
										26
										27
										28
										29

Water (2020-04-01) Depth: 8.24 m Elev.: m Diam.: 25.4 mm

Notes:

BOREHOLE RECORD: **BH20-02**

Prepared by: **Ben Killion** Date (Start): **2020-03-11**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-12**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 °W
Y = 48.44 °N
Surface Elevation: 14 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth : 10 m
Length : 6 m
Opening : #10
WATER Elevation: m
WATER Date: 2020-04-01
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
9.10 *4.90*		Firm to stiff blue CLAY, moist PP = 0.5 kg/cm^2 Shear vane @ 10.1m (Small vane used) Peak = 4 m.kg Residual = 0.8 m.kg	BH20-02 @ 9.1m			0 1 1 2 — 2				30–39
11.60 *2.40*		Dense brown SAND & GRAVEL, moist	BH20-02 @ 11.6m			24 28 33 36 — 61				38–39
12.20 *1.80*		... Switched to HQ3 drill METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess], joint spacing close, fractures inclined 15° to 50°	RC1		65 (29)		29			40–48
		... Highly fractured from 14.8 - 15.5m, fractures inclined 15° to 50°	RC2		100 (31)		31			48–51
15.50 *-1.50*		Borehole terminated at scheduled depth End of borehole at 15.50 m.								51–59

Notes:

BOREHOLE RECORD: **BH20-03**

Prepared by: **Ben Killion** Date (Start): **2020-03-10**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-11**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 °W
Y = 48.44 °N
Surface Elevation: 14 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
		Ground surface.					RQD (%) PLASTIC LIMIT w (%) LIQUID LIMIT 20 40 60 80; Shear strength - Vane Torvane Remolded - Vane PENTEST SPT DCPT/BPT; Shear (kPa) 30 60 90 120			
14.00		FILL - Light greyish brown sandy gravelly fine to coarse subangular to angular cobbles, moist.								
		Borehole progressed to 2.2m below grade using hydrovac								
		... ODEX Drill through fills Non-standard SPT spoon used				50 57 24 81				
		Non-standard SPT spoon used	BH20-03 @ 4.0m			33 46 33 23 79				
		Non-standard SPT spoon used				20 20 30 50				
6.10										
7.90		Stiff CLAY, some gravel, trace organics, moist	BH20-03 @ 6.1m			1 2 2 4 4				
			BH20-03 @ 6.7m			2 5 6 7 11				
7.30										
6.70		Stiff brown CLAY ... Switched to mud rotary drill PP = 4.0 kg/cm^2	BH20-03 @ 7.3m			2 5 6 7 11				
9.0										

Notes:

BOREHOLE RECORD: **BH20-03**

Prepared by: **Ben Killion** Date (Start): **2020-03-10**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-11**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 °W
Y = 48.44 °N
Surface Elevation: 14 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
9.5		Stiff brown CLAY Shear vane @ 9.5m (Small vane used) Peak = 3 m.kg Residual = 1 m.kg								30
10.0			BH20-03 @ 10.0m							31
10.5										32
11.0										33
11.5										34
12.0										35
12.20 *1.80*										36
12.5		Soft grey silty CLAY PP = 0.4 kg/cm^2	BH20-03 @ 12.2m			0 1 1 2 2				37
13.0										38
13.20 *0.80*										39
13.5		Dense greyish brown silty SAND and GRAVEL	BH20-03 @ 13.2m			22 27 28 55 26				40
14.0										41
14.5										42
15.00 *-1.00*		... Switched to HQ3 drill								43
15.5		METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess]	RC1		42 (0)	0				44
16.0										45
16.5		... Highly fractured to 19.3m, joint spacing close, fractures inclined 15° to 50°, core recovered as fine to coarse sandy gravel, sub-rounded to angular								46
17.0			RC2		61 (0)	0				47
17.5										48
18.0										49
										50
										51
										52
										53
										54
										55
										56
										57
										58
										59

Notes:

BOREHOLE RECORD: **BH20-03**

Prepared by: **Ben Killion** Date (Start): **2020-03-10**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-11**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 °W
Y = 48.44 °N
Surface Elevation: 14 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
18.5		METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess]	RC3		85 (24)		24			60
19.0										61
19.30 -5.30										62
		Borehole terminated at scheduled depth End of borehole at 19.30 m.								63
19.5										64
20.0										65
20.5										66
21.0										67
21.5										68
22.0										69
22.5										70
23.0										71
23.5										72
24.0										73
24.5										74
25.0										75
25.5										76
26.0										77
26.5										78
27.0										79
										80
										81
										82
										83
										84
										85
										86
										87
										88

Notes:

BOREHOLE RECORD: **BH20-04**

Prepared by: **Ben Killion** Date (Start): **2020-03-04**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-05**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 W
Y = 48.44 N
Surface Elevation: 4.6 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
4.60		Ground surface.							
0.30		ASPHALT							
4.30		FILL - Light greyish brown sandy gravelly fine to coarse subangular to angular cobbles, moist.							
1.20									
3.40		METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess]	RC1		73 (0)	0			
		... Highly fractured from 2.4 - 3.0m, core recovered as medium to coarse gravel, sub-rounded to angular, joint spacing close, fractures inclined 15° to 50°							
		... As above, joint spacing close, fractures inclined 15° to 50°	RC2		93 (71)	71			
		... As above, joint spacing moderately close, fractures inclined 15° to 50°	RC3		100 (90)	90			
			RC4		100 (45)	45			
			RC5		94 (83)	83			

Notes:

BOREHOLE RECORD: **BH20-04**

Prepared by: **Ben Killion** Date (Start): **2020-03-04**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-05**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 W
Y = 48.44 N
Surface Elevation: 4.6 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
9.5		METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess]								30
10.0			RC6		100 (62)					33
10.5		... As above, joint spacing close, fractures inclined 15° to 50°								35
11.0										36
11.5			RC7		94 (39)					38
12.0										39
12.5										41
13.0			RC8		94 (19)					43
13.5										44
14.0										46
14.5			RC9		97 (78)					48
15.0										49
15.5										51
16.0			RC10		100 (47)					53
16.5										54
17.0										56
17.5										58
18.0			RC11		100 (53)					59

GEOTECHNICAL: RQD (%); PLASTIC LIMIT; w (%); LIQUID LIMIT; 20 40 60 80; Shear strength - Vane; Torvane; Remolded - Vane; PENTEST; SPT; DCPT/BPT; Shear (kPa) 30 60 90 120; 62; 39; 19; 78; 47; 53

Notes:

Project : 201-00771-00 GINT.GPJ Type of report : WSP_EN_WELL-GEOTECHNICAL ONLY Data Template : 20190604_CD.GDT 6-1-2020

BOREHOLE RECORD: **BH20-04**

Prepared by: **Ben Killion** Date (Start): **2020-03-04**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-05**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 W
Y = 48.44 N
Surface Elevation: 4.6 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
18.5		METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess]								60
19.0										61
										62
		... Highly fractued from 19.1 - 20.3m, core recovered as fine to coarse sandy gravel, sub-rounded to angular	RC12		73 (25)		25			63
19.5										64
										65
20.0										66
										67
20.5			RC13		94 (43)		43			68
21.0										69
		... As above, joint spacing moderately close, fractures inclined 15° to 50°								70
21.5										71
22.0										72
			RC14		93 (86)		86			73
22.5										74
23.0										75
										76
23.5										77
		... Highly fractured from 23.6 - 24.0m, core recovered as fine to coarse sandy gravel, sub-angular to angular	RC15		100 (53)		53			78
24.0										79
										80
24.5										81
25.0										82
			RC16		94 (67)		67			83
25.5										84
26.0										85
										86
26.5										87
							74			88
27.0										

Notes:

Project : 201-00771-00 GINT.GPJ Type of report : WSP_EN_WELL-GEOTECHNICAL ONLY Data Template : 20190604_CD.GDT 6-1-2020

BOREHOLE RECORD: **BH20-04**

Prepared by: **Ben Killion** Date (Start): **2020-03-04**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-05**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 W
Y = 48.44 N
Surface Elevation: 4.6 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
27.5		METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess]	RC17		100 (74)					89
28.0										90
28.5			RC18		100 (55)					91
29.0										92
29.5		... Highly fractued from 29.5 - 30.6m, core recovered as fine to coarse gravel, sub-angular to angular	RC19		100 (23)					93
30.0										94
30.5										95
30.60										96
-26.00		Borehole terminated at scheduled depth End of borehole at 30.60 m.								97
31.0										98
31.5										99
32.0										100
32.5										101
33.0										102
33.5										103
34.0										104
34.5										105
35.0										106
35.5										107
36.0										108
										109
										110
										111
										112
										113
										114
										115
										116
										117
										118

GEOTECHNICAL: RQD (%); PLASTIC LIMIT; w (%); LIQUID LIMIT; 20 40 60 80; Shear strength - Vane; Torvane; Remolded - Vane; PENTEST; SPT; DCPT/BPT; Shear (kPa) 30 60 90 120; 74; 55; 23

Notes:

BOREHOLE RECORD: **BH20-07**

Prepared by: **Ben Killion** Date (Start): **2020-03-06**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-07**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 W, Y = 48.44 N
Surface Elevation: 4.6 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth : 27.3 m
Length : 23.5 m
Opening : #10
WATER Elevation: m
WATER Date: 2020-04-01
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
		Ground surface.								
0.20 / *4.40*		ASPHALT								
		FILL - Light greyish brown sandy gravelly fine to coarse subangular to angular cobbles, moist.								
2.00 / *2.60*		No recovery due to wash out during drilling								
3.30 / *1.30*		METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess] Joint spacing close, fractures inclined 15° to 50°	RC1		87 (61)		61			
			RC2		100 (74)		74			
		... Highly fractured from 5.85 - 5.87m (core recovered as medium gravel, sub-angular to angular) ... As above, joint spacing moderately close, fractures inclined 15° to 50°	RC3		100 (73)		73		
			RC4		97 (81)		81			
9.0										

Water (2020-04-01) Depth: 1.52 m Elev.: m Diam.: 25.4 mm

Notes:

BOREHOLE RECORD: **BH20-07**

Prepared by: **Ben Killion** Date (Start): **2020-03-06**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-07**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 W, Y = 48.44 N
Surface Elevation: 4.6 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth : 27.3 m
Length : 23.5 m
Opening : #10
WATER Elevation: m
WATER Date: 2020-04-01
Water Level / Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed / Remoulded / Lost / Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
9.5		METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess] ... As above, joint spacing close, fractures inclined 15° to 50°								30
10.0			RC5		100 (53)					33
10.5										35
11.0										36
11.5			RC6		100 (75)					38
12.0		... Highly fractured from 11.7 - 11.71m (core recovered as medium gravel, sub-angular to angular)								39
12.5		... As above, joint spacing moderately close, fractures inclined 15° to 50°								41
13.0			RC7		100 (55)					43
13.5										44
14.0		... Highly fractured from 13.7 - 18.7m (core recovered as fine to coarse sand and gravel, sub-angular to angular) joint spacing very close, fractures inclined 15° to 50°								46
14.5			RC8		88 (8)					48
15.0										49
15.5										51
16.0			RC9		73 (14)					53
16.5										54
17.0										56
17.5			RC10		93 (31)					57
18.0										59

GEOTECHNICAL: RQD (%); PLASTIC LIMIT; w (%); LIQUID LIMIT (20, 40, 60, 80); Shear strength - Vane; Torvane; Remolded - Vane; PENTEST; SPT; DCPT/BPT; Shear (kPa) (30, 60, 90, 120)

Notes:

BOREHOLE RECORD: **BH20-07**

Prepared by: **Ben Killion** Date (Start): **2020-03-06**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-07**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 W, Y = 48.44 N
Surface Elevation: 4.6 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth : 27.3 m
Length : 23.5 m
Opening : #10
WATER Elevation: m
WATER Date: 2020-04-01
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
18.5		METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess]								60
19.0		... As above, joint spacing moderately close, fractures inclined 15° to 50°	RC11		100 (63)		63			62
19.5		... As above, joint spacing close, fractures inclined 15° to 50°								64
20.0		... Moderately fractured from 20.2-20.4m (core recovered as fine to coarse sandy gravel, sub-angular to angular)	RC12		100 (52)		52			66
20.5										67
21.0										68
21.5										70
22.0			RC13		100 (73)		73			72
22.5										74
23.0		... As above, joint spacing moderately close, fractures inclined 15° to 50°								75
23.5			RC14		100 (83)		83			77
24.0										78
24.5										80
25.0			RC15		100 (94)		94			82
25.5										84
26.0										85
26.5			RC16		100 (84)		84			87
27.0										88

Notes:

BOREHOLE RECORD: **BH20-07**

Prepared by: **Ben Killion** Date (Start): **2020-03-06**
Reviewed by: **Stewart Dolan** Date (End): **2020-03-07**

Project Name: **Esquimalt Graving Dock East End Extension**
Site: **Esquimalt Graving Docks**
Sector: **Esquimalt Graving Docks**
Client: **Public Works and Government Services Canada (PWGSC)**

Project Number: **201-00771-00**
Geographic Coordinates: X = 123.42 W
Y = 48.44 N
Surface Elevation: 4.6 m *(Geodetic)*
Plunge / Azimuth:

Drilling Company: Mud Bay Drilling
Drilling Equipment: Rotary Drilling Machine
Drilling Method: Mud Rotary / HQ Casing
Borehole Diameter:

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth : 27.3 m
Length : 23.5 m
Opening : #10
WATER Elevation: m
WATER Date: 2020-04-01
Water Level Free phase

SAMPLE TYPE
AS - Auger sample
GS - Grab sample
MA - Manual Auger
SS - Split Spoon
ST - Shelby Tube
TA - Auger
TR - Trowel
TU - DT32 Liner

ANALYSIS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Blow Counts/300mm
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	DESCRIPTION	TYPE & NO.	STATE	% RECOVERY (RQD)	Blows Counts/300 mm N Value = SPT DCPT= Blows Counts	GEOTECHNICAL	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
27.5		METADIORITE, medium to coarse grained, dark greenish grey, slightly to moderately weathered, medium strong [Wark Gniess]					RQD (%) PLASTIC LIMIT w (%) LIQUID LIMIT 20 40 60 80 Shear strength - Vane Torvane Remolded - Vane PENTEST SPT DCPT/BPT R 30 60 90 120 Shear (kPa)			89
28.0		... As above, joint spacing close, fractures inclined 15° to 35°								90
28.5			RC17		48 (22)		22			91
29.0										92
29.5		... Highly fractured from 29.4-29.6m (core recovered as fine to coarse gravel, sub-angular to angular)								93
30.0										94
30.5			RC18		100 (75)		75			95
31.0										96
	31.10 -26.50	Borehole terminated at scheduled depth End of borehole at 31.10 m.								97
31.5										98
32.0										99
32.5										100
33.0										101
33.5										102
34.0										103
34.5										104
35.0										105
35.5										106
36.0										107
										108
										109
										110
										111
										112
										113
										114
										115
										116
										117
										118

Notes:

APPENDIX

C PHOTO TABLE

PHOTO TABLE

Photo	Description
	Photo 1: Overview of upper slope above east end of graving dock. Approximate location of BH20-01, BH20-02, & BH20-03.
	Photo 2: Typical hydro-vacuuming operation to approximately 2m.

Photo 3:

Typical coring of asphalt/concrete for lower boreholes located at east end of graving dock.

Photo 4:

Typical pavement structure at east end of graving dock (i.e. 25-75 mm asphalt over 100-200 mm concrete)

Photo 5:

Open hydro-vac holes covered with road plates until backfilling is completed.

Photo 6:

Overview of BH20-04 location prior to coring.

Photo 7:

Hydro-vac excavation of BH20-04 in progress.

Photo 8:

HQ3 drilling of bedrock in progress for BH20-04.

Photo 9:

Runs 1 & 2 of BH20-04.

Photo 10:

Runs 3 & 4 of BH20-04.

Photo 11:

Runs 5 & 6 of BH20-04.

Photo 12:

Runs 7 & 8 of BH20-04.

Photo 13:

Runs 9 & 10 of BH20-04.

Photo 14:

Runs 11, 12, & 13 of BH20-04.

	Photo 15: Runs 14 & 15 of BH20-04.
	Photo 16: Runs 16 & 17 of BH20-04.

	Photo 17: Runs 18 & 19 of BH20-04.
	Photo 18: Overview of Enviro Boreholes BH20-05 and BH20-06 locations.

Photo 19:

Overview of Enviro Boreholes BH20-08, BH20-09, & BH20-10.

Photo 20:

Boreholes typically backfilled with bentonite chips up to underside of pavement.

	Photo 21: BH20-04 backfilled and asphalt pavement patched.
	Photo 22: BH20-05 backfilled and asphalt pavement patched.

Photo 23:

BH20-06 backfilled and asphalt pavement patched.

Photo 24:

BH20-09 backfilled and asphalt pavement patched.

	Photo 25: BH20-10 backfilled and asphalt pavement patched.
	Photo 26: BH20-11 backfilled and asphalt pavement patched.

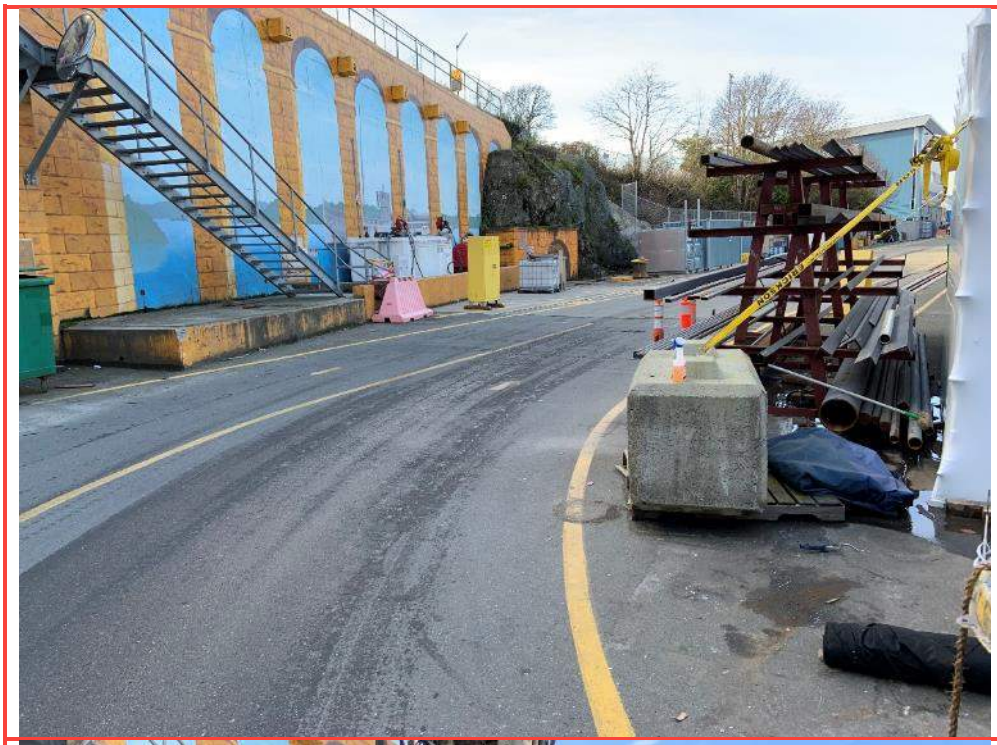


Photo 27:

Overview of BH20-07 location prior to coring of pavement.

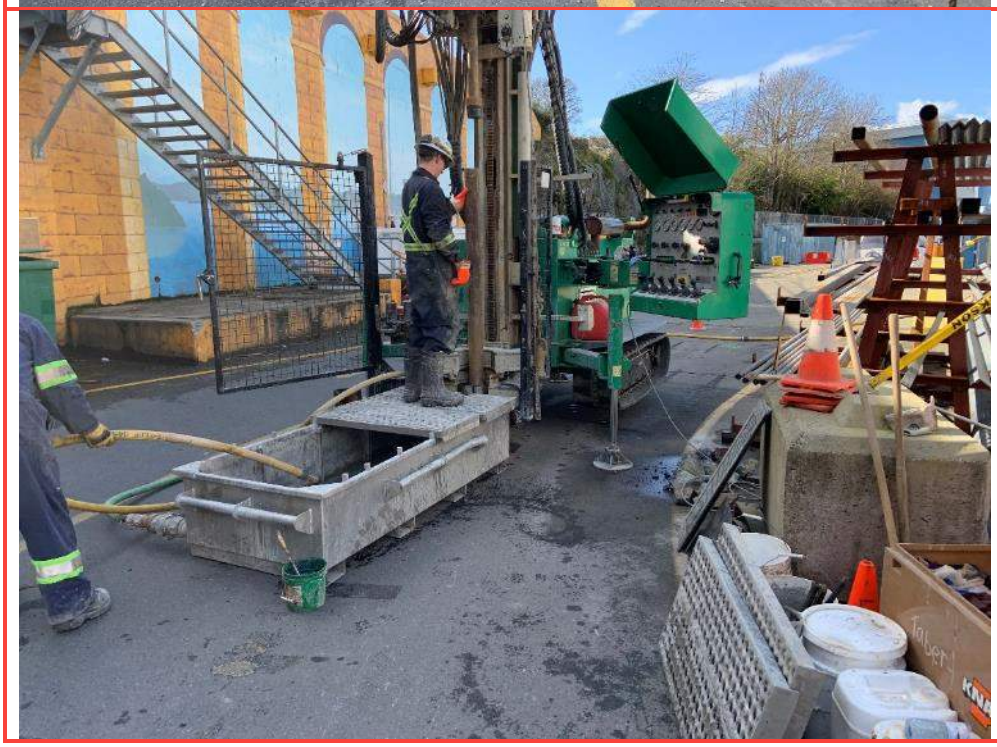


Photo 28:

Overview of HQ3 drilling of BH20-07.

Photo 29:

Runs 1 & 2 of BH20-07

Photo 30:

Runs 3 & 4 of BH20-07

Photo 31:

Runs 5 & 6 of BH20-07

Photo 32:

Runs 7, 8, & 9 of BH20-07

Photo 33:

Runs 10 & 11 of BH20-07.

Photo 34:

Runs 12 & 13 of BH20-07.

Photo 35:

Runs 14 & 15 of BH20-07.

Photo 36:

Runs 16, 17, & 18 of BH20-07.

Photo 37:

Contractor installing monitoring well in BH20-07.

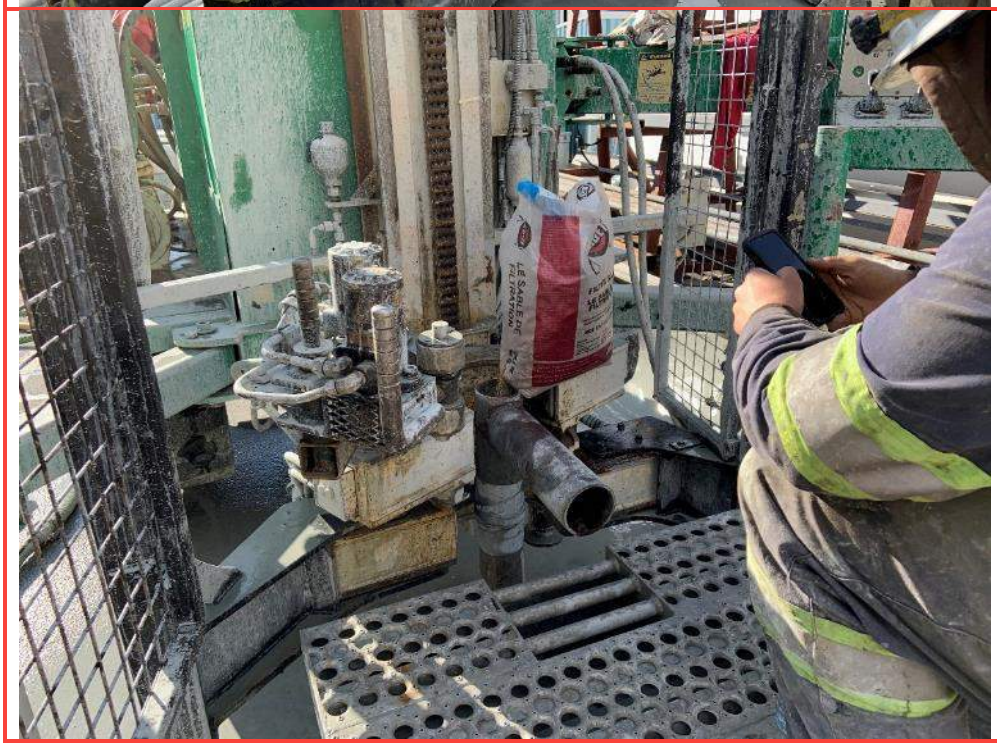


Photo 38:

Contractor backfilling monitoring well using filter sand.

	Photo 39: Monitoring well flush mounted to pavement at BH20-07.
	Photo 40: Drill rig set up over BH20-01 after hydro-vac excavation complete.

Photo 41:

ODEX drilling in progress for BH20-01.

Photo 42:

Light grey sand and gravel retrieved from ODEX drilling of BH20-01.

Photo 43:

Runs 1, 2, & 3 of BH20-01

Photo 44:

Runs 4 & 5 of BH20-01

Photo 45:

Runs 6 & 7 of BH20-01.

Photo 46:

Runs 8 & 9 of BH20-01.

Photo 47:

Monitoring well installed in BH20-01. Adjacent BH20-01A excavated approximately 1.2m by hand before drilling.

Photo 48:

SPT sample from sand and gravel till within BH20-01A.

	Photo 49: BH20-01A backfilled using bentonite chips and thin lift of native soil at surface.
	Photo 50: SPT sample at 4.0m from BH20-03

	Photo 51: SPT sample at 6.1m from BH20-03
	Photo 52: SPT sample at 6.7m from BH20-03

	Photo 53: SPT sample at 7.3m from BH20-03
	Photo 54: SPT sample at 12.2m from BH20-03.

	Photo 55: SPT sample at 13.2m from BH20-03.
	Photo 56: Runs 1, 2, & 3 of BH20-03.

Photo 57:

Contractor backfilling BH20-03 up to existing grade using bentonite chips and a thin lift of filter sand.

Photo 58:

SPT sample at 3.9m from BH20-02.

	Photo 59: SPT sample at 4.9m from BH20-02.
	Photo 60: SPT sample at 6.1m from BH20-02.

Photo 61:

SPT sample at 9.1m from BH20-02.

Photo 62:

SPT sample at 11.6m from BH20-02.

Photo 63:

SPT sample at 11.6m from BH20-02.

Photo 64:

Runs 1 & 2 of BH20-02.

Photo 65:

Monitoring well installed within BH20-02.

APPENDIX

D PARTICLE SIZE DISTRIBUTION

WSP Canada Inc.
760 Enterprise Crescent
Victoria, BC V8Z 6R4
Phone +1 250-475-1000
WSP.com

AGGREGATE GRADATION CHART

IDENTIFICATION:

Client: Public Works
Project: Esquimalt Graving Dock
Sample Location: BH01A 3.0-3.6m

File No.: 201-00771-00
Report No.: 1
Date: 23-Mar-20

SAMPLING INFORMATION:

Material: Sand and Gravel
Specification: n/a

Date Sampled	09-Mar-20
Date Tested	18-Mar-20
Sample No:	1
Fracture by mass	n/a
Supplier:	Existing
Sampled by:	BK
Tested by:	GG

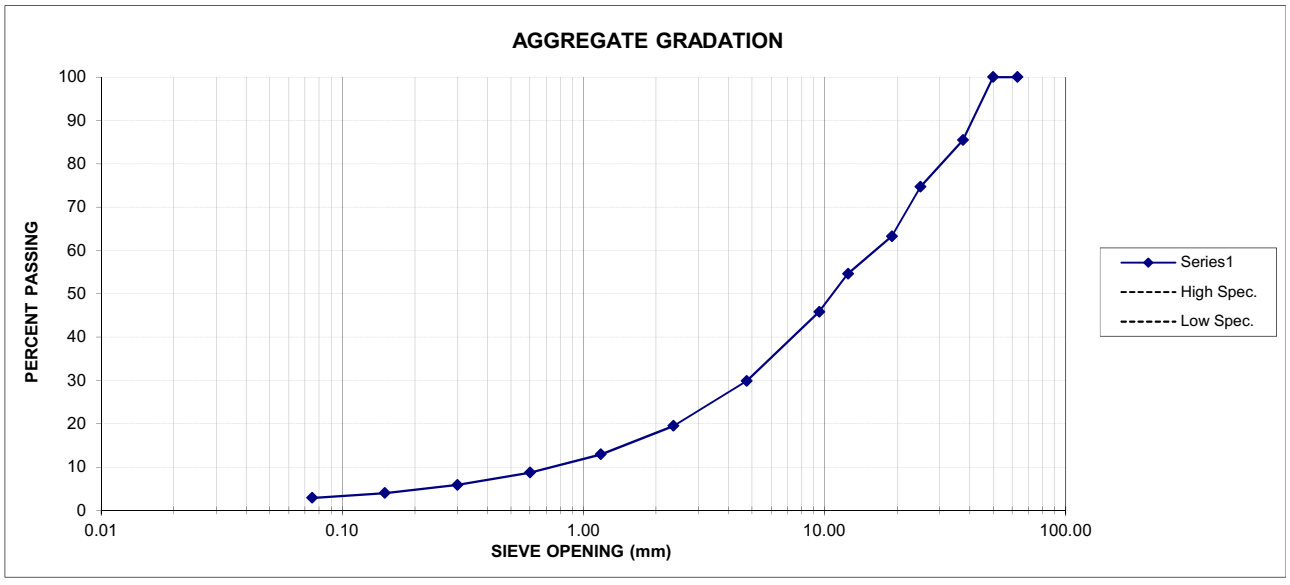
Material Specification

Sieve	High Spec.	Low Spec.

Sieve Analysis

Sieve	% Passing
75.0	
63.0	100.0
50.0	100.0
37.5	85.5
25.0	74.7
19.0	63.3
12.5	54.6
9.5	45.8
4.75	29.9
2.36	19.5
1.18	12.9
0.600	8.7
0.300	5.9
0.150	4.0
0.075	2.9

AGGREGATE GRADATION:



REMARKS: Tested according to ASTM C-: 136 and C-117

REPORTS TO:

WSP CANADA INC.

per:

WSP Canada Inc.
760 Enterprise Crescent
Victoria, BC V8Z 6R4
Phone +1 250-475-1000
WSP.com

AGGREGATE GRADATION CHART

IDENTIFICATION:

Client: Public Works
Project: Esquimalt Graving Dock
Sample Location: BH02 11.6-12.2m

File No.: 201-00771-00
Report No.: 2
Date: 23-Mar-20

SAMPLING INFORMATION:

Material: Sand, some gravel, some fines.
Specification: n/a

Date Sampled	12-Mar-20
Date Tested	18-Mar-20
Sample No:	2
Fracture by mass	n/a
Supplier:	Existing
Sampled by:	BK
Tested by:	GG

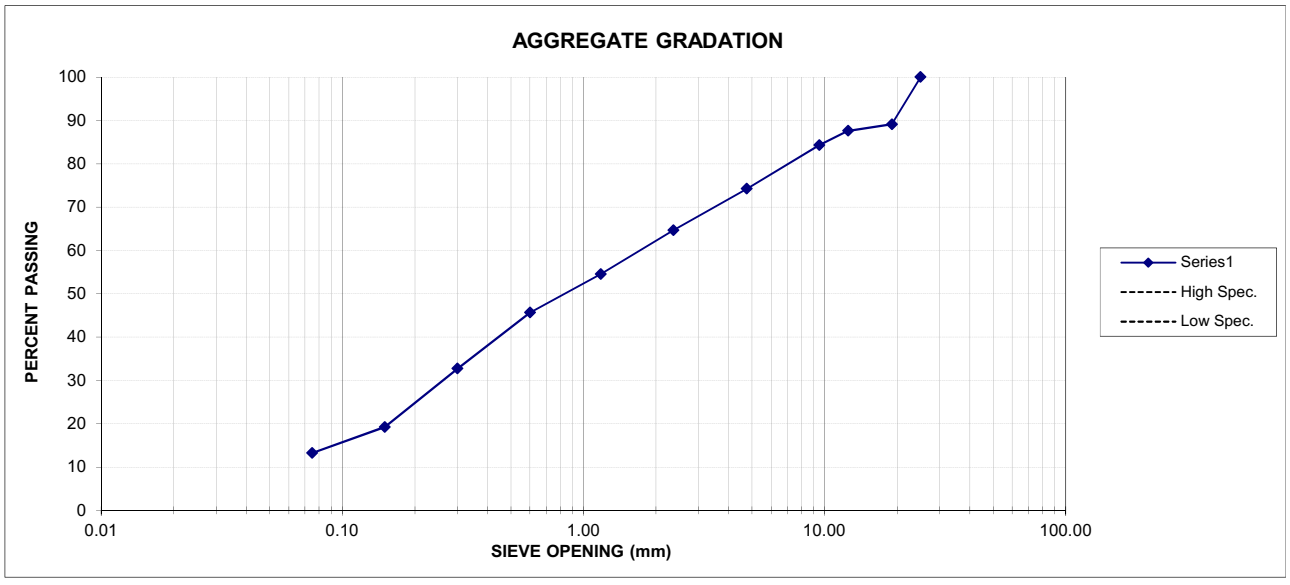
Material Specification

Sieve	High Spec.	Low Spec.

Sieve Analysis

Sieve	% Passing
75.0	
63.0	
50.0	
37.5	
25.0	100.0
19.0	89.1
12.5	87.6
9.5	84.3
4.75	74.2
2.36	64.7
1.18	54.6
0.600	45.7
0.300	32.7
0.150	19.2
0.075	13.3

AGGREGATE GRADATION:



REMARKS: Tested according to ASTM C-: 136 and C-117

REPORTS TO:

WSP CANADA INC.

per:

WSP Canada Inc.
760 Enterprise Crescent
Victoria, BC V8Z 6R4
Phone +1 250-475-1000
WSP.com

AGGREGATE GRADATION CHART

IDENTIFICATION:

Client: Public Works
Project: Esquimalt Graving Dock
Sample Location: BH03 13.2-13.8m

File No.: 201-00771-00
Report No.: 3
Date: 23-Mar-20

SAMPLING INFORMATION:

Material: Sand, some fines, trace gravel.
Specification: n/a

Date Sampled	11-Mar-20
Date Tested	18-Mar-20
Sample No:	3
Fracture by mass	n/a
Supplier:	Existing
Sampled by:	BK
Tested by:	GG

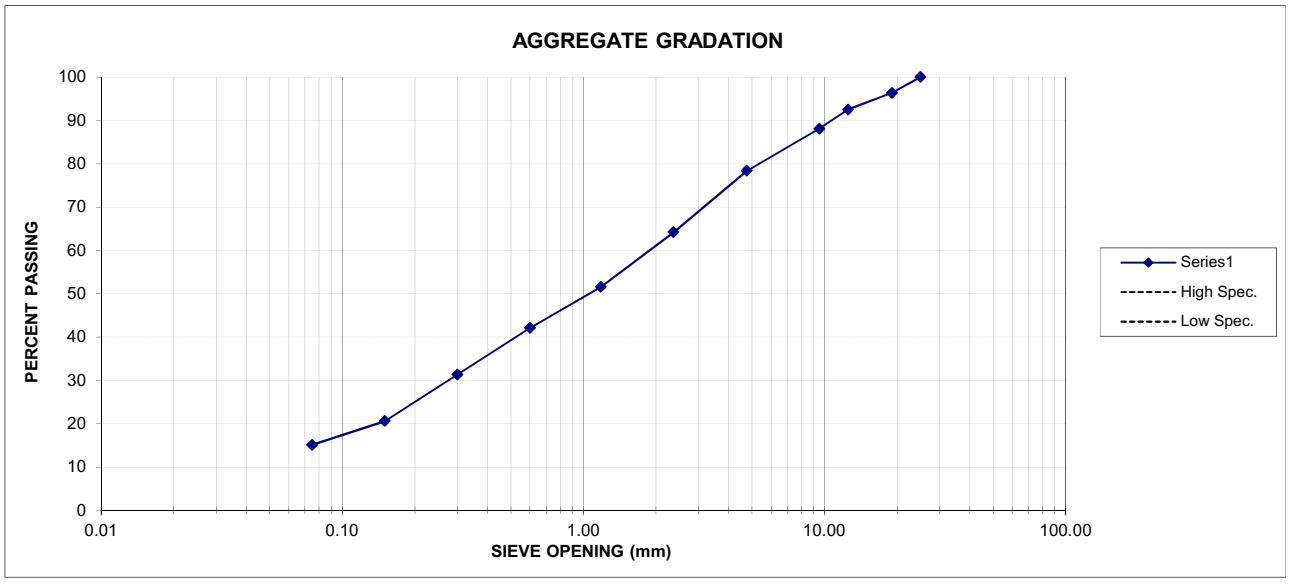
Material Specification

Sieve	High Spec.	Low Spec.

Sieve Analysis

Sieve	% Passing
75.0	
63.0	
50.0	
37.5	
25.0	100.0
19.0	96.3
12.5	92.5
9.5	88.1
4.75	78.4
2.36	64.2
1.18	51.6
0.600	42.1
0.300	31.4
0.150	20.6
0.075	15.1

AGGREGATE GRADATION:



REMARKS: Tested according to ASTM C-: 136 and C-117

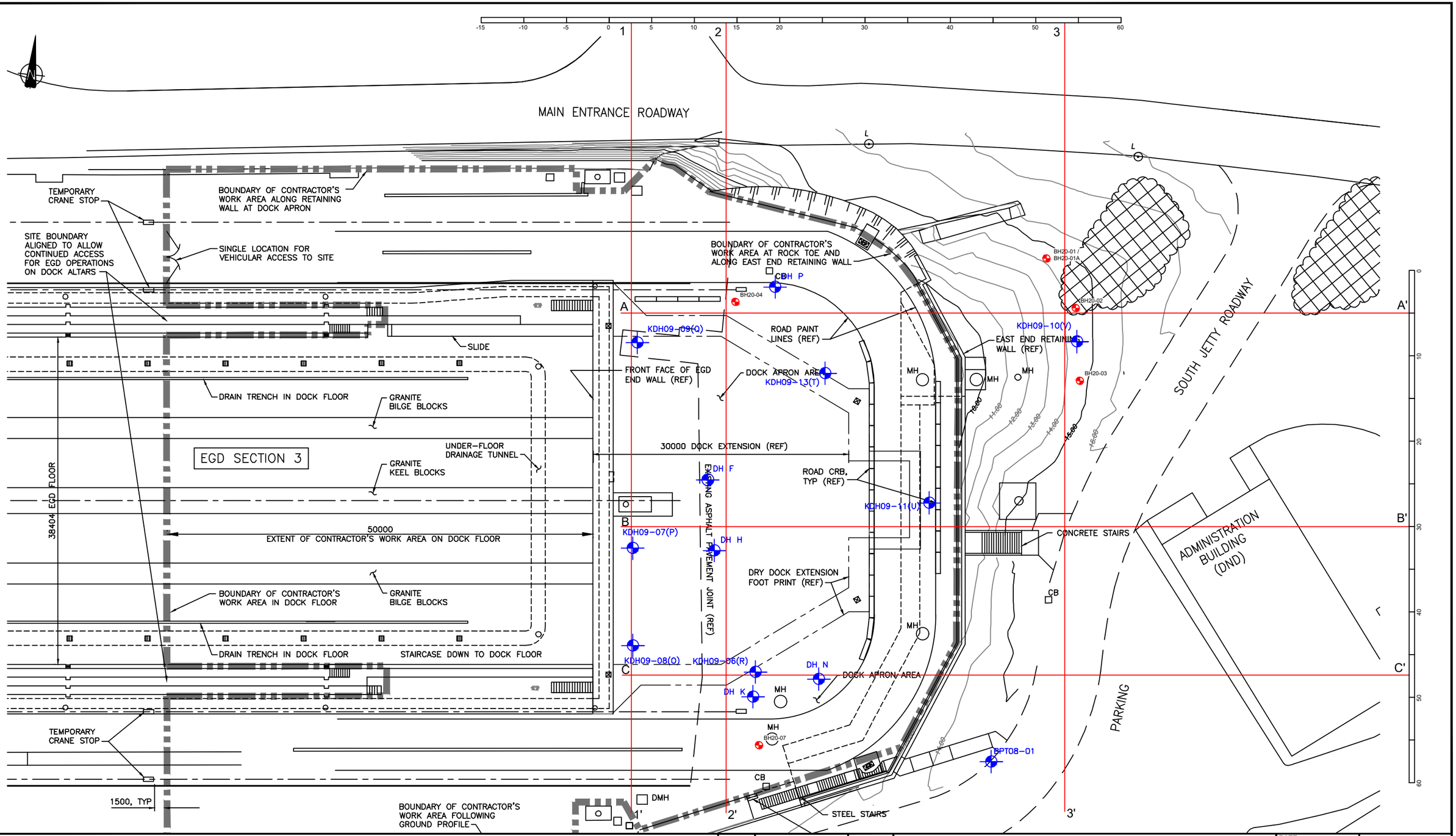
REPORTS TO:

WSP CANADA INC.

per:

APPENDIX

E GEOLOGICAL CROSS SECTIONS



LEGEND:

- HISTORIC BOREHOLES
- WSP 2020 BOREHOLE

Base plan taken from Klohn Cirppen Berger - Esquimalt Graving Dock Dry Dock Extensions (Drawing C5)

#	???	MM/DD/YY
REV. :	DESCRIPTION:	DATE : (M/D/YR)

PROJECT: Esquimalt Graving Docks East End Extension

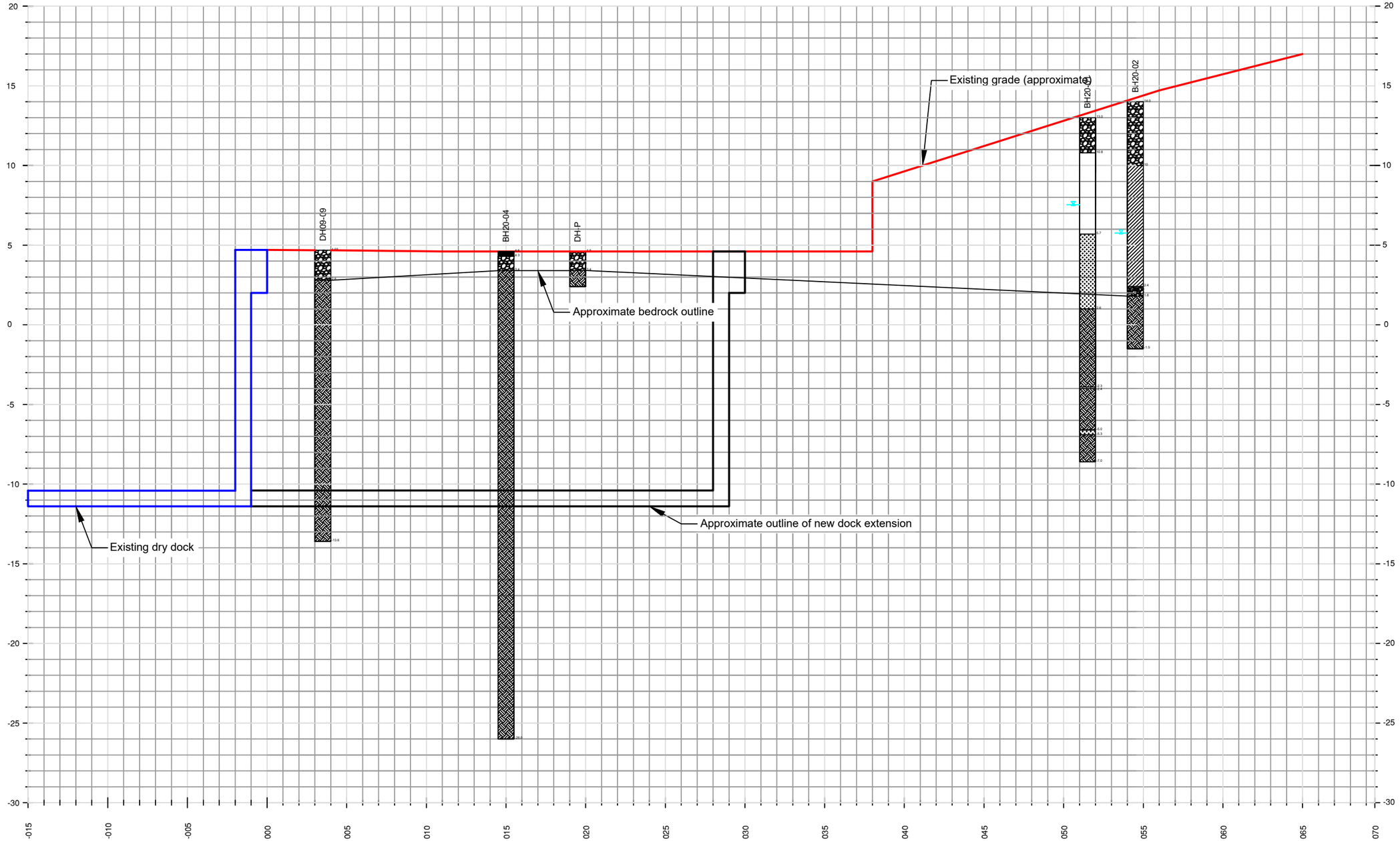
CLIENT: Public Works and Government Servies Canada (PWGSC)

TITLE: Borehole Location Plan

DATE: MAY 2020
DESIGN BY: RDS
DRAWN BY: AJB
CHECKED BY: SKD
SCALE: NTS
PROJECT No.: 201-00771-00
FIGURE NO.: 1

WSP Canada Inc.
760 Enterprise Cres.,
Victoria, B.C. V8Z 6R4
P: 250.475.1000
www.wsp.com

Section A-A'



Legend

- Asphalt
- Sand & Gravel Fill
- Silt
- Clay
- Bedrock
- Highly Fractured Bedrock

REV. :	DESCRIPTION:	DATE : (M/D/YR)
#	???	MM/DD/YY

PROJECT: Esquimalt Graving Docks East End Extension

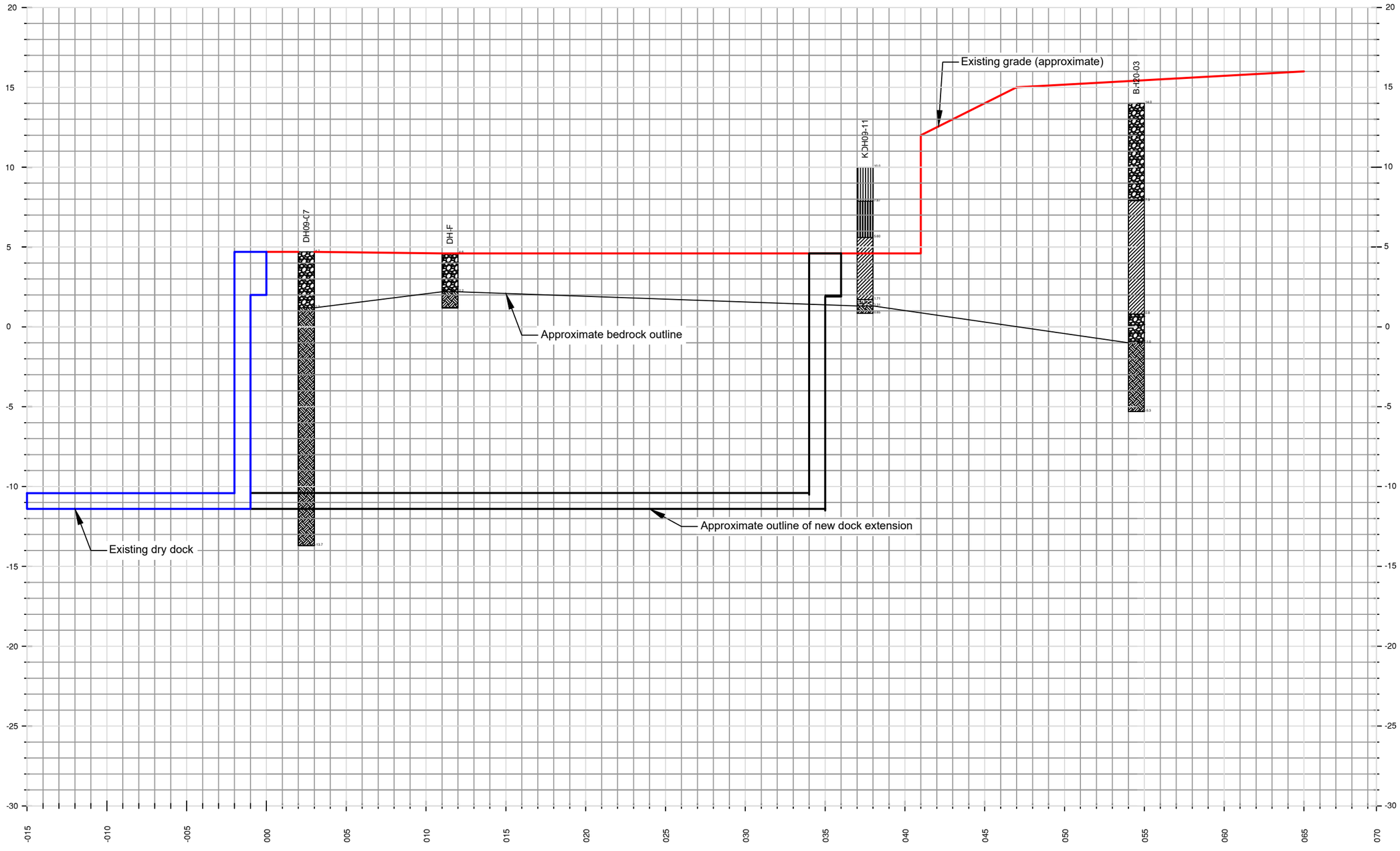
CLIENT: Public Works and Government Servies Canada (PWGSC)

TITLE: Section A-A'

DATE: MAY 2020
DESIGN BY: RDS
DRAWN BY: AJB
CHECKED BY: SKD
SCALE: NTS
PROJECT No.: 201-00771-00
FIGURE NO.: 2

WSP Canada Inc.
760 Enterprise Cres.,
Victoria, B.C. V8Z 6R4
P: 250.475.1000
www.wsp.com

Section B-B'



Legend

- Asphalt
- Sand & Gravel Fill
- Silt
- Clay
- Bedrock
- Highly Fractured Bedrock

REV. :	DESCRIPTION:	DATE : (M/D/YR)
#	???	MM/DD/YY

PROJECT: Esquimalt Graving Docks East End Extension

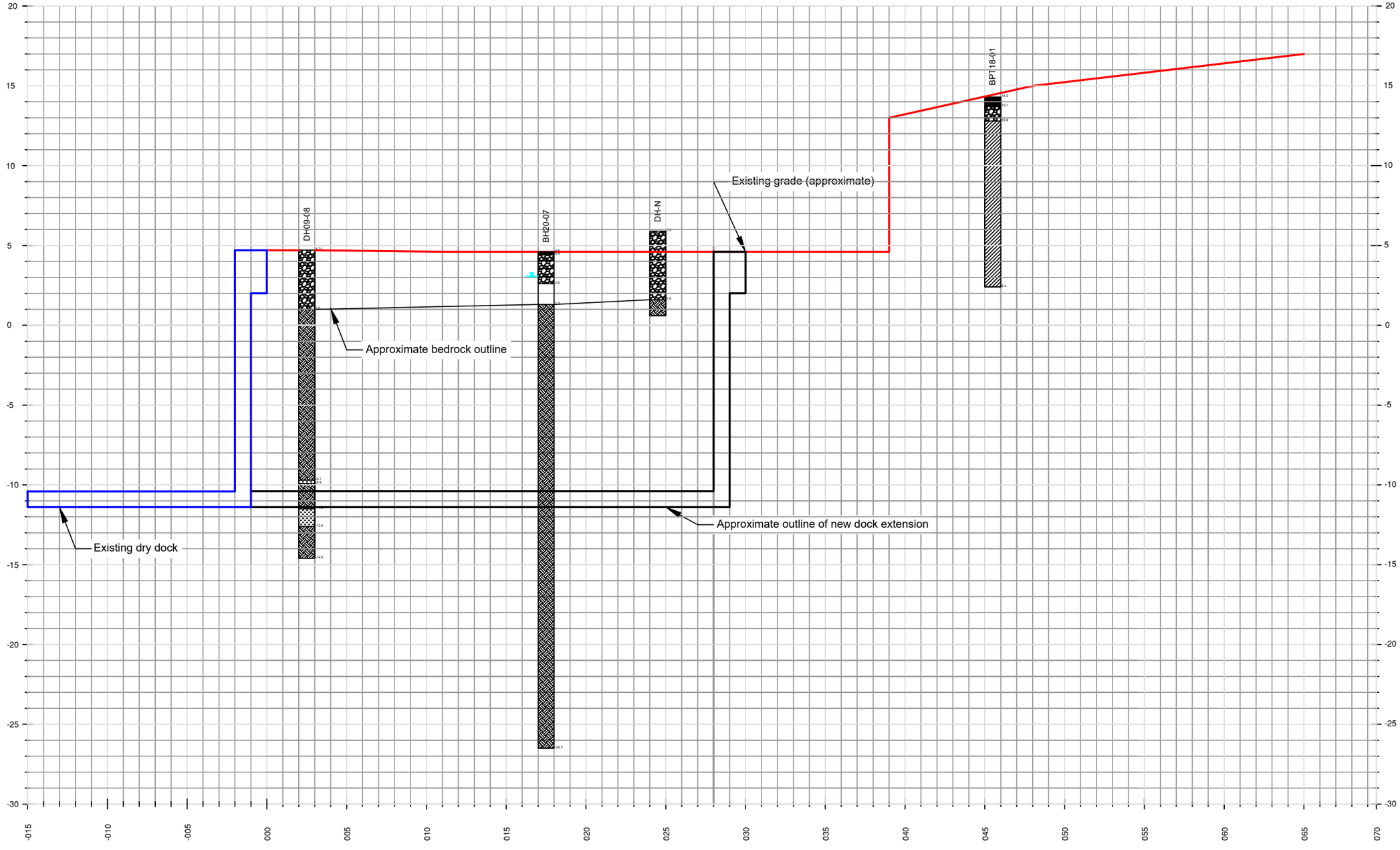
CLIENT: Public Works and Government Servies Canada (PWGSC)

TITLE: Section B-B'

DATE: MAY 2020
DESIGN BY: RDS
DRAWN BY: AJB
CHECKED BY: SKD
SCALE: NTS
PROJECT No.: 201-00771-00
FIGURE NO.: 3

WSP Canada Inc.
760 Enterprise Cres.,
Victoria, B.C. V8Z 6R4
P: 250.475.1000
www.wsp.com

Section C-C'



Legend

- Asphalt
- Sand & Gravel Fill
- Silt
- Clay
- Bedrock
- Highly Fractured Bedrock

REV. :	DESCRIPTION:	DATE : (M/D/YR)
#	???	MM/DD/YY

PROJECT: Esquimalt Graving Docks East End Extension

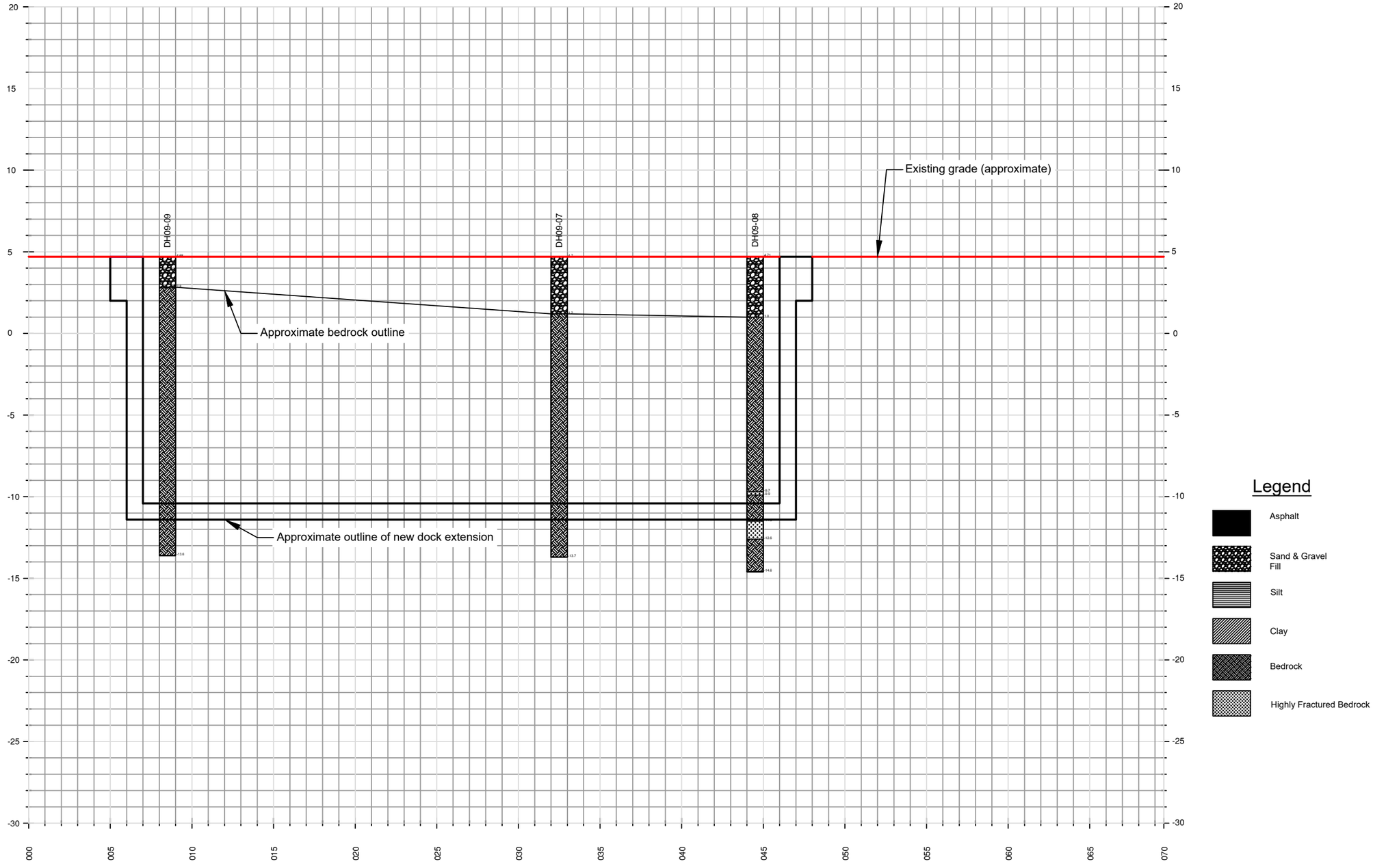
CLIENT: Public Works and Government Servies Canada (PWGSC)

TITLE: Section C-C'

DATE: MAY 2020
DESIGN BY: RDS
DRAWN BY: AJB
CHECKED BY: SKD
SCALE: NTS
PROJECT No.: 201-00771-00
FIGURE NO.: 4

WSP Canada Inc.
760 Enterprise Cres.,
Victoria, B.C. V8Z 6R4
P: 250.475.1000
www.wsp.com

Section 1-1'



Legend

- Asphalt
- Sand & Gravel Fill
- Silt
- Clay
- Bedrock
- Highly Fractured Bedrock

REV. :	DESCRIPTION:	DATE : (M/D/YR)
#	???	MM/DD/YY

PROJECT: Esquimalt Graving Docks East End Extension

CLIENT: Public Works and Government Servies Canada (PWGSC)

TITLE: Section 1-1'

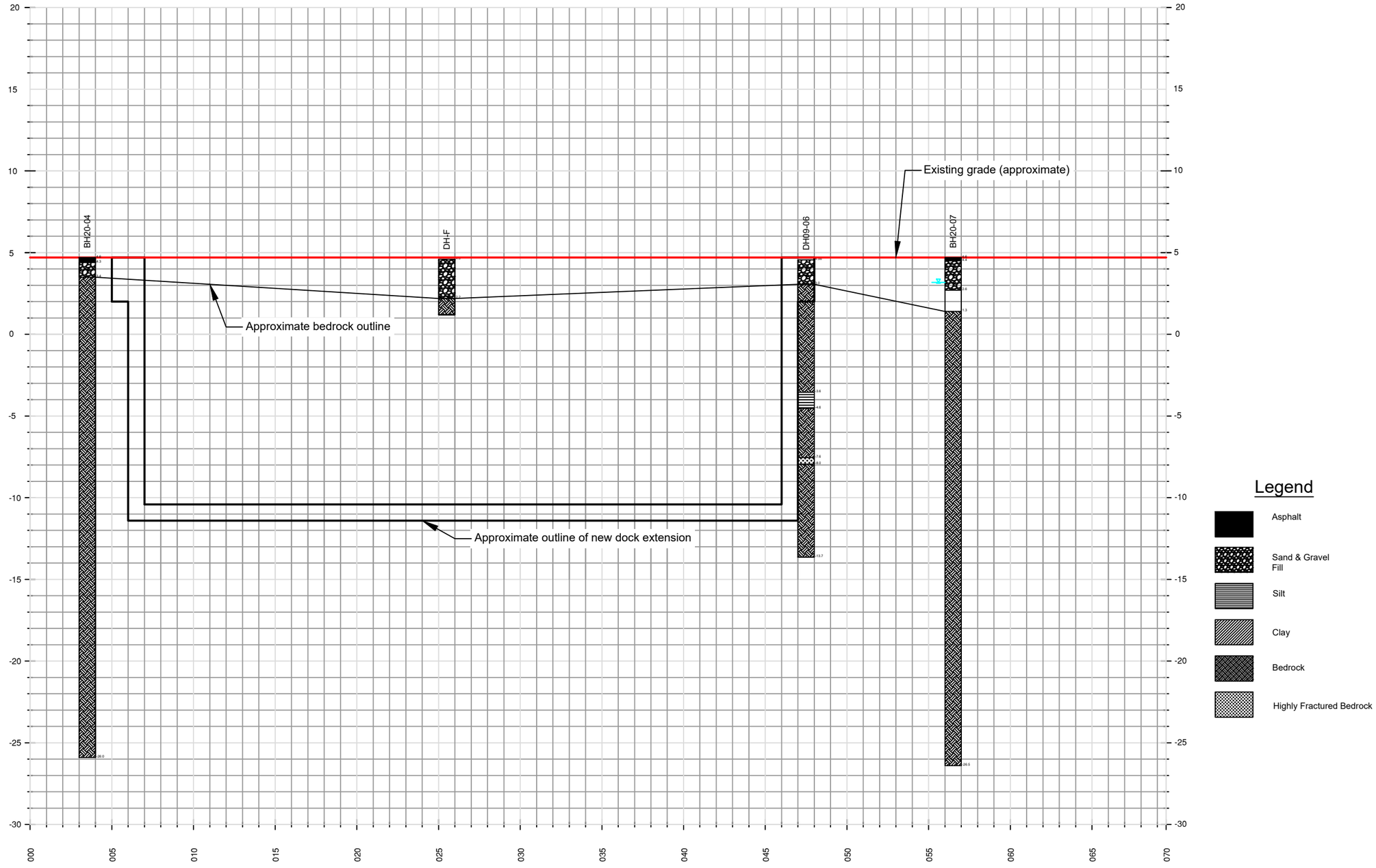
DATE: MAY 2020
DESIGN BY: RDS
DRAWN BY: AJB
CHECKED BY: SKD
SCALE: NTS

PROJECT No.: 201-00771-00

FIGURE NO.: 5

WSP Canada Inc.
760 Enterprise Cres.,
Victoria, B.C. V8Z 6R4
P: 250.475.1000
www.wsp.com

Section 2-2'



REV. :	DESCRIPTION:	DATE : (M/D/YR)
#	???	MM/DD/YY

PROJECT: Esquimalt Graving Docks East End Extension

CLIENT: Public Works and Government Servies Canada (PWGSC)

TITLE: Section 2-2'

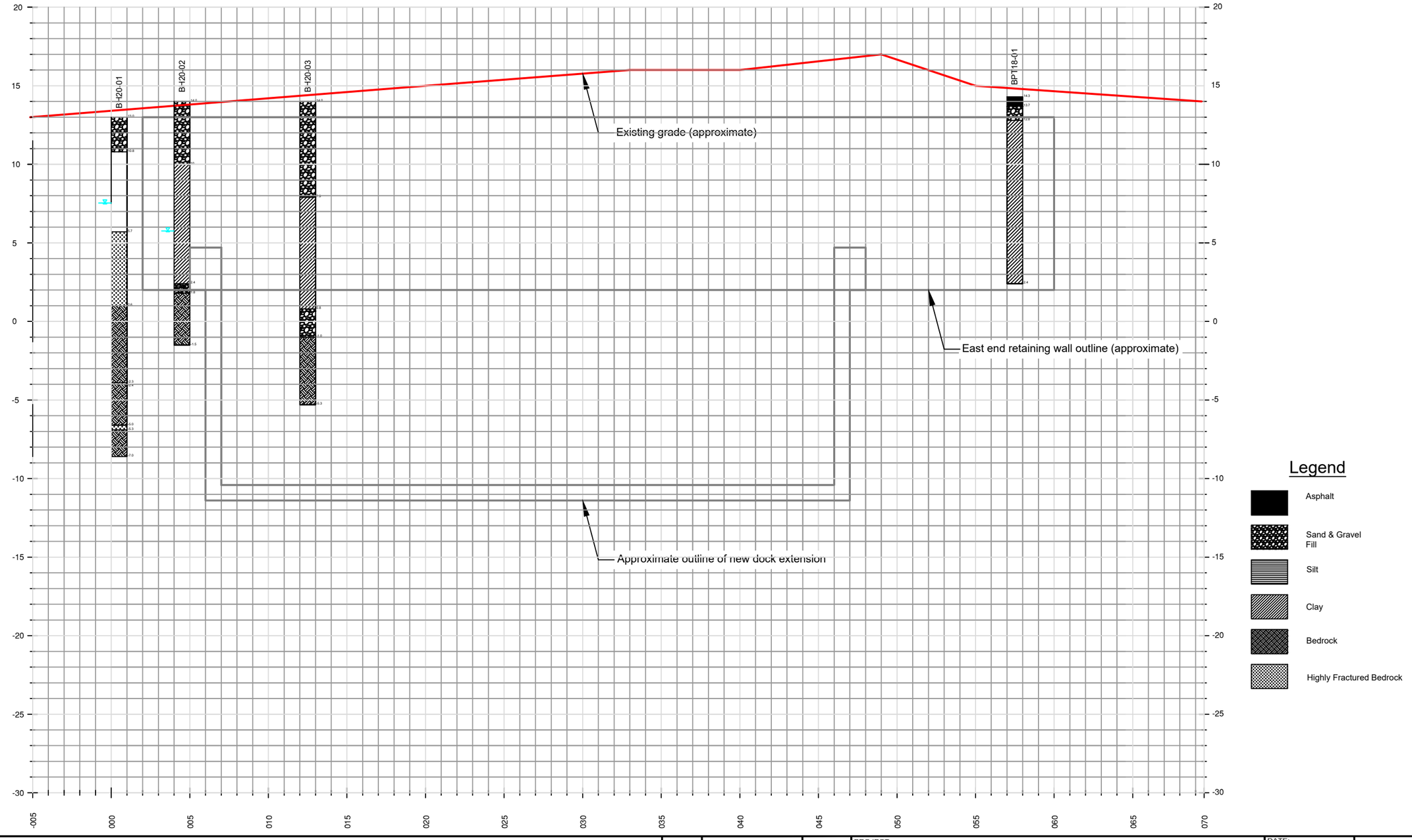
DATE: MAY 2020
DESIGN BY: RDS
DRAWN BY: AJB
CHECKED BY: SKD
SCALE: NTS

WSP Canada Inc.
760 Enterprise Cres.,
Victoria, B.C. V8Z 6R4
P: 250.475.1000
www.wsp.com

PROJECT No.: 201-00771-00

FIGURE NO.: 6

Section 3-3'



REV. :	DESCRIPTION:	DATE : (M/D/YR)
#	???	MM/DD/YY

PROJECT: Esquimalt Graving Docks East End Extension

CLIENT: Public Works and Government Servies Canada (PWGSC)

TITLE: Section 3-3'

DATE: MAY 2020
DESIGN BY: RDS
DRAWN BY: AJB
CHECKED BY: SKD
SCALE: NTS

WSP Canada Inc.
760 Enterprise Cres.,
Victoria, B.C. V8Z 6R4
P: 250.475.1000
www.wsp.com

PROJECT No.: 201-00771-00

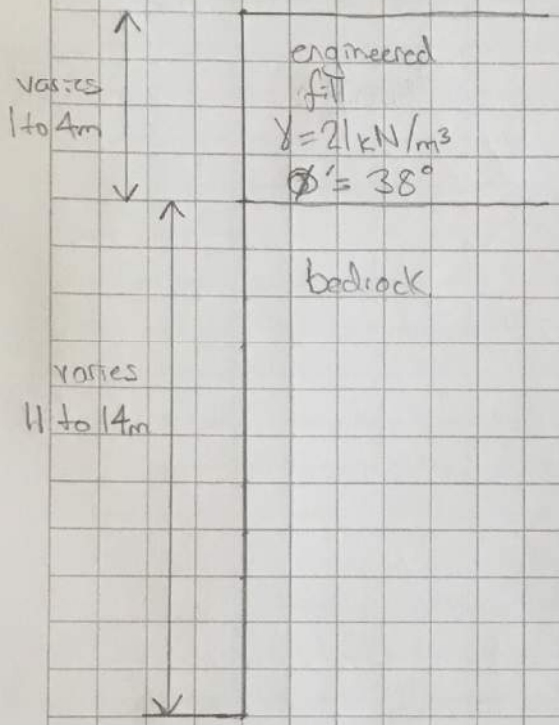
FIGURE NO.: 7

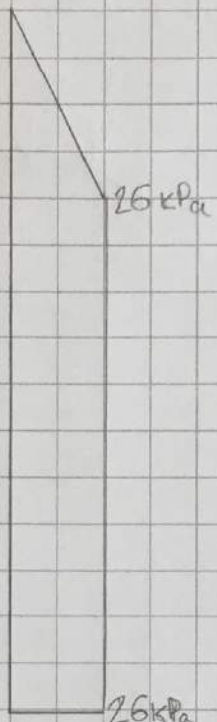
APPENDIX

F WALL PRESSURE DIAGRAMS

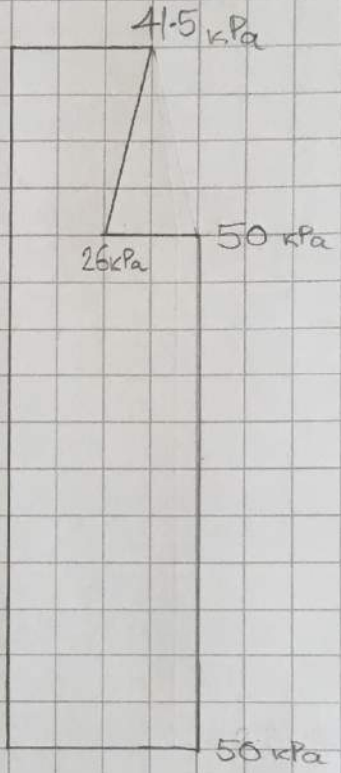
WSP

PROJECT:	No.:	Sheet no. 1 of
EGD East Dock Extension	201-00771-00	Date 28/08/20
SUBJECT: Earth Pressure Distribution (Static) (Seismic)		By SKD





Horizontal earth pressure static case



Horizontal earth pressure seismic case

DISTRIBUTION:

WSP

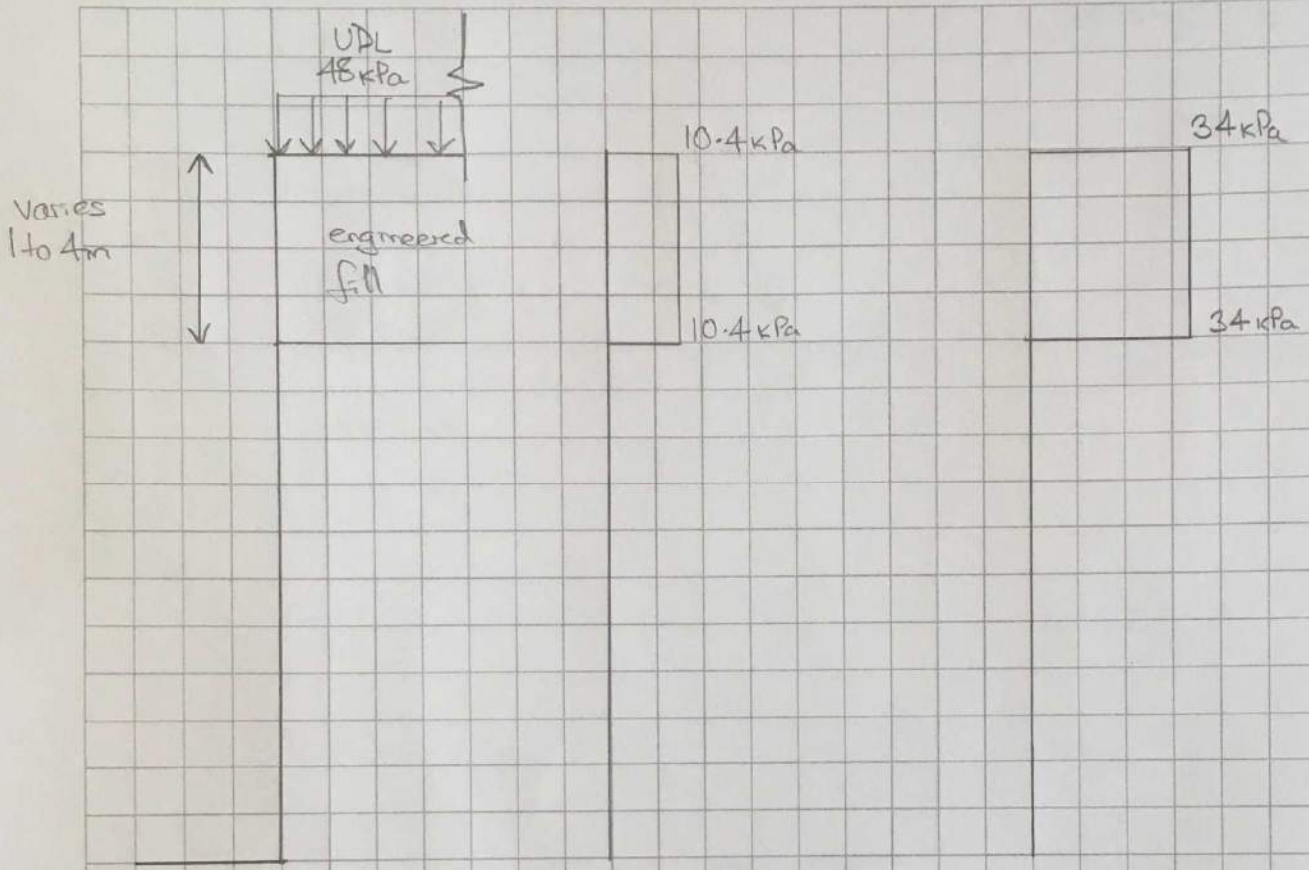
PROJECT: EGD East Dock Extension No.: 201-00771-00

SUBJECT: Earth Pressure – Surcharges.

Sheet no. 2 of

Date 28/08/20

By SKD



Horizontal earth pressure from 48 kPa UDL (static)

Horizontal earth pressure from 48 kPa UDL (seismic)

DISTRIBUTION:

APPENDIX

G STANDARD LIMITATIONS

Standard Limitations

WSP Canada Inc. ("WSP") prepared this report solely for the use of the intended recipient, Public Works and Government Services Canada, in accordance with the professional services agreement between the parties. In the event a contract has not been executed, the parties agree that the WSP General Terms for Consultant shall govern their business relationship which was provided to you prior to the preparation of this report.

The report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings in the assessment.

The conclusions presented in this report are based on work performed by trained, professional and technical staff, in accordance with their reasonable interpretation of current and accepted engineering and scientific practices at the time the work was performed.

The content and opinions contained in the present report are based on the observations and/or information available to WSP at the time of preparation, using investigation techniques and engineering analysis methods consistent with those ordinarily exercised by WSP and other engineering/scientific practitioners working under similar conditions, and subject to the same time, financial and physical constraints applicable to this project.

WSP disclaims any obligation to update this report if, after the date of this report, any conditions appear to differ significantly from those presented in this report; however, WSP reserves the right to amend or supplement this report based on additional information, documentation or evidence.

WSP makes no other representations whatsoever concerning the legal significance of its findings.

The intended recipient is solely responsible for the disclosure of any information contained in this report. If a third party makes use of, relies on, or makes decisions in accordance with this report, said third party is solely responsible for such use, reliance or decisions. WSP does not accept responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken by said third party based on this report.

WSP has provided services to the intended recipient in accordance with the professional services agreement between the parties and in a manner consistent with that degree of care, skill and diligence normally provided by members of the same profession performing the same or comparable services in respect of projects of a similar nature in similar circumstances. It is understood and agreed by WSP and the recipient of this report that WSP provides no warranty, express or implied, of any kind. Without limiting the generality of the foregoing, it is agreed and understood by WSP and the recipient of this report that WSP makes no representation or warranty whatsoever as to the sufficiency of its scope of work for the purpose sought by the recipient of this report.

In preparing this report, WSP has relied in good faith on information provided by others, as noted in the report. WSP has reasonably assumed that the information provided is correct and WSP is not responsible for the accuracy or completeness of such information.

Benchmark and elevations used in this report are primarily to establish relative elevation differences between the specific testing and/or sampling locations and should not be used for other purposes, such as grading, excavating, construction, planning, development, etc.

WSP disclaims any responsibility for consequential financial effects on transactions or property values, or requirements for follow-up actions /or costs.

Standard Limitations

Design recommendations given in this report are applicable only to the project and areas as described in the text and then only if constructed in accordance with the details stated in this report. The comments made in this report on potential construction issues and possible methods are intended only for the guidance of the designer. The number of testing and/or sampling locations may not be sufficient to determine all the factors that may affect construction methods and costs. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

Overall conditions can only be extrapolated to an undefined limited area around these testing and sampling locations. The conditions that WSP interprets to exist between testing and sampling points may differ from those that actually exist. The accuracy of any extrapolation and interpretation beyond the sampling locations will depend on natural conditions, the history of Site development and changes through construction and other activities. In addition, analysis has been carried out for the identified chemical and physical parameters only, and it should not be inferred that other chemical species or physical conditions are not present. WSP cannot warrant against undiscovered environmental liabilities or adverse impacts off-Site.

The original of this digital file will be kept by WSP for a period of not less than 10 years. As the digital file transmitted to the intended recipient is no longer under the control of WSP, its integrity cannot be assured. As such, WSP does not guarantee any modifications made to this digital file subsequent to its transmission to the intended recipient.

This limitations statement is considered an integral part of this report.

Klohn Crippen Berger

September 5, 2008

Public Works and Government Services Canada
825 Admirals Road
Victoria, British Columbia
V9A 2P1

Mr. D. Blythe
Project Administrator

Dear Mr. Blythe:

Esquimalt Graving Dock East End Extension
Phase I Geotechnical Investigations - Data Report

This letter presents the results of the Phase I Geotechnical Site Investigations at the Esquimalt Graving Dock. Public Works and Government Services Canada (PWGSC) plans to excavate and cut back the Esquimalt Graving Dock (EGD) East Slope to facilitate the expansion of the EGD dry dock. Klohn Crippen Berger (KCBL) carried out the site investigation to provide data for the preliminary geotechnical design.

The work was carried out in general accordance with KCBL's proposal of April 25, 2008.

1. 2008 SITE INVESTIGATION

1.1 Ground Penetrating Radar Site Investigation

A ground penetrating radar investigation was conducted by TerraProbe of Burnaby, BC on May 22 and May 23, 2008.

Ground penetrating radar is the general term applied to techniques that employ radio waves to profile structures and features in the subsurface. Depth of exploration varies from less than a meter in clay-rich soils to more then 5000 meters in polar ice. Typical maximum penetration depth in common geological materials varies between 10 and 30 meters. Detectability of targets in the ground depends on their size, shape and orientation relative to the antennas, contrast with the host medium as well as external radio frequency noise and interferences.

The interpreted radar profiles provide a two-dimensional image of the subsurface along the surveyed lines. With adequate line spacing, depth contour maps and/or three-dimensional block models can be generated.

Klohn Crippen Berger Ltd. • 500 – 2955 Virtual Way • Vancouver BC V5M 4X6 • CANADA
604.669.3800 t • 604.669.3835 f • www.klohn.com

Terraprobe employed three GPR units. These consisted of a low frequency unit (100 MHz) mounted on a one meter wide frame that was carried across the ground by a team of two people, a very low frequency unit (50 MHz) with sensors two meters apart, that was carried by a team of two or three people, and a high frequency unit (250 MHz) that was mounted on a wheeled cart and pushed by one person. The low frequency units were used to locate the bedrock surface at depth, while the higher frequency unit was used to locate the bedrock surface or underground utilities near surface.

The results of TerraProbe's investigation are presented in Appendix I. In general, the investigation was not successful since the GPR could not locate the bedrock surface in most locations. The GPR could not locate the bedrock surface beneath the slope, or in most locations beneath the road since the depth to rock was too great and the overlying silty material quickly attenuated the signal. Results were slightly better on the pavement area at the east end of the drydock, but the bedrock surface could still not be located with any confidence except near the north and south edges of the drydock where the rock surface is shallow.

1.2 Hydraulic (Air Track) Drill Investigation

A hydraulic drill investigation program was conducted on May 26, 2008 by Western Grater of Victoria, using an Atlas Copco ROC D9 track-mounted hydraulic drill rig.

The hydraulic drill is a very fast and efficient method of proving depth to bedrock, but material types and stratigraphy can not be interpreted from the hydraulic drill action. Drill hole locations are shown on the attached Drawing SK9522-05. A drill hole summary is presented in Table 1.

Table 1 Hydraulic Drill Hole Summary

Drill Hole	Ground Elevation (m)	Depth to Rock (m)	Elevation of Bedrock Surface (m)
A	16.1	17.4	-1.3
B	15.3	15.2	0.1
C	15.1	17.1	-2.0
D	4.6	6.4	-1.8
E	4.6	3.9	-0.7
F	4.6	2.4	2.2
G	4.5	3.9	0.6
H	4.6	1.8	2.8
I	4.5	1.5	3.0
J	4.6	1.2	3.4
K	4.6	1.8	2.8
N	5.9	4.3	1.6
P	4.6	1.2	3.4

2. LIMITATIONS AND USE OF REPORT

This report is an instrument of service of Klohn Crippen Berger Ltd. The report has been prepared for the exclusive use of PWGSC for the specific application to the Esquimalt Graving Dock, East End Extension project. The report's contents may not be relied upon by any other party without the express written permission of Klohn Crippen Berger. In this report, Klohn Crippen Berger has endeavoured to comply with generally accepted geotechnical practice common to the local area. Klohn Crippen Berger makes no warranty, express or implied.

The analyses, conclusions and recommendations contained in this report are based on data derived from a limited number of test holes obtained from widely spaced subsurface explorations. The methods used indicate subsurface conditions only at the specific locations where samples were obtained or where in-situ tests would infer, only at the time they were obtained, and only to the depths penetrated. The samples and tests cannot be relied on to accurately reflect the nature and extent of strata variations that usually exist between sampling or testing locations.

The recommendations included in this report have been based in part on assumptions about strata variations between test holes that will not become evident until construction or further investigation. Accordingly, Klohn Crippen Berger should be retained to perform construction observation and thereby provide a complete professional geotechnical engineering service through the observational method. If variations or other latent conditions become evident during construction, Klohn Crippen Berger will re-evaluate this report's recommendations. Klohn Crippen Berger cannot assume responsibility or liability for the adequacy of its recommendations when they are used in the field without Klohn Crippen Berger being retained to observe construction.

Although Klohn Crippen Berger has explored subsurface conditions as part of this program, Klohn Crippen Berger has not conducted analytical laboratory testing of samples obtained, has not evaluated the site for potential presence of contaminated soil, and has not evaluated groundwater conditions.

We trust this data report meets your requirements at this time. Please contact us if you have any questions.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Andrew Port, P.Eng.
Geotechnical Engineer

James Williams, EIT
Geotechnical Engineer

Geoff Cooper, P.Eng.
Senior Project Manager

Photo 1: Assembling 100 MHz equipment

Photo 2: Carrying 100 MHz equipment across east end of dry dock

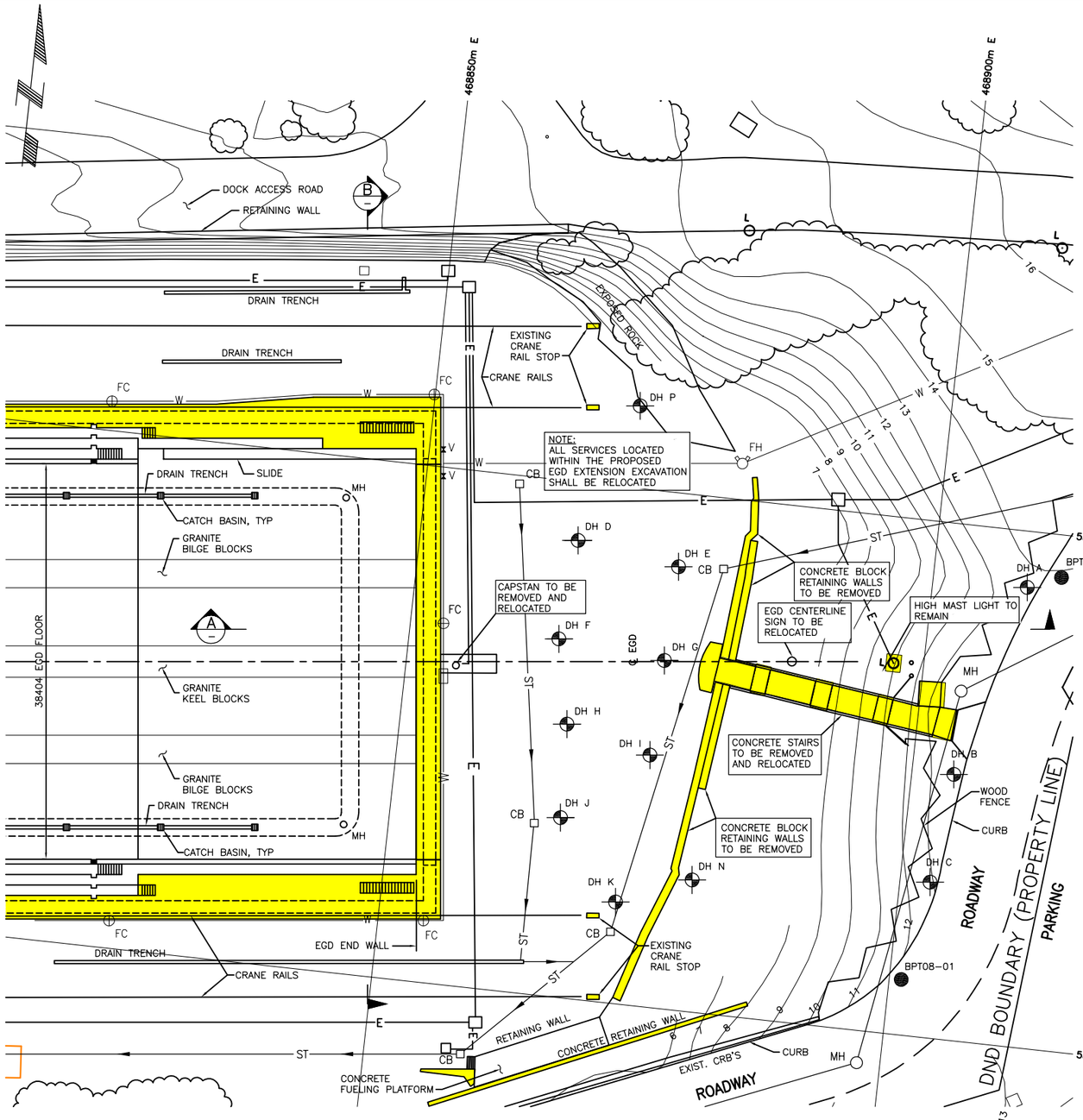
Photo 3: Carrying 100 MHz equipment on slope.

Photo 4: Carrying 50 MHz equipment along east end of drydock

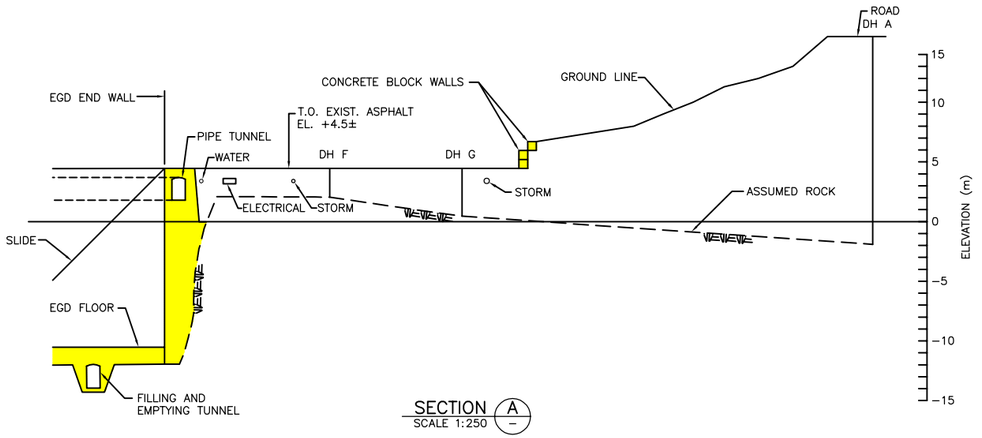
Photo 5: Pushing 250 MHz equipment

Photo 6: Atlas Copco ROC D9 hydraulic drill

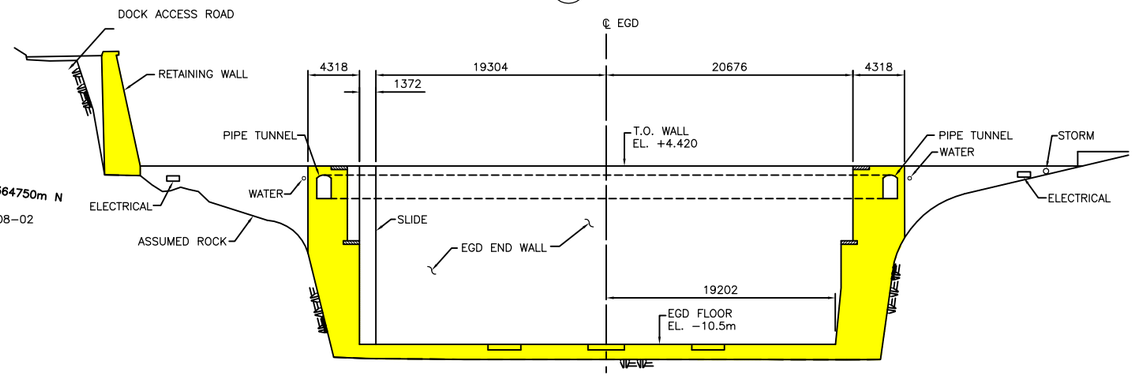
FIGURES



PLAN
1:250



SECTION A
SCALE 1:250



SECTION B
SCALE 1:250

NOTES:

1. DIMENSIONS AND SERVICES SHOWN FOR THE EXISTING ESQUIMALT GRAVING DOCK ARE INFERRED FROM ORIGINAL "RECORD" DRAWINGS AND FIELD MEASUREMENTS.
2. DRILL HOLE LOCATIONS ARE APPROXIMATE.

LEGEND

EGD ESQUIMALT GRAVING DOCK
DH K — AIR TRACK DRILL HOLE. MAY 26 2008
BPT08-01 — BECKER HAMMER TEST HOLE. JULY 17 2008
L — LIGHT POLE
V — WATER VALVE
FH — FIRE HYDRANT
FC — FIRE CONTROL
CB — CATCH BASIN
MH — MANHOLE
W — WATER
ST — STORM SEWER
E — ELECTRICAL
CONCRETE

SCALE AS SHOWN

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN REPORT DATED _____

NO.	DATE	ISSUED / REVISION	DRAWN	CHK'D	DESIGN	APP'D
A	DEC. 19/08	ISSUED TO CLIENT	B.K.S.	J.C.T.		

CLIENT
Public Works and Government Services Canada
Travaux publics et Services Gouvernementaux Canada

Klohn Crippen Berger

PROJECT
ESQUIMALT GRAVING DOCK
EAST END EXTENSION

TITLE
EXISTING EAST END
PLAN & SECTIONS

PROJECT No. P09522A01

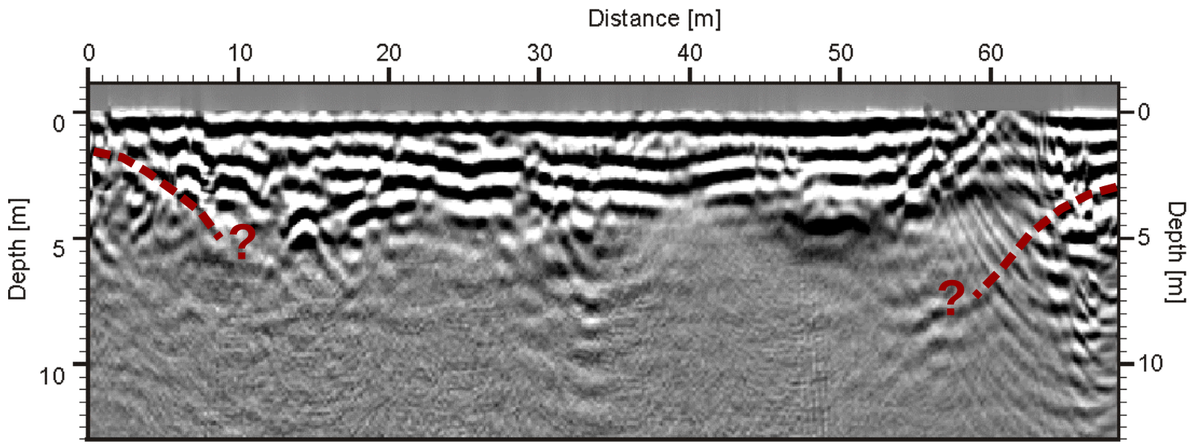
FIG. No. SK9522-01

KCB-DM

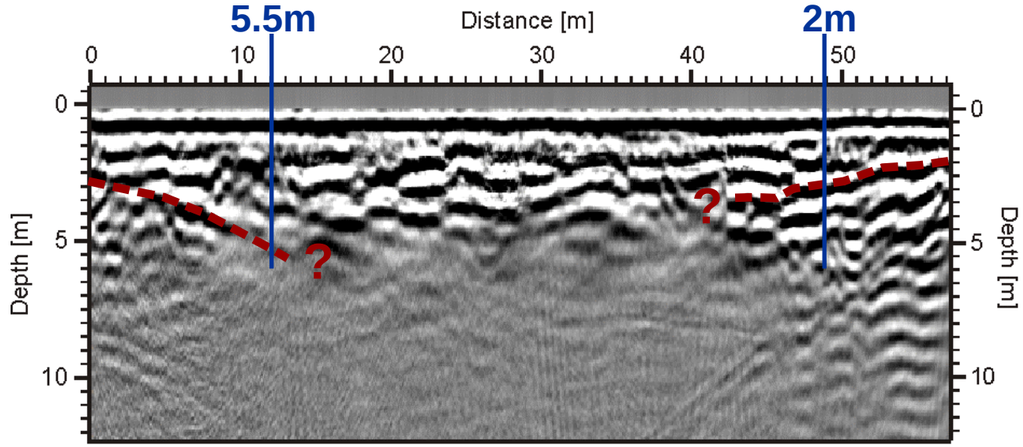
APPENDIX I

TerraProbe Ground Penetrating Radar Report

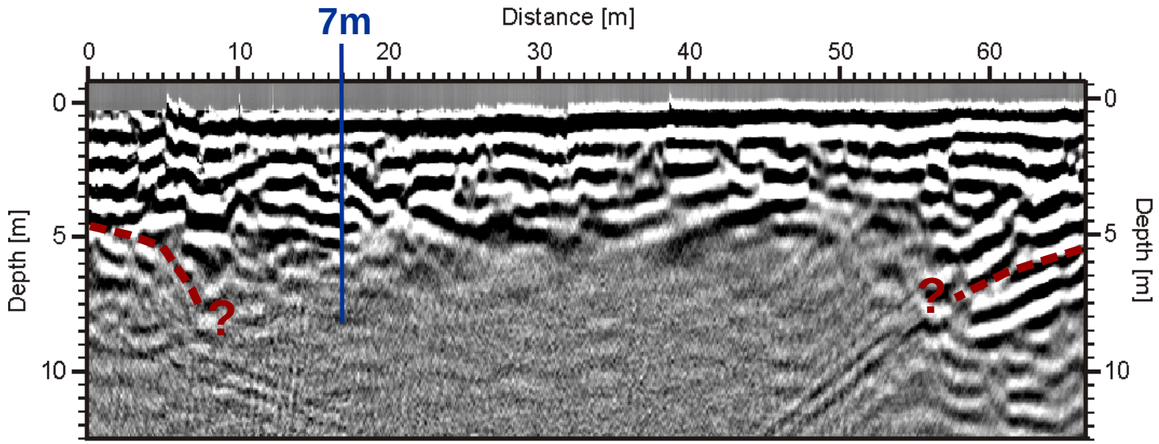
Line 1A



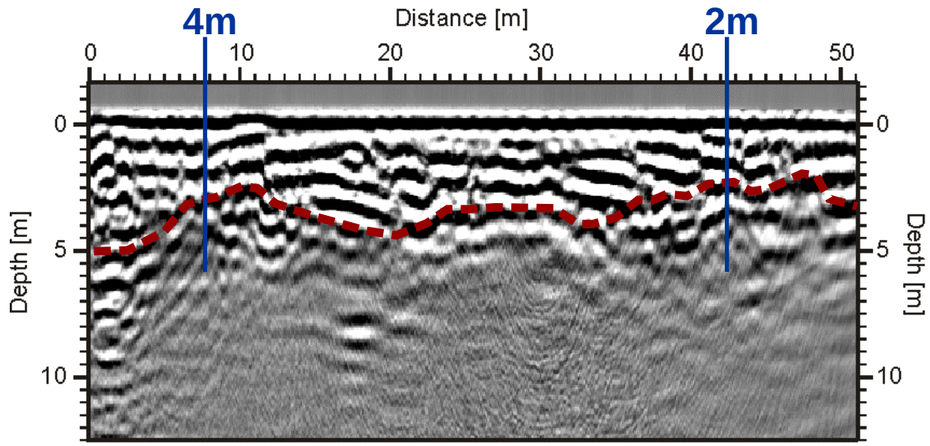
Line 3B



Line 2B



Line 4A



Legend

- Interpreted bedrock depth
- Drill data of known bedrock depth

DRAFT

TERRAprobe
The Leader in Georadar Consulting
Tel: 604 291 9391
Web: www.terraprobe.com

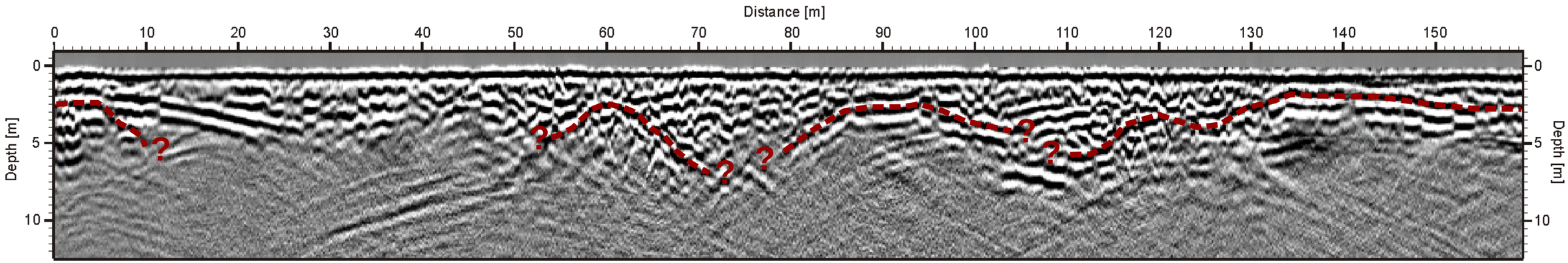
Klohn Crippen Berger Ltd.
Esquimalt Graving Dock
Preliminary Results

Ground Penetrating Radar Survey
Figure 1: GPR profiles

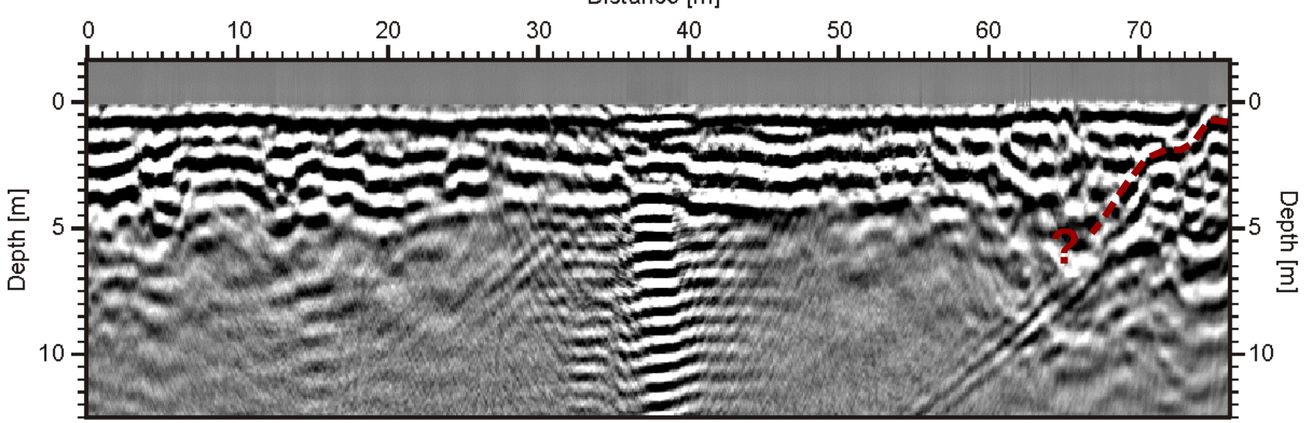
Terraprobe Geoscience Corp.

Terry Wong	May 2008	TGC20080522D

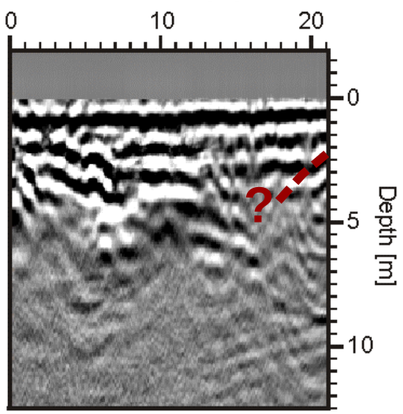
Slope 3



Line 5B



Line 7A



Legend

- Interpreted bedrock depth
- Drill data of known bedrock depth

DRAFT

TERRAprobe
The Leader in Georadar Consulting
Tel: 604 291 9391
Web: www.terraprobe.com

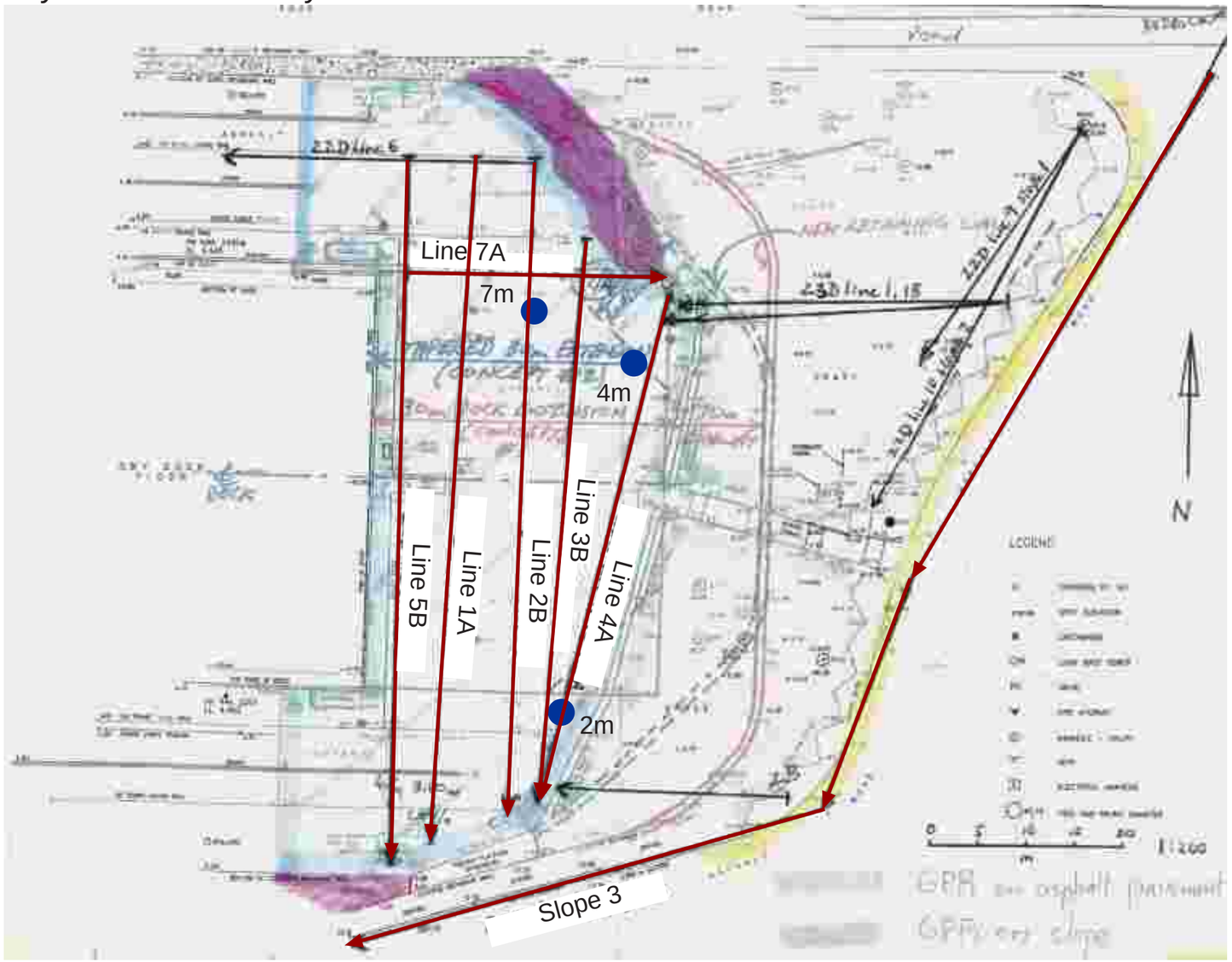
Klohn Crippen Berger Ltd.
Esquimalt Graving Dock
Preliminary Results

Ground Penetrating Radar Survey
Figure 2: GPR profiles

Terraprobe Geoscience Corp.

Terry Wong	May 2008	TGC20080522D

Layout of GPR survey lines



Legend

- Processed survey data
- Bedrock depth

DRAFT

TERRAprobe
The Leader in Georadar Consulting
Tel: 604 291 9391
Web: www.terraprobe.com

Klohn Crippen Berger Ltd.
Esquimalt Graving Dock
Preliminary Results

Ground Penetrating Radar Survey
Figure 3: Plan overview

Terraprobe Geoscience Corp.

Terry Wong	**May 2008**	**TGC20080522D**

Klohn Crippen Berger

September 17, 2008

Public Works and Government Services Canada
825 Admirals Road
Victoria, British Columbia
V9A 2P1

Mr. D. Blythe
Project Administrator

Dear Mr. Blythe:

Esquimalt Graving Dock
East Slope Stability Investigation – Data Report

This letter presents the results of the East Slope Stability Investigation at the Esquimalt Graving Dock.

The work was carried out in general accordance with KCBL's proposal of June 26, 2008.

1. 2008 SITE INVESTIGATION

1.1 Becker Hammer Investigation

A Becker site investigation program was carried out on July 17 and 18, 2008, by Foundex Explorations of Surrey, BC using a truck-mounted HAV180 Becker Hammer Drill.

The Becker drill program included two drill sites; BK08-01 and BK08-02. An open ended Becker test hole and a closed ended Becker penetration test were completed at each location. The two drilling sites were located on the asphalt road that separates the EGD East Slope and the DND Administration Building. The approximate locations of the drill holes are shown on Drawing SK9522-06. Underground utilities were located using the "Fresh Water and Fire", "Sewer" and "Power and Communications" drawings provided by PWGS. Water that was needed for drilling was obtained from a fire hydrant at the north-east corner of the graving dock.

During the open ended Becker test holes the soil was logged and samples were taken for testing at our laboratory in Vancouver. During the closed ended Becker penetration tests, blow counts per 0.3m of penetration were recorded and logged. The Becker test hole logs and the laboratory testing results are appended to this letter in Appendix I.

Klohn Crippen Berger Ltd. • 500 – 2955 Virtual Way • Vancouver BC V5M 4X6 • CANADA
604.669.3800 t • 604.669.3835 f • www.klohn.com

At the completion of each test, the holes were backfilled with pea gravel and bentonite seals in accordance with the British Columbia Groundwater Protection Act. The depths of the bentonite seals are included in the appended test hole logs. At the road elevation, the asphalt was patched with concrete or a flush mounted monument was grouted in place.

Standpipe piezometers were installed in each of the open ended Becker test holes to determine water table depths. A water level meter was temporarily left with PWGSC to allow them to continue monitoring water levels once KCBL had left site, and results are shown in Table 1.

Table 1 Water Levels

Test Hole	Depth to Water Table (m)		Approximate Elevation of Ground Surface (m)	Average Depth to Water Table (m)	Approximate Elevation of Water Table (m)
	21-Jul-08	25-Jul-08			
BK08-01	2.986	3.044	14.3	3.01	11.28
BK08-02	5.210	5.205	15.7	5.20	10.49

2. LIMITATIONS AND USE OF REPORT

This report is an instrument of service of Klohn Crippen Berger Ltd. The report has been prepared for the exclusive use of PWGSC for the specific application to the Esquimalt Graving Dock, East End Extension project. The report's contents may not be relied upon by any other party without the express written permission of Klohn Crippen Berger. In this report, Klohn Crippen Berger has endeavoured to comply with generally accepted geotechnical practice common to the local area. Klohn Crippen Berger makes no warranty, express or implied.

The analyses, conclusions and recommendations contained in this report are based on data derived from a limited number of test holes obtained from widely spaced subsurface explorations. The methods used indicate subsurface conditions only at the specific locations where samples were obtained or where in-situ tests would infer, only at the time they were obtained, and only to the depths penetrated. The samples and tests cannot be relied on to accurately reflect the nature and extent of strata variations that usually exist between sampling or testing locations.

The recommendations included in this report have been based in part on assumptions about strata variations between test holes that will not become evident until construction or further investigation. Accordingly, Klohn Crippen Berger should be retained to perform construction observation and thereby provide a complete professional geotechnical engineering service through the observational method. If variations or other latent conditions become evident during construction, Klohn Crippen Berger will re-

evaluate this report's recommendations. Klohn Crippen Berger cannot assume responsibility or liability for the adequacy of its recommendations when they are used in the field without Klohn Crippen Berger being retained to observe construction.

Although Klohn Crippen Berger has explored subsurface conditions as part of this program, Klohn Crippen Berger has not conducted analytical laboratory testing of samples obtained, has not evaluated the site for potential presence of contaminated soil, and has not evaluated groundwater conditions.

We trust this data report meets your requirements at this time. Please contact us if you have any questions.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Andrew Port, P.Eng.
Geotechnical Engineer

James Williams, EIT
Geotechnical Engineer

Geoff Cooper, P.Eng.
Senior Project Manager

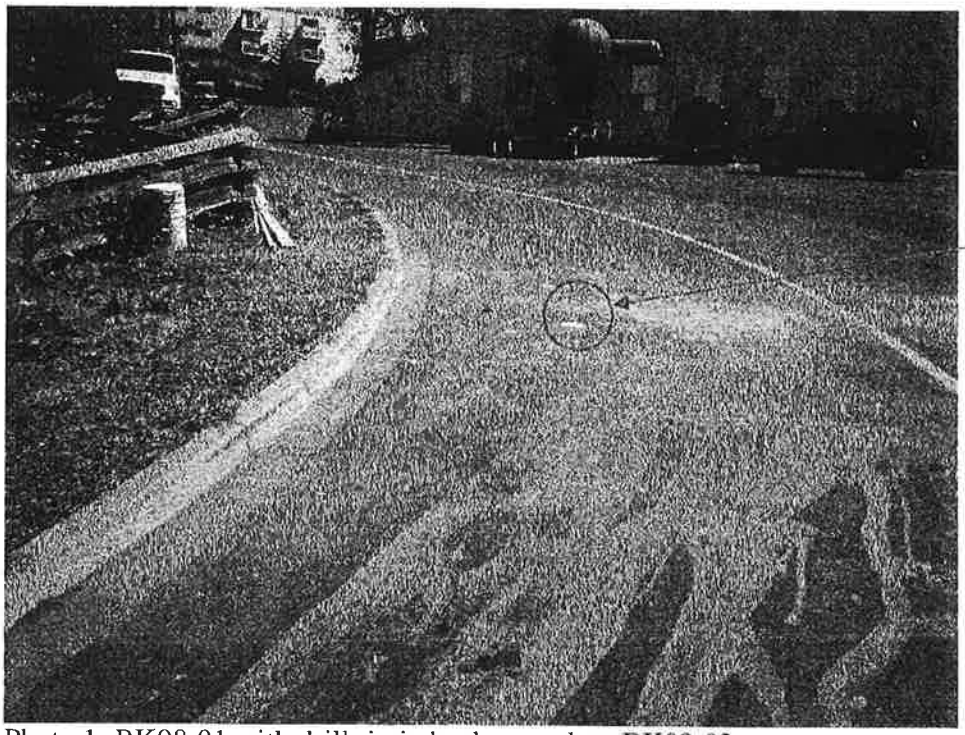


Photo 1: BK08-01 with drill rig in background on BK08-02

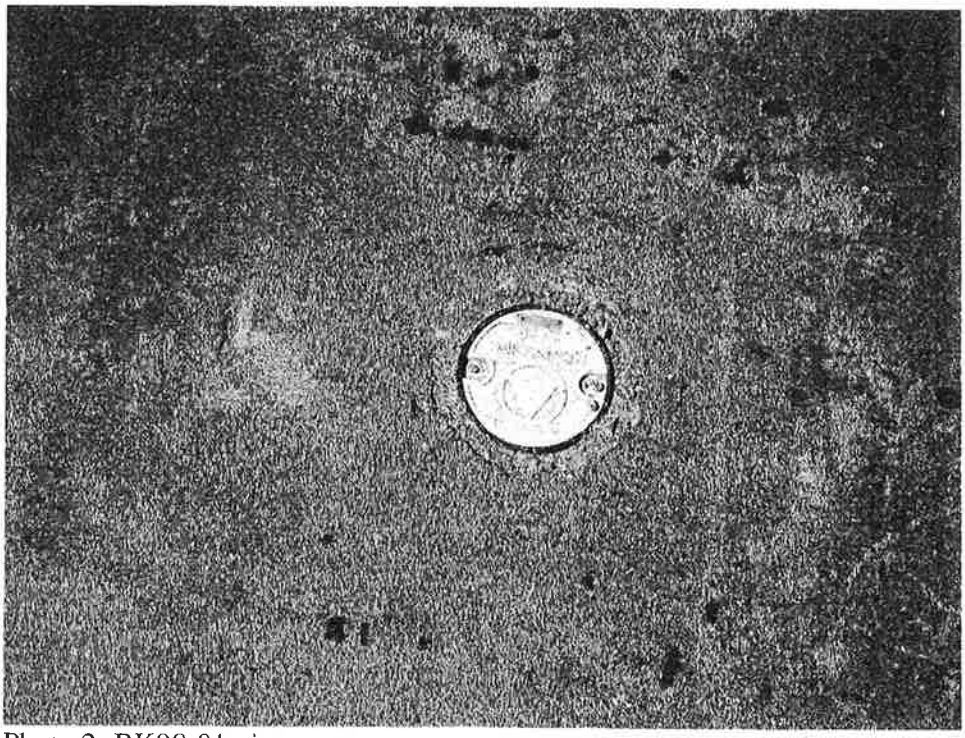
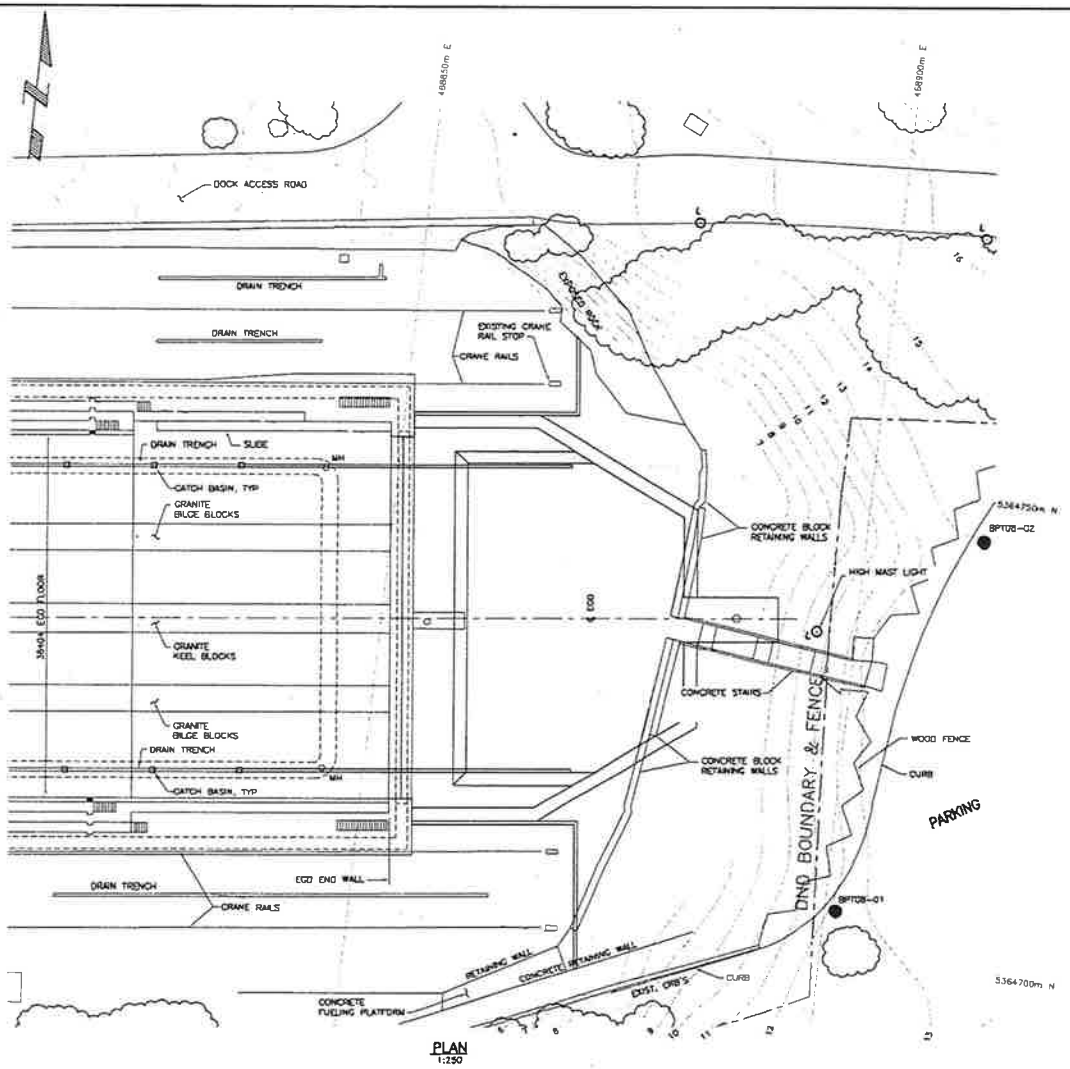


Photo 2: BK08-01 piezometer monument cover

FIGURES



PLAN
1:250

NOTES:

1. DIMENSIONS AND SERVICES SHOWN FOR THE EXISTING ESQUIMALT GRAVING DOCK ARE INFERRED FROM ORIGINAL "RECORD" DRAWINGS AND FIELD MEASUREMENTS.
2. TEST HOLE LOCATIONS ARE APPROXIMATE.

LEGEND

EGD ESQUIMALT GRAVING DOCK

BPT08-01
● BECKER HAMMER TEST HOLE, JULY 17 2008

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN-CRIPPEN REPORT DATED _____

SCALE AS SHOWN

NO	DATE	ISSUE / REVISION	DRAWN	CHK'D	DESIGN	APP'D

CLIENT
Public Works and Government Services Canada
Travaux publics et Services Gouvernementaux Canada

Klohn Crippen Berger

PROJECT
ESQUIMALT GRAVING DOCK
EAST END EXPANSION

TITLE
BECKER HAMMER TEST HOLES

PROJECT No. P09522A02

DWG. No. SK9522-06

REV

CHECK PRINTS BEARING PREVIOUS

APPENDIX I

Becker Drill Hole Logs

Klohn Crippen Berger

SYMBOLS AND TERMS

FOR SOIL DESCRIPTION AND TEST HOLE LOGS

BASIC SYMBOLS

SYMBOL VARIATIONS - EXAMPLES[1]

CLASSIFICATION BY PARTICLE SIZE				
		Size Range		
			U.S. Standard Sieve Size	
Name		(mm) [3]	Retained	Passing
Boulders		> 200	8 inch	-
Cobbles		75 - 200	3 inch	8 inch
Gravel:	coarse	19 - 75	0.75 inch	3 inch
	fine	5 - 19	No. 4	0.75 inch
Sand:	coarse	2 - 5	No. 10	No. 4
	medium	0.4 - 2	No. 40	No. 10
	fine	0.075 - 0.4	No. 200	No. 40
Fines (Silt or Clay) [4]		< 0.075	-	No. 200

PROPORTION OF MINOR COMPONENTS BY WEIGHT[2]	
and	35 - 50%
y/ey	20 - 35%
some	10 - 20%
trace	0 - 10%

PARTICLE SHAPE	
Flat	width/thickness > 3
Elongated	length/width > 3

DENSITY OF GRANULAR SOILS		
Description	SPT N [5]	SPT $(N_1)_{60}$ [6]
Very Loose	0 - 4	0 - 3
Loose	4 - 10	3 - 8
Compact	10 - 30	8 - 25
Dense	30 - 50	25 - 42
Very Dense	> 50	> 42

CONSISTENCY OF COHESIVE SOILS			
Description	S_u [7]		SPT
	(kPa) [8]	(ksf) [8]	N [9]
Very Soft	< 12	< 0.25	< 2
Soft	12 - 25	0.25 - 0.5	2 - 4
Firm	25 - 50	0.5 - 1	4 - 8
Stiff	50 - 100	1 - 2	8 - 15
Very Stiff	100 - 200	2 - 4	15 - 30
Hard	> 200	> 4	> 30

(1) Only selected examples of the possible variations or combinations of the basic symbols are illustrated.
(2) Example: SAND, silty, trace of gravel = sand with 20% to 35% silt and up to 10% gravel, by weight.
(3) Approximate metric conversion.
(4) Fines are classified as silt or clay on the basis of Atterberg limits (refer to Plasticity Chart).
(5) Standard Penetration Test (SPT) blow count (uncorrected), after Terzaghi and Peck, 1948.
(6) Standard Penetration Test blow count, based on above N value corrected to 60% hammer efficiency and 96 kPa (1.0 ton/ft²) effective overburden pressure, after Skempton, 1986.
(7) Undrained shear strength can be estimated by vane (gives S_u), pocket penetrometer (gives unconfined compressive strength, i.e., 2 S_u), or unconfined compression test (gives 2 S_u).
(8) ksf = 1000 pounds per square foot = 0.5 tsf (ton/ft²) = approximately 0.5 kg/cm².
(9) Very approximate correlation with Standard Penetration Test blow counts, after Terzaghi and Peck, 1948.

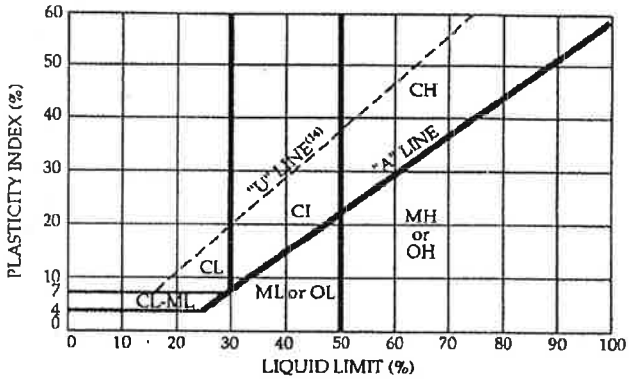
Klohn Crippen Berger

SYMBOLS AND TERMS
FOR SOIL DESCRIPTION AND TEST HOLE LOGS

PLASTICITY OF COHESIVE SOILS[10]		
Description	Silt	Clay
High	W_L[11] > 50	W_L > 50
Medium	–	30 < W_L < 50
Low	W_L < 50	W_L < 30
Non-Plastic	NP[12]	–

SENSITIVITY OF COHESIVE SOILS	
Description	$\frac{\text{Undisturbed Strength}}{\text{Remoulded Strength}}$[13]
High	> 8
Medium	4 to 8
Low	< 4

PLASTICITY CHART FOR SOILS PASSING NO. 40 SIEVE[10]



CLASSIFICATION OF GROUND ICE[15]			
GROUP		SUBGROUP	
Symbol	Description	Symbol	Description
N	Ice not visible by unaided eye	Nf	Poorly bonded or friable
		Nbn	Well bonded, no excess ice
		Nbe	Well bonded, excess ice
V	Visible ice less than 25 mm thick	Vx	Individual ice crystals or inclusions
		Vc	Ice coatings on soil particles
		Vr	Random or irregularly oriented ice
		Vs	Stratified or distinctly oriented ice
ICE	Visible ice greater than 25 mm thick	ICE + (soil type)	Ice with soil inclusions
		ICE	Ice without soil inclusions

(10) This plasticity classification conforms to the Unified Soil Classification System (USCS) and the ASTM D-2487 plasticity chart, except for the addition of an intermediate category for clay, where the liquid limit is between 30% and 50% (CI). Under ASTM and USCS, all clays with a liquid limit less than 50% are classified as low plasticity (CL).
(11) W_L = Liquid Limit (%).
(12) NP = Non Plastic (silts only).
(13) Dimensionless ratio.
(14) "U" Line marks typical upper limit. "A" Line divides clays from silts and organic soils.
(15) For soil descriptions, estimate percentage of ground ice based on volume, after National Research Council of Canada, 1963.

Klohn Crippen Berger

SYMBOLS AND TERMS
FOR SOIL TEST HOLE LOGS

TEST TYPES[1]

DH	Drill Hole - *typical drilling methods include tricone, percussion, wash boring, machine auger with SPT or thin-walled tube samples and coring.*
BK	Becker hammer drill hole - *both open and closed test at the same location.*
BKS	Becker hammer drill hole - *open casing, sampled.*
BPT	Becker penetration test - *closed casing.*
TP	Test pit - *machine or hand dug.*
CPT	Electric cone penetration test with pore pressure measurements.
DCT	Dynamic cone penetration test.
VST	Vane shear test.
AH	Auger hole - *machine or hand auger, no SPT or thin-walled tube samples taken.*

IN SITU TESTS OR DOWNHOLE INSTRUMENTATION[2]

BM	Benchmark
DMT	Dilatometer test
IN	Inclinometer
PMT	Pressuremeter test
PT	Permeability test
PZ	Piezometer
SW	Shear wave velocity test

LABORATORY AND/OR FIELD TESTS[3]

S_u Undrained shear strength, measured by:[4]

- ◆ Field Vane (peak)
- ◇ Field Vane (remoulded)
- ■ Lab Vane (peak)
- □ Lab Vane (remoulded)
- ▲ Unconfined Compression
- △ Pocket penetrometer

- ● Standard Penetration Test (SPT) blow count, uncorrected (N)
- ○ W% In situ moisture content
- × W_p% Plastic limit
- × W_L% Liquid limit
- Becker penetration test blow counts, closed casing
- Becker penetration test blow counts, open casing
- ▼ or ▽ Water level, measured on date and from piezometer indicated on log

OTHER LABORATORY TESTS[5]

CD	Consolidated, drained triaxial test
CUP	Consolidated, undrained triaxial test with pore pressure measurements
CUCY	Consolidated, undrained triaxial test with cyclic loading
UU	Unconsolidated, undrained triaxial test
UC	Unconfined (uniaxial) compression test
DS	Direct shear test
DSS	Direct simple shear test
GSD	Grain size distribution *(by sieve or hydrometer)*
MDR	Moisture-density relationship *(i.e. standard or modified Proctor test)*
ORG	Organic content
OED	Oedometer consolidation test
RD	Relative density *(also known as density index)*
GS	Specific gravity
K	Permeability
UW	Unit Weight

(1) Test type abbreviation is typically followed by a two-part number indicating year and chronological sequence of test. Example: CPT93-1 indicates the first electric cone penetration test at a particular site in 1993.
(2) In situ test or downhole instrumentation abbreviations are typically shown in brackets following the appropriate test type designation. Example: DH93-1(PZ) indicates a piezometer was installed in drill hole 93-1.
(3) These symbols are for laboratory and/or field test results shown on the test hole log.
(4) Vane gives S_u. Pocket penetrometer and unconfined compression tests give 2 S_u, so results are divided by 2 for plotting on log.
(5) Where other laboratory test results are available but not shown on the test hole log, the applicable abbreviation appears under the heading *"Other Tests"* on the log.

BECKER TEST HOLE LOG

STARTED: 07/17/2008 **FINISHED:** 07/17/2008

DRILL RIG MODEL: Becker

GROUND ELEV. (m): 14.3

COORDINATES (m):

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
0					ASPHALT	
0.6		GRAB	2		GRAVEL (GW), fine to coarse grained, sandy, some cobbles, well graded, compact, maximum particle size 150mm, sub-angular, brown-grey, no odour, dry, (Road Fill).	
1.5		GRAB	3		CLAY (Cl), silty, medium plasticity, very soft to soft, grey, no odour, moist.	
3		GRAB	4			
4.4		GRAB	5			
9.9		GRAB	6		CLAY (Cl), silty, medium plasticity, very soft to soft, grey, no odour, moist.	
		GRAB	7			
		GRAB	8			
		GRAB	9			
		GRAB	10			
		GRAB	11			
11.9		GRAB	12			
14.3					End of Becker Drill Hole at 11.9 m	

Notes:

1) Open and Closed Becker holes were done approximately 1.5 m apart

2) Both holes were conducted using a truck-mounted HAV 180 Becker drill rig operated by Foundex Explorations Ltd. of Surrey, BC

3) Open and Closed Becker terminated at practial refusal at 11.9 m (200 blows / no penetration)

4) Closed Becker hole backfilled with pea gravel with bentonite chip seals at 0.3 m to 1.2 m, 4.6 m to 5.8 m, and 10.4 m to 12.2 m

5) Open Becker hole backfilled with pea gravel with bentonite chip seals at 0.3 m to 1.2 m and 6.6 m to 7.5 m. Piezometer Installed.

BECKER PENETRATION TEST

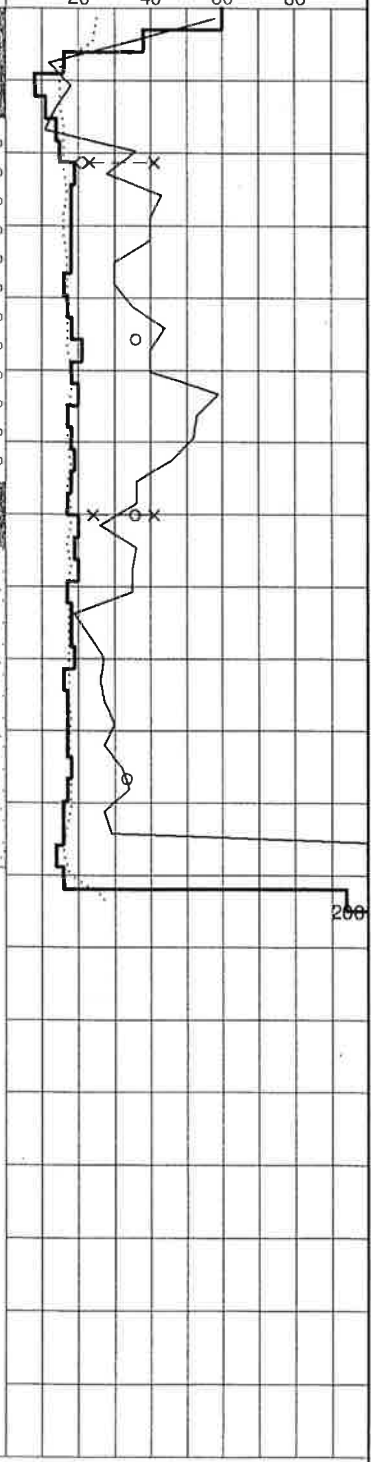
Casing O.D.: 6 5/8 inch — CLOSE ENDED (blows/0.3m)

Hammer Energy: 11 kJ max. rated — OPEN ENDED (blows/0.3m)

● SPT N — BOUNCE PRESS (kPa)

W_P% W% W_L%

20 40 60 80



Klohn Crippen Berger

PROJECT NO.: P09522 A02

PROJECT: EGD East End Extension - Slope Stability

LOCATION: Esquimalt Graving Dock

LOGGED BY: JW **CHECKED BY:**

SHEET 1 **OF** 1 **HOLE NO.:** BPT08-01

KCBL BECKER-SI DRILL HOLE LOGS.GPJ KC_DATA.GDT 9/3/08

BECKER TEST HOLE LOG

STARTED: 07/18/2008 **FINISHED:** 07/18/2008

DRILL RIG MODEL: Becker

GROUND ELEV. (m): 15.7

COORDINATES (m):

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					ASPHALT (0.6)	
1		GRAB	13		15.1 SAND and GRAVEL (GWS), fine sand to medium gravel, trace cobbles, trace silt, well graded, compact to dense, brown, no odour. (FILL)	
2		GRAB	14			
3					3.4	
4		GRAB	15		12.4 SAND and GRAVEL (GWS), fine sand to medium gravel, some silt, well graded, compact, dark brown, no odour.	
5		GRAB	16		4.6 11.1 SAND and GRAVEL (GWS), fine sand to medium gravel, some cobbles, some silt, well graded, compact, dark brown, no odour. 5.5	▽
6		GRAB	17		10.2 CLAY (CI), silty, medium plasticity, very soft to soft, grey, no odour, moist.	
7		GRAB	18			
8					8.2	
9		GRAB	19		7.5 CLAY (CI), silty, medium plasticity, very soft to soft, grey, no odour, moist.	
10		GRAB	20			
11		GRAB	21			
12		GRAB	22			
13		GRAB	23			
14					14.3	
15		GRAB	24		1.4 SAND (GP), medium to coarse grained, some gravel, poorly graded, dense, rounded, no odour, wet.	
16		GRAB	25			
17		GRAB	26		17.2 -1.5	
18					End of Becker Drill Hole at 17.2 m	
19					Notes:	
20					1) Open and Closed Becker holes were done approximately 1.5 m apart	
					2) Both holes were conducted using a Continued Next Page	

BECKER PENETRATION TEST

Casing O.D.: 6 5/8 inch — CLOSE ENDED (blows/0.3m)

Hammer Energy: 11 kJ max. rated — OPEN ENDED (blows/0.3m)

● SPT N — BOUNCE PRESS (kPa)

W_P% W% W_L%

20 40 60 80

127 127 104 104 104 200 200

Klohn Crippen Berger

PROJECT NO.:	P09522 A02
PROJECT:	EGD East End Extension - Slope Stability
LOCATION:	Esquimalt Graving Dock
LOGGED BY:	JW **CHECKED BY:**
SHEET	1 **OF** 2 **HOLE NO.:** BPT08-02

KCBL_BECKER ...LL HOLE LOGS.GPJ KC_DATA.GDT 9/3/08

BECKER TEST HOLE LOG

STARTED: 07/18/2008 **FINISHED:** 07/18/2008

DRILL RIG MODEL: Becker

GROUND ELEV. (m): 15.7

COORDINATES (m):

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
21					truck-mounted HAV 180 Becker drill rig operated by Foundex Explorations Ltd. of Surrey, BC	
22					3) Open and Closed Becker terminated at practial refusal at 17.2 m (200 blows / no penetration)	
23					4) Closed Becker hole backfilled with pea gravel with bentonite chip seals at 0.3 m to 1.2 m, 2.7 m to 3.4 m, 8.2 m to 8.8 m and 15.5 m to 17.2 m	
24					5) Open Becker hole backfilled with pea gravel with bentonite chip seals at 0.3 m to 1.2 m, 6.4 m to 7.3 m and 13.0 m to 13.9 m. Piezometer Installed.	
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						

BECKER PENETRATION TEST

Casing O.D.: 6 5/8 inch — CLOSE ENDED (blows/0.3m)

Hammer Energy: 11 kJ max. rated — OPEN ENDED (blows/0.3m)

● SPT N — BOUNCE PRESS (kPa)

W_P% W% W_L%

20 40 60 80

Klohn Crippen Berger

PROJECT NO.: P09522 A02

PROJECT: EGD East End Extension - Slope Stability

LOCATION: Esquimalt Graving Dock

LOGGED BY: JW **CHECKED BY:**

SHEET 2 **OF** 2 **HOLE NO.:** BPT08-02

KCBL_BECKER-SI DRILL HOLE LOGS.GPJ KC_DATA.GDT 9/3/08

Klohn Crippen Berger

February 25, 2009

File No.: P09632A01
Log No.: LTR-001

Public Works and Government Services Canada
825 Admirals Road
Victoria, British Columbia
V9A 2P1

Mr. Doug Ferrier

Dear Mr. Ferrier:

Esquimalt Graving Dock
East End Extension – Geotechnical Data Report

We are pleased to enclose three (3) copies of our Geotechnical Data Report for the Esquimalt Graving Dock East End Extension project.

Please contact us if you have any questions.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Geoff Cooper, P.Eng.
Project Manager

Klohn Crippen Berger Ltd. • 500 – 2955 Virtual Way • Vancouver BC V5M 4X6 • CANADA
604.669.3800 t • 604.669.3835 f • www.klohn.com

TABLE OF CONTENTS

PAGE

1. INTRODUCTION 1
2. SITE INVESTIGATION 2
   - 2.1 General 2
   - 2.2 HQ3 Diamond Coring 3
   - 2.3 Mud Rotary Drilling 4
3. LABORATORY TESTING 5
4. LIMITATIONS AND USE OF REPORT 6

FIGURES

Figure 1 Drill Hole Location Plan

APPENDICES

Appendix I Drill Hole Logs
Appendix II Photographs
Appendix III Pressure Packer Test Results
Appendix III Laboratory Testing Results

1. INTRODUCTION

This report summarized the results of the 2009 site investigation program undertaken by Klohn Crippen Berger for Public Works and Government Services Canada at Esquimalt Graving Dock (EGD) located in Esquimalt, B.C.

The site investigation program was conducted between December 7 and 21, 2009 and consisted of mud rotary drilling and HQ3 diamond coring at the East End of EGD. The objectives of the site investigation were:

1) To determine the stratigraphy and soil properties of the East End slope for retaining wall design; and
2) To determine the bedrock quality and bedrock permeability for the proposed dock extension at the East End.

All elevations in this report are referenced to chart datum. Chart datum is equal to El.- 1.87 m geodetic datum.

2. SITE INVESTIGATION

2.1 General

The site investigation consisted of six diamond core holes on the East End of the EGD at the crane rail level and two mud-rotary drill holes on the slope above the East End of the EGD. The drilling was carried out by Foundex Explorations Ltd. of Surrey, B.C. using a track mounted HT-700 drill rig.

Figure 1 shows the location of the 2009 drill holes. Drill hole information is summarized in Table 1 and the drill hole logs are presented in Appendix I. Selected photographs taken during the investigation and drill core photographs are included in Appendix II.

Table 1 Summary of 2009 Site Investigation at East End of EGD

Drill Hole #	Drilling Method	Depth to Bedrock (m)	Total Hole Depth (m)	Comments
DH09-06	HQ3 Coring	1.5	18.3	
DH09-07	HQ3 Coring	3.1	18.4	
DH09-08	HQ3 Coring	3.8	19.3	
DH09-09	HQ3 Coring	1.9	18.3	
DH09-10	Mud Rotary	10.5	11.1	
DH09-11	Mud Rotary	8.7	9.2	
DH09-12	HQ3 Coring	3.0	18.3	
DH09-13	HQ3 Coring	> 6.1 m	6.1	Hole terminated in boulder at 6.1 m.

2.2 HQ3 Diamond Coring

Due to the unavailability of accurate drawings on the underground utilities at the East End of EGD, the six diamond core hole locations were first checked for underground utilities by Western Utility Services Ltd. and subsequently hydro-excavated by McRae's Environmental Services prior to drilling.

HQ3 diamond coring consists of recovery of continuous bedrock cores samples (core diameter of 61 mm) using a triple tube core barrel system. The triple tube core barrel system comprises of the following: an outer tube that couples onto the drill rod and drill bit; an inner tube that is swivel mounted and remains stationary while the drill rods rotate; and mounted inside the inner tube is a steel core tube that receives the drill core. The core tube is split longitudinally and can be pumped out of the inner tube once the core barrel is removed from the drill hole.

Water pressure tests using a drill hole packer system were carried out in four of the six diamond core holes. The results of the water pressure tests are presented on the drill hole logs in Appendix I and the detailed test data are found in Appendix III.

The six drill holes were grouted using cement-bentonite mix that was tremmied from the bottom of the hole to the interface between bedrock and surficial fill. The holes were then filled up to surface using bentonite chips. Holes were completed at the surface with asphalt cold patch.

In general, holes could not be grouted above the bedrock and surficial fill contact due to grout loss above the contact. This was particularly prevalent at drill holes DH09-07, DH09-08, DH09-09. Grout and drilling fluid were observed entering the drydock base and dewatering tunnel though cracks in the concrete and through drainage pipes and we

assume that this grout and drilling fluid were travelling downwards along the bedrock contact surface toward the drydock.

2.3 Mud Rotary Drilling

Two mud rotary drill holes were completed on the slope above the East End of the dry dock. Prior to the drilling, the bushes around the two drill hole locations were cleared and the areas were flattened using an excavator provided by Trident Contracting Ltd. To commence drilling at DH09-11, the drill rig was disassembled and lifted using a mobile crane supplied by EGD onto the drill pad. For DH09-10 , the drill rig was driven down to the hole location from the top of the slope.

Mud rotary drilling was conducted with Standard Penetration Tests (SPT), Shelby tube sampling and Field Vane Tests (VSTs) at selected intervals. The drilling fluid consisted of a bentonite-gel/water mixture. All drilling fluids were collected and disposed of off-site.

A standard 50 mm O.D. SPT split spoon sampler with plastic soil catcher was used without an inner liner. A 63.5 kg safety hammer was used with a nominal drop height of 0.76 m. The safety hammer was raised with a hydraulic winch line and was generally permitted to drop unimpeded. The number of hammer blows required to drive the sampler for each of the three 0.15 m increments was recorded. VSTs were conducted at selected intervals. The drill hole logs are presented in Appendix I.

The holes were sealed with a cement-bentonite grout mix that was tremmied from the bottom of the hole to surface.

3. LABORATORY TESTING

Soil samples obtained from the drill holes were returned to KCBL's laboratory for index testing. Atterberg limits tests and laboratory vane tests were conducted on selected samples. The laboratory test results are included in Appendix IV.

4. LIMITATIONS AND USE OF REPORT

This report is an instrument of service of Klohn Crippen Berger Ltd. The report has been prepared for the exclusive use of Public Works and Government Services Canada for the specific application of Esquimalt Graving Dock East End Extension Project. The report's contents may not be relied upon by any other party without the express written permission of Klohn Crippen Berger. In this report, Klohn Crippen Berger has endeavored to comply with generally accepted geotechnical practice common to the local area. Klohn Crippen Berger makes no other warranty, express or implied.

The geotechnical investigations conducted indicate subsurface conditions only at the specific locations where samples were obtained or where in-situ tests would infer, only at the time they were obtained, and only to the depths penetrated. The samples and tests cannot be relied on to accurately reflect the nature and extent of strata variations that usually exist between sampling or testing locations.

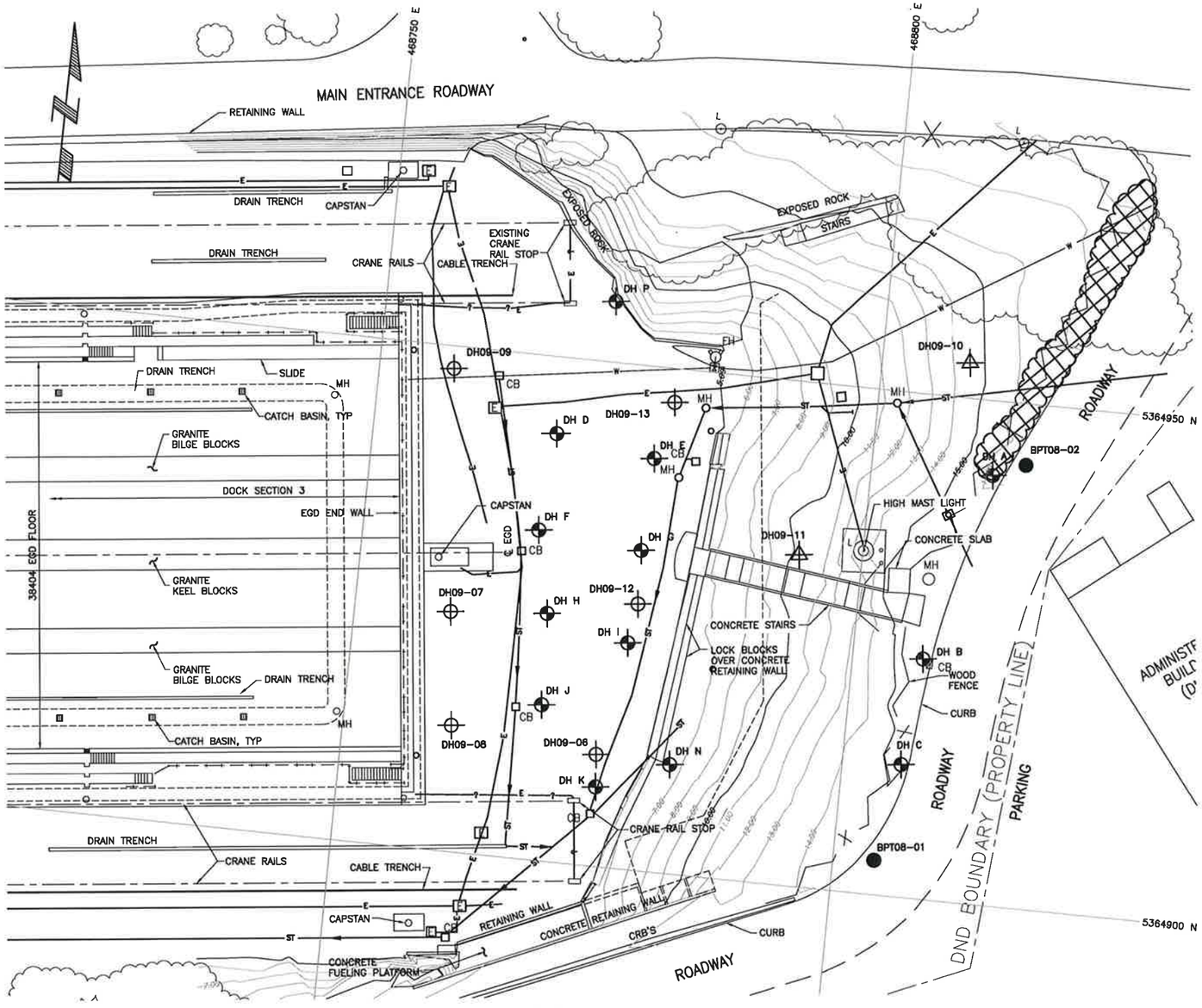
Although Klohn Crippen Berger has explored subsurface conditions as part of this program, Klohn Crippen Berger has not evaluated the site for potential presence of contaminated soil, and has not evaluated groundwater conditions.

KLOHN CRIPPEN BERGER LTD.

Ann Wen, E.I.T.
Geotechnical Field Engineer

Andrew Port, P.Eng.
Geotechnical Engineer

Geoff Cooper, P.Eng.
Project Manager



PLAN

NOTES:

1. DIMENSIONS AND SERVICES SHOWN FOR THE EXISTING ESQUIMALT GRAVING DOCK ARE INFERRED FROM ORIGINAL "RECORD" DRAWINGS AND FIELD MEASUREMENTS.
2. DRILL HOLE LOCATIONS ARE APPROXIMATE.
3. BASE PLAN FROM FOWS TOPOGRAPHIC SURVEY DRAWING. 030200583-104TS1.2-UTM.
4. ELEVATIONS SHOWN ARE CHART DATUM.

LEGEND

SONGHEES 1st NATION "MIDDEN SOIL PILES"

EGD ESQUIMALT GRAVING DOCK

DH K — AIR TRACK DRILL HOLE. MAY 26 2008

BPT08-01 — BECKER HAMMER TEST HOLE. JULY 17 2008

DH09-08 — DIAMOND CORE HOLE. DEC 2009

DH09-10 — MUD ROTARY DRILL HOLE. DEC 2009

L — LIGHT POLE

FH — FIRE HYDRANT

CB — CATCH BASIN

MH — MANHOLE

0 1:250 10

Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

Klohn Crippen Berger

PROJECT: ESQUIMALT GRAVING DOCK EAST END EXTENSION

TITLE: DRILL HOLE LOCATION PLAN

PROJECT No. P09632A01 | DWG. No. FIGURE 1 | REV.

NO.	DATE	ISSUE / REVISION	DRAWN	CHK'D	DESIGN	APP'D

CANCEL PRINTS BEARING PREVIOUS

APPENDIX I

Drill Hole Logs

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-06

CLIENT: PWGSC	PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension	DATE HOLE STARTED: Dec. 8/2009 FINISHED: Dec. 9/2009
LOCATION:	DATUM: Chart
DIRECTION AZIMUTH: DIP (from horiz):	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 468775.47m N 5364911.08m	GROUND ELEVATION: 4.56 m
MANUFACTURER'S DRILL DESIGNATION: HT-700	TOTAL DEPTH OF HOLE: 18.28 m
DRILLING CONTRACTOR: Foundex	DRILLING METHOD SOIL: Vaccum Truck ROCK: HQ Core
LOGGED BY: AW	DRILLING FLUID: Water CASED TO: m
CHECKED BY: GWS	HOLE DIA.: HQ3

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gnessosity, M= Schistosity, S= Shear, V= Vein; ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY (%) 25 50 75	R.Q.D. (%) 25 50 75
1		FILL, gravels and cobbles with clay											
		1.5											
2		3.0 METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets, moderately weathered, medium weak, all joints highly oxidized to dark brown/black colour [Wark Gneiss] 1.92 - 2.21m: joint dipping at 20 deg to core axis, rusty with highly fracture rock on one side of the joint 2.32m: highly weathered calcite vein 2.37m: highly crushed zone dipping at 20 deg to core axis 2.42m: highly fractured with clayey infills					J	R	I	R	12	85	25
		2.7											
3		1.8 METADIORITE, slightly to moderately weathered, weak to medium strong 2.84 - 3.06m: highly fractured with fragments size of coarse sand to fine to coarse gravel 3.06 - 3.29m: highly crushed zone with fragments size of fine to coarse sand 3.29 - 3.47m: joint dipping at 30 deg to core axis, infilled with fine to coarse grained sand sized fragments									2	100	0
4													

DISCONTINUITY CODES:
JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay
ROUGHNESS: R: Rough S: Smooth Sl: Slickenside
SHAPE: P: Planar C: Curved I: Irregular
WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-06

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) J = Joint B= Bedding D= Drill Break F= Foliation G= Gneissosity M= Schistosity S= Shear V= Vein ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
5		5.08 - 5.30m: joint parallel to core axis					J	C	I R			
							J	C	P R			
								Ca	I R			
							J	Py	I R			
								R	P R			
								Py	P R	0	100	0
									I SL			
								C	I R			
6								C	I R			
							J	C	P R			
		6.27 - 6.64m: two joints at 20 deg to core axis, moderately fractured along joint, joint irregular, smooth to slickensided						C	I R	10	100	59
7								C	P R			
		7.14 - 7.29m: joint at 30 deg to core axis with calcite infill, planar, slickensided						C	I R			
							J	Ca	P R			
		7.61 - 8.18m: highly fracture at about 20 deg to core axis, infilled with calcite, chlorite, irregular, smooth to slickensided						C	P R			
8										12	100	81
		8.2 -3.6 DYKE, light yellowish green, weak, slightly weathered					J					
								Ca	I R			
9												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-06

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75 100	R.Q.D. % 25 50 75 100
		(continued from previous page)										
		9.1 -4.6 METADIORITE, slightly to moderately weathered, weak to medium strong						C	I R			
		9.40 - 9.54m: joint at 30 deg to core axis, highly fractured aroun the joint, infilled with calcite, pyrite, joint irregular, slickensided						C	I R			
								C	I R			
								Ca	I R			
10								Py Ch Ca	I R	12	100	78
		10.24 - 10.34m: joint at 20 to core axis, irregular, slickensided, infilled with clay, calcite and chlorite						C	I R			
		10.47 - 10.66m: joint at 30 deg to core axis, infilled with calite, chlorite, joint planar, slickensided										
11		11.01 - 11.50m: joint parallel to core axis, infilled with clay, chlorite and rust, joint undulating, slickensided						Ca	P S			
		11.50 - 12.18m: many healed joints with altered light yellow quartz/calcite veins						Ca	I R	12	98	38
								Cl	I R			
12								Ca	I R			
		12.2 -7.6 12.06 - 12.16m: highly weathered with clay and decomposed rock fragments on joints (chloritic sand sized fragments)										
		FAULT ZONE, highly fractured, highly weathered to coarse sand to coarse gravel sized rock fragments, decomposed at 12.59m; upper contact perpendicular to core axis, lower contact at about 40 degrees to core axis								100	75	0
		12.6 -8.0 METADIORITE, moderately to highly weathered, highly fractured, partly healed										
13										0	59	0
14												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-06

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES): J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gneissosity, M= Schistosity, S= Shear, V= Vein; ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
15				2.80E-07						100	93	13
		15.2 / -10.7 METADIORITE, slightly to moderately weathered 15.44 - 15.55m: highly fractured zone										
16										100	99	40
17							J J J	Ca Ca Cl	P S I S I R			
							J	Ca	P S			
18							J J J J	Ch Ca Ca Ch Ca Ch Ca	P R I R P S P R	9	100	54
		18.3 / -13.7 End of Hole at: 18.3 m						Ca	I R			
19												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

KCBL_ROCK-SI_WITH DISCONTINUITIES 2009 EGD EEE DRILL LOGS - ROCK R1.GPJ ROCK-LOG.GDT 2/25/10

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-07

CLIENT: PWGSC	PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension	DATE HOLE STARTED: Dec. 9/2009 FINISHED: Dec. 11/2009
LOCATION:	DATUM: Chart
DIRECTION AZIMUTH: DIP (from horiz):	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 468759.6m N 5364923.74m	GROUND ELEVATION: 4.7 m
MANUFACTURER'S DRILL DESIGNATION: HT-700	TOTAL DEPTH OF HOLE: 18.36 m
DRILLING CONTRACTOR: Foundex	DRILLING METHOD SOIL: Vaccum Truck ROCK: HQ Core
LOGGED BY: AW	DRILLING FLUID: Water CASED TO: m
CHECKED BY: GWS	HOLE DIA.: HQ3

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY (%) 25 50 75	R.Q.D. (%) 25 50 75
0		FILL, cobble and gravel with brown and sandy clay infills									0	32	0
1											0	22	0
2													
3													
3.1													
1.6		FILL, clay, some gravel, some sand, soft, non-plastic, some wood											
3.3													
1.4		FILL, gravel, trace sand, up to 3cm, angular to subangular, loose, brown											
3.5													
1.2		METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets and healed fractures, joints planar, smooth, moderately and highly weathered, highly oxidized, weak [Wark Gneiss]									0	34	0
4													

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-07

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)					J = Joint B= Bedding D= Drill Break F= Foliation G= Gneissosity M= Schistosity S= Shear V= Vein					
5		4.90 - 5.08m: highly fractured, joints highly oxidized to orange brown, joints generally at 70 deg to core axis, joints irregular, rough 5.30 - 5.72m: highly fractured, irregular fracture pattern, two prominent joints at 35 deg to core axis, joint surfaces highly oxidized					J	R	I S	17	100	26
6		6.10 - 6.17m: highly fractured, crushed with fragment at the coarse grained sand, highly weathered 6.45 - 6.53m: highly fractured zone					J	R Ca	P S			
7								R	P SL	8	100	59
								R	P S			
								C	P S			
								R	P S			
							J	R	P S			
							J	C	I R			
								R Ca	P SL			
8		7.83 - 8.00m: highly fractured, highly weathered with calcite, chlorite with rusty stain 8.00 - 8.18m: moderately fractured 8.18 - 8.27m: highly fracture, at about 70 deg to core axis 8.33 - 8.62m: joint at 10 deg to core axis, irregular, smooth, with calcite and pyrite blotches					J	R Ca	P SL	15	100	7
							J	R Ca	P S			
9		8.70 - 9.05m: highly fractured, highly weathered					J	R Cl	P S			

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-07

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
		9.05 - 9.33m: highly weathered, very weak, crushed rock zone coarse to fine gravel sized fragments										
		9.3 -4.6 METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets, moderately weathered with calcite veins at 60 deg to core axis [Wark Gneiss]					J	R	P S			
		9.53 - 9.97m: moderately to highly fractured, highly fractured zone						R Ca	P R P S			
10										15	100	47
								Py Ca	I S I S			
								Py Ch Ca	P SL			
		10.55 - 10.72m: highly fractured, joints smooth, slickensided, infilled with 2mm of decomposed rock						Py Ca	P SL			
		10.8 -6.1 10.72 - 10.75m: highly fractured zone to coarse gravel sized rock fragments										
11		METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets, weak, moderately fractured, moderately weathered, joints at 60 to 70 deg to core axis and at 30 deg to core axis [Wark Gneiss]								100+	100	0
		10.95 - 11.14m: highly fractured zone										
12		12.06 - 12.12m: highly fractured zone					J	R Si	I S			
		12.12 - 12.13m: decomposed rock fragments along joint					J	R	I S			
		12.28 - 12.38m: highly fractured to fine gravel size						C	P S			
		12.78 - 12.87m: highly fractured, highly weathered zone					J	R	I R			
13		12.99 - 13.07m: highly weathered		5.20E-07			J J	Py Ca R Cl	P S I R	18	100	64
							J	R Cl	I R			
		13.25 - 13.28m: highly weathered					J	R Ca R	I R I S			
								Ca	I S			
							J		I S			
		13.8 -9.1 METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets, weak to moderately					J	Py Ca	I S			
14												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-07

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
		strong, slighty to moderately weathered, moderately fractured [Wark Gneiss]						C	I R			
		13.85 - 13.90m: highly fractured zone						C	I R			
								C	I SL			
		14.44 - 14.82m: joints dipping at 60 to 80 deg to core axis, irregular. Rough/smooth, infilled with rust, clay and calcite						C	I R	8	100	28
15							J	R Ca	I S			
							J	C	P S			
		15.53 - 15.54m: highly fractured, highly weathered						R Si	I R			
								Ca	I R			
								Ca	I R			
		15.56 - 15.57m: highly fractured zone						Ch Ca	I S			
							J	Ca	I S			
16		15.94 - 16.11m: highly fractured zone, rock fragments smaller than coarse gravel						Ca	I S	0	100	0
								Ca	P SL			
								Ca	I S			
								R Ca	I S			
		16.52 - 16.82m: highly fractured, highly weathered, with fragments size of fine gravel		5.20E-08				R Ca	I R			
17		17.00 - 17.20m: highly fractured zone infilled with gravel sized fragments										
		17.20 - 18.27m: intact with healed joints						Py Ca	I S			
								Ca	I R			
								Ca	I S	9	100	53
								Ca	I S			
18								Ca	I S			
								C	I S			
		18.27 - 18.36m: highly weathered with joints parallel to core axis, infilled with coarse grained sand sized fragements and clay and calcite, planar, rough joints						C	I S			
		18.4 -13.7 End of Hole at: 18.4 m						C	I S			
19												

DISCONTINUITY CODES:
JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay
ROUGHNESS: R: Rough S: Smooth Sl: Slickenside
SHAPE: P: Planar C: Curved I: Irregular
WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

KCBL_ROCK-SI_WITH DISCONTINUITIES 2009 EGD EEE DRILL LOGS - ROCK R1.GPJ ROCK-LOG.GDT 2/25/10

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-08

CLIENT: PWGSC	PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension	DATE HOLE STARTED: Dec. 11/2009 FINISHED: Dec. 13/2009
LOCATION:	DATUM: Chart
DIRECTION AZIMUTH: DIP (from horiz):	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 468760.84m N 5364912.51m	GROUND ELEVATION: 4.71 m
MANUFACTURER'S DRILL DESIGNATION: HT-700	TOTAL DEPTH OF HOLE: 19.26 m
DRILLING CONTRACTOR: Foundex	DRILLING METHOD SOIL: Vaccum Truck ROCK: HQ Core
LOGGED BY: AW	DRILLING FLUID: Water CASED TO: m
CHECKED BY: GWS	HOLE DIA.: HQ3

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY (%) 25 50 75	R.Q.D. (%) 25 50 75
1		FILL, cobbles and gravesl with brown and grey stiff clay					J = Joint B= Bedding D= Drill Break F= Foliation G= Gnessosity M= Schistosity S= Shear V= Vein						
2													
3													
4		3.8 1.0 METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, moderately fractured, moderately weathered, joints highly									13 82 22		

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-08

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA: SEE BOTTOM OF FORM FOR CODES. J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gneissosity, M= Schistosity, S= Shear, V= Vein; ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY / JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
		oxidized to a dark brown to black colour. [Wark Gneiss]					J	C	P R			
		4.7 / 0.0 METADIORITE, similar to above, slightly to moderately weathered, all joints highly oxidized to dark orange brown colour					J	R Py Ca / R Py	P SL / I S			
5							J	R	P S			
		5.37 - 5.50m: joint at 40 deg to core axis, irregular, smooth with rust and calcite infill					J	R	P S			
							J	R	P S			
							J	R Ca	I S			
		5.7 / -1.0 DYKE, light yellowish green, moderately to highly weathered, upper contact at 40 deg to core axis, contact modrately fractured, highly oxidized with brown clay infill					J	R Ca	P R	18	100	59
		5.9 / -1.2 METADIORITE, similar to 3.75 to 4.73 m, slightly to moderately weathered, all joints highly oxidized to dark orange brown colour					J	R	I S			
6							J	R	I S			
							J	R	I R			
								R	I S			
								R Ca				
		6.3 / -1.5 METADIORITE, similar to 3.75 to 4.73 m, slightly to moderately weathered, all joints highly oxidized to dark orange brown colour					J	R	P S			
		6.25 - 6.40m: joint at 20 deg to core axis, planar, rough, with rust and chlorite infill					J	C	P R			
		6.45 - 6.61m: joint at 20 deg to core axis, irregular, rough with rust infill					J	R	C R			
							J	R Ch	P R			
							J	R Ca	P R			
							J	R	I R			
							J	R Ca	I R			
							J	Py	I R			
7							J	R	I R	13	100	72
		7.19 - 7.20m: highly fractured zone					J	C	P R			
							J	R Ca	I S			
							J	R	P R			
							J	R Ca	P S			
							J	R	P S			
		7.8 / -3.1 DYKE, light yellowish green, highly weathered, highly fractured, fractures highly oxidized, lower contact planar and slickensided					J	R	P R			
8		8.0 / -3.3 7.97 - 8.03m: joint parallel to core axis, planar, rough					J	R	P R			
		METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, occasional yellowish calcite blotches, moderately fractured with irregular fracture pattern, moderately weathered, joints highly oxidized to a dark brown to black colour. [Wark Gneiss]					J	R Py	P R			
								C	P R			
								R	P S	20	100	54
		8.57 - 8.77m: joint at 30 deg to core axis, planar, smooth, with rust stains					J	R	I S			
		8.77 - 9.00m: curved joint parallel to core axis, rough with calcite and chlorite infill						Ca Ch	C R			
9												

DISCONTINUITY CODES:
JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay
ROUGHNESS: R: Rough S: Smooth Sl: Slickenside
SHAPE: P: Planar C: Curved I: Irregular
WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-08

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gneissosity, M= Schistosity, S= Shear, V= Vein; ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY / JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
9.3 / -4.6		METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, slghtly weathered [Wark Gneiss] 9.57 - 10.09m: moderately fractured zone with a curved joint parallel to core axis stained with rust								13	100	59
10.3 / -5.6		METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, moderately weathered [Wark Gneiss] 10.56 - 10.60m: highly fractured zone with clay infill										
10.8 / -6.1		METADIORITE, coarse grained, greenish grey with light yellow alterations, thin quartz veinlets throughout, moderately weathered, moderately fractured [Wark Gneiss] 11.13 - 11.36m: highly fractured zone								100>>	90	19
11.5 / -6.8		METADIORITE, coarse grained, greenish grey with light yellow alterations, highly fractured, highly weathered with sand and clay sized decomposed rock fragments [Wark Gneiss]								100>>	89	0
12.3 / -7.6		METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, moderately fractured with healed joints, slightly weathered [Wark Gneiss] 12.54 - 12.61m: highly fractured zone 13.14 - 13.18m: highly fractured zone								20	100	28
13.2 / -8.5		DYKE, light yellowish green, joints generally at 50 to 70 deg to core axis, spaced 2 - 5 cm apart, planar, rough, infilled with calcite and chlorite, no oxidation										
13.9 / -9.2		DYKE, similar to 13.18 to 13.86m										

Depth scale: 10, 11, 12, 13, 14

Discontinuity data (in order, top to bottom):

Type	Joint Infill	Planarity	Roughness
	R	I	R
J	R	P	R
J	R	P	R
J	Py Ca	P	SL
J	C	P	S
J	C	I	R
	R	C	
J	Py	I	R
J	Ca	I	R
	C	P	R
J		I	R
	Ca	I	R
J		I	R
	Ca	P	S
J	Ca Cl	P	R
J		I	R
J	Ca	P	R
J	Ca	P	R
J	Ca	I	R
J	Ca	I	R
J	C	I	R
J	Py	P	R
J	C	P	R
J	Cl	P	R
J	C	P	S

DISCONTINUITY CODES:	
JOINT INFILL:	C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay
SHAPE:	P: Planar C: Curved I: Irregular
ROUGHNESS:	R: Rough S: Smooth Sl: Slickenside
WEATHERING:	F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

KCBL_ROCK-SI_WITH DISCONTINUITIES 2009 EGD EEE DRILL LOGS - ROCK R1.GPJ ROCK-LOG.GDT 2/25/10

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-08

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gneissosity, M= Schistosity, S= Shear, V= Vein; ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
		14.1 -9.4 METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, slightly weathered [Wark Gneiss]					J J	Ca Cl C Ca	P R I SL	100	100	38
		14.4 -9.7 FAULT ZONE, highly weathered to decomposed with rock fragment size of fine gravel and coarse sand\; lower contact at 90 deg to core axis. 14.6 -9.9 DYKE, similar to 13.18 to 13.86m										
15		15.0 -10.3 DYKE, similar to 13.18 to 13.86m, very weak, highly fractured								10	100	30
		15.4 -10.7 METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, moderately to highly weathered, weak [Wark Gneiss]					J	Ca C Ca	I R I R I R			
16		16.2 -11.5 FAULT ZONE, highly weathered to decomposed METADIORITE with fine sand/silt sized rock fragments; upper contact at about 60 deg to core axis								8	100	39
		16.6 -11.9 CORE LOSS										
17		17.2 -12.4 FAULT ZONE, clay/sand sized fault gouge 17.3 -12.6 METADIORITE, coarse grained, greenish grey, highly fractured with coarse gravel sized rock fragments, highly weathered								100	61	0
18		18.0 -13.3 METADIORITE, coarse grained, greenish grey, moderately fractured, highly weathered 18.3 -13.5 METADIORITE, coarse grained, greenish grey, moderate to highly weathered 18.25 - 18.45m: highly fractured 18.55 - 18.99m: highly fractured			2.20E-07					100	95	32
19												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-08

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gneissosity, M= Schistosity, S= Shear, V= Vein; ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
		18.99 - 19.26m: intact but moderately to highly weathered										
19.3 -14.6		End of Hole at: 19.3 m										
20												
21												
22												
23												
24												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-09

CLIENT: PWGSC	PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension	DATE HOLE STARTED: Dec. 13/2009 FINISHED: Dec. 13/2009
LOCATION:	DATUM: Chart
DIRECTION AZIMUTH: DIP (from horiz):	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 468757.45m N 5364947.76m	GROUND ELEVATION: 4.68 m
MANUFACTURER'S DRILL DESIGNATION: HT-700	TOTAL DEPTH OF HOLE: 18.29 m
DRILLING CONTRACTOR: Foundex	DRILLING METHOD SOIL: Vaccum Truck ROCK: HQ Core
LOGGED BY: AW	DRILLING FLUID: Water CASED TO: m
CHECKED BY: GWS	HOLE DIA.: HQ3

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY (%) 25 50 75	R.Q.D. (%) 25 50 75
0		FILL, cobbles and gravesl with brown and grey stiff clay											
1													
1.9													
2.8		METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets, moderately weathered, medium weak, all joints highly oxidized to dark brown/black colour [Wark Gneiss]											
2		2.20 - 2.25m: highly fractured zone				R R R R R	J	I I P P P	S S S S S				
		2.46 - 2.58m: highly fractured, highly weathered zone 2.58 - 2.72m: joint parallel to core axis with rust stain				R	J	I	R	14	100	18	
		2.79 - 2.90m: highly fractured/crushed zone, rock fragments size of fine gravel				R R R Ca	J	P P I	R R R				
3						R Ca	J	I	R				
		3.41 - 3.52m: highly weathered; also highly fractured from 3.52 to 3.61m											
3.8						R R	J	I I	R R	16	100	53	
0.9		DYKE, light yellowish green, weak, slightly weathered, contact at 60 deg to core axis				Ca	J	P	R				
4													

DISCONTINUITY CODES:
JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay
SHAPE: P: Planar C: Curved I: Irregular
ROUGHNESS: R: Rough S: Smooth Sl: Slickenside
WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-09

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gneissosity, M= Schistosity, S= Shear, V= Vein; ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
		0.0 METADIORITE, coarse grained, dark greenish grey, medium strong, slightly to moderately weathered [Wark Gneiss]					J	Py Ca	I R			
		4.57 - 4.62m: highly fractured zone										
5		5.0 -0.3 METADIORITE, coarse grained, dark greenish grey with increasing light yellowish dyke fingers, thin quartz veinlets perpendicular to core axis approximately every 5 cm, medium strong, slightly to moderately weathered [Wark Gneiss]					J	Ch Ca	I R			
							J	Ca	I R			
							J	Ca	I R	6	100	80
							J	R Ca	I R			
6								Ca	P R			
		6.14 - 6.19m: highly fractured zone, highly oxidized					J	R	P R			
		6.39 - 6.47m: highly fractured zone, highly oxidized						R	P R			
								R	P R			
								R	P R			
							J	Py Ca	I S			
								Ch Ca	I S			
							J	Py Ca	I R	13	100	48
7							J	Py	I R			
		7.1 -2.5 METADIORITE, similar description to 4.02 to 4.97m, highly weathered [Wark Gneiss]					J	Py Ch Ca	P R			
							J	R Ca	P S			
								R Ch Ca	P S			
		7.6 -2.9 METADIORITE, similar description to 4.02 to 4.97m, slightly weathered from 7.62 to 8.01m and from 8.65 to 9.13m, moderately weathered from 8.01 to 8.65m						Py Ca	I R			
8								C	P R			
								Ca	I S			
		8.12 - 8.13m: highly fractured zone					J	Ca	I R	12	100	70
							J	Ca	I SL			
								Ca	P S			
								Ca	P R			
								Ca	I S			
9								Ca	P SL			
							J	Ch Ca	P SL			

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-09

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)					J = Joint B= Bedding D= Drill Break F= Foliation G= Gneissosity M= Schistosity S= Shear V= Vein					
10		9.1 -4.5 METADIORITE, similar description to 4.02 to 4.97 9.63 - 9.70m: highly fractured zone 9.79 - 9.83m: highly fractured zone 10.23 - 10.43m: highly weathered, very weak 10.37 - 10.40m: decomposed rock zone					J	Py Ca	I R	11	100	79
11		10.7 -6.0 DYKE, light yellowish green, weak, slightly weathered, lower contact highly fractured, slickensided, very weak 10.8 -6.2 METADIORITE, coarse grained, dark greenish grey, medium strong, slightly to moderately weathered [Wark Gneiss]								11	100	88
12		12.2 -7.5 METADIORITE, coarse grained, dark greenish grey, medium strong, moderately weathered [Wark Gneiss] Highly fractured from 12.32 - 12.33m, 12.42 - 12.46m, 13.52 - 13.62m Highly weathered from 12.42 - 12.50m, 12.99 - 13.23, 13.52 - 13.72m Crushed rock zone from 12.55 - 12.62m, 13.11 - 13.16m, 13.54 - 13.55m 12.72 - 12.92m: moderately fractured with no regular pattern								9	100	17
13												
14		13.7 -9.0 METADIORITE, coarse grained, dark greenish grey, medium strong, moderately weathered [Wark Gneiss]										

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-09

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES): J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gneissosity, M= Schistosity, S= Shear, V= Vein; ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)											
15		14.88 - 14.98m: highly fractured zone with coarse gravel sized rock fragments		2.60E-09				Py Ca Ca Py Ca Ca Ch Ca Ch Ca Py Py Py Ch Ca Py Ca Ch Ca Ch Ca Py Ch Ca	I I P P I P P P I I P I I	SL R SL S SL SL R R S S S SL SL	14 12	100 100	57 61
16		16.38 - 16.39m: highly fractured zone						Ca Ch Ca Ch Ca C C C Ca Py Ca Ca Ca Py Ca Ca Ca	I P P P I I I I P P P P P	R SL SL S R R S S R S R S SL	12	100	55
17		17.65 - 17.66m: crushed rock zone with fragments size of coarse sand to fine gravel											
18		18.28 - 18.29m: crushed rock zone											
		18.3 -13.6 End of Hole at: 18.3 m											
19													

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

TEST HOLE LOG

STARTED: 12/14/2009 **FINISHED:** 12/14/2009
DRILL METHOD: Mud Rotary
GROUND ELEV. (m): 14.50
COORDINATES (m): N 5364953.49 E 468808.78

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					SILT (ML), some clay, some fine sand, trace coarse sand, occasional organics, stiff, brown	
3	2/5/3	SPT	SPT 1			
4	3/5/7	SPT	SPT 2			
			Vane 1		[82kPa Peak / 42kPa Residual / 21kPa Remolded - Field Vane]	
5					4.88 / 9.62 CLAY (CL), some silt, trace fine sand, occasional organics, low to medium plastic, stiff, brown	
		TUBE	Shelby 1		[75kPa Peak / 18kPa Residual - Lab Vane]	
6	2/3/5	SPT	SPT 3			
			Vane 2		[110kPa Peak - Field Vane]	
7					7.01 / 7.49 CLAY (CL), some silt, medium to high plastic, very soft, grey	
		TUBE	Shelby 2		[42kPa Peak / 12kPa Residual - Lab Vane]	
8	0/1/2	SPT	SPT 4		Continued Next Page	

Su - kPa: 20 60 100 140 180
VANE PEAK ◆ ■ ▲ UC/2
VANE REMOLD ◇ □ △ P.PEN/2
★ % FINES ● SPT N
W_P% W% W_L%
20 40 60 80

Klohn Crippen Berger

PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension
LOCATION: Esquimalt, Victoria, B.C.
LOGGED BY: AW **CHECKED BY:**
SHEET 1 **OF** 2 **HOLE NO.:** KDH09-10 (V)

KCBL_TEST_HOLE-SI 2009 EGD EEE DRILL LOGS - MUD ROTARY R1.GPJ KC_DATA.GDT 2/16/10

TEST HOLE LOG

STARTED: 12/14/2009 **FINISHED:** 12/14/2009
DRILL METHOD: Mud Rotary
GROUND ELEV. (m): 14.50
COORDINATES (m): N 5364953.49 E 468808.78

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					[23kPa Peak / 16kPa Residual / 5kPa Remolded - Field Vane]	
			Vane 3			
		TUBE	Shelby 3a			
9					[38kPa Peak / 15kPa Residual - Lab Vane]	
		TUBE	Shelby 3b			
					9.75 / 4.75 SAND (SW), coarse grained, some fine to medium grained, some gravel, well graded, dense, subrounded to angular, grey	
10	10/20/23	SPT	SPT 5			
					10.52 / 3.98 BEDROCK {assumed}	
11					11.13 / 3.37 End of Hole at 11.13 m	
12						
13						
14						
15						
16						

1. Drilling was carried out by Foundex Explorations Ltd. Of Surrey, B.C.

2. The hole was backfilled with Cement-bentonite grout consisting of 1 bag cement, 1/2 bag bentonite geland 40 gallons of water.

3. Standard penetration tests (SPT) were conducted using an automatic trip hammer (63.5 kg, 762 mm drop), AWJ rods, and a split spoon sampler (51mm O.D., 38mm I.D.). * 0 blows indicates that the sampler was advanced from the weight of the hammer.

Su - kPa
20 60 100 140 180
VANE PEAK ◆ FIELD ■ LAB ▲ UC/2
REMOLD ◇ □ △ P.PEN/2
★ % FINES ● SPT N
W_P% W% W_L%
× – – – o – – – ×
20 40 60 80

Klohn Crippen Berger

PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension
LOCATION: Esquimalt, Victoria, B.C.
LOGGED BY: AW **CHECKED BY:**
SHEET 2 **OF** 2 **HOLE NO.:** KDH09-10 (V)

KCBL_TEST_HOLE-SI 2009 EGD EEE DRILL LOGS - MUD ROTARY R1.GPJ KC_DATA.GDT 2/18/10

TEST HOLE LOG

STARTED: 12/17/2009 **FINISHED:** 12/18/2009
DRILL METHOD: Mud Rotary
GROUND ELEV. (m): 10.00
COORDINATES (m): N 5364932.83 E 468793.62

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					Silt (ML), some sand, some gravel, trace clay, trace cobbles, low plastic, stiff, brown, some organics. [Fill]	
1					1.00 / 9.00 Silt (ML), sandy, trace clay, trace gravel, low plastic, moist, grey with reddish brown pockets, some organics.	
2	0/0/1	SPT	SPT 1			
					2.13 / 7.87 Silt (MH), clayey, trace sand, high plastic, moist, grey.	
			Vane 1		[23kPa Peak / 23kPa Residual - Field Vane]	
3		GRAB	Grab 1			
			Vane 2		[83kPa Peak / 42kPa Residual / 20kPa Remolded - Field Vane]	
					[25kPa Peak / 8kPa Residual - Lab Vane]	
4		TUBE	Shelby 1			
					4.40 / 5.60 Clay (CL), silty, trace sand, low plastic, very soft, high dry strength, grey.	
			Vane 3		[49kPa Peak / 25kPa Residual / 15kPa Remolded - Field Vane]	
5						
6	0/0/0	SPT	SPT 2			
			Vane 4		[45kPa Peak / 22kPa Residual / 9kPa Remolded - Field Vane]	
7						
8					Continued Next Page	

Su - kPa: 20 60 100 140 180
VANE PEAK FIELD ◆ LAB ■ ▲ UC/2
VANE REMOLD FIELD ◇ LAB □ △ P.PEN/2
★ % FINES ● SPT N
W_P% W% W_L%
20 40 60 80

Klohn Crippen Berger

PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension
LOCATION: Esquimalt, Victoria, B.C.
LOGGED BY: JW **CHECKED BY:**
SHEET 1 **OF** 2 **HOLE NO.:** KDH09-11 (U)

KCBL_TEST_HOLE-SI 2009 EGD EEE DRILL LOGS - MUD ROTARY R1.GPJ KC_DATA.GDT 2/16/10

TEST HOLE LOG

STARTED: 12/17/2009 **FINISHED:** 12/18/2009
DRILL METHOD: Mud Rotary
GROUND ELEV. (m): 10.00
COORDINATES (m): N 5364932.83 E 468793.62

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
	0/0/3	SPT	SPT 3		8.29 1.71 Sand (SP) coarse grained, some fine grained gravel, poorly graded, dense, greyish brown.	
					8.69 1.31 BEDROCK (assumed)	
9	50 (for 1cm)	SPT	SPT 4		9.15 0.85 End of Hole at 9.15 m	
10						
11						
12						
13						
14						
15						
16						

1. Drilling was carried out by Foundex Explorations Ltd. Of Surrey, B.C.

2. The hole was backfilled with Cement-bentonite grout consisting of 1 bag cement, 1/2 bag bentonite geland 40 gallons of water.

3. Standard penetration tests (SPT) were conducted using an automatic trip hammer (63.5 kg, 762 mm drop), AWJ rods, and a split spoon sampler (51mm O.D., 38mm I.D.). * 0 blows indicates that the sampler was advanced from the weight of the hammer.

Su - kPa
20 60 100 140 180
VANE FIELD LAB
PEAK ◆ ■ ▲UC/2
REMOLD ◇ □ △P.PEN/2
★ % FINES ● SPT N
W_P% W% W_L%
× – – – – o – – – – ×
20 40 60 80

Klohn Crippen Berger

PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension
LOCATION: Esquimalt, Victoria, B.C.
LOGGED BY: JW **CHECKED BY:**
SHEET 2 **OF** 2 **HOLE NO.:** KDH09-11 (U)

KCBL_TEST_HOLE-SI 2009 EGD EEE DRILL LOGS - MUD ROTARY R1.GPJ KC_DATA.GDT 2/16/10

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-12

CLIENT: PWGSC	PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension	DATE HOLE STARTED: Dec. 19/2009 FINISHED: Dec. 19/2009
LOCATION:	DATUM: Chart
DIRECTION AZIMUTH: DIP (from horiz):	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 468778.13m N 5364926.36m	GROUND ELEVATION: 4.59 m
MANUFACTURER'S DRILL DESIGNATION: HT-700	TOTAL DEPTH OF HOLE: 18.29 m
DRILLING CONTRACTOR: Foundex	DRILLING METHOD SOIL: Vaccum Truck ROCK: HQ Core
LOGGED BY: JW	DRILLING FLUID: Polymer / Water CASED TO: m
CHECKED BY: GWS	HOLE DIA.: HQ3

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY (%) 25 50 75	R.Q.D. (%) 25 50 75
1		FILL, gravels and cobbles with clay											
2													
3		3.0 1.6 METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets, moderately weathered, medium weak, all joints highly oxidized to dark brown/black colour [Wark Gneiss]					J J J J	R Cl C Cl R	I P P P R	R R S S R	0 7	100 61	100 9
4		3.8 - 3.9m: Zone of broken rock											

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-12

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)					J = Joint B= Bedding D= Drill Break F= Foliation G= Gneissosity M= Schistosity S= Shear V= Vein					
		4.4 0.2 METADIORITE, slightly to moderately weathered, weak to medium strong						R C C R	P P I	S R R R	9	113	92
5								Cl R R Ca	I P U	R R R			
6								R R R Ca Ca Ca R R Cl Cl Ca R	P I U R R R U I P	R S R S S S S R R S	10	104	79
7								Cl R R	U P P	R S R	9	99	85
		7.65m: Shear Zone - 1 cm thick silt infill in joint						R R Cl C Cl Si Ch	U I I I I P	R R R R R S R			
8								C C Ch Ch	I I P U	R R S R	7	91	53
		8.47 - 8.53m: zone of broken rock, calcite in joints 8.67 - 8.76m: zone of broken rock						Cl Ch	U U	S S			
9								C C C	I I I	R R R			

DISCONTINUITY CODES:
JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay
ROUGHNESS: R: Rough S: Smooth Sl: Slickenside
SHAPE: P: Planar C: Curved I: Irregular
WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-12

(continued from previous page)

10.72 - 10.85m: zone of broken rock

13.87 - 13.95m: zone of broken rock

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
10							J	R Cl C	I U			
							J	Ca	P S	5	96	77
							J	C C	P R P R			
							J	Ch	P R			
							J	Ch	I R			
							J	Ch C	P S U S			
11							J	C	U S	9	51	17
							J	Ch	P S			
							J	Ch Cl	I R P S	5	97	65
							J	Ch C	U R U S			
12							J	Ch	U S			
							J	C	I R			
							J	C	I S			
							J	C	I R	4	107 >>	89
13							J	C	I R			
							J	Ch	I R			
							J	Ch	I R			
							J	C	P S	5	125 >>	36
14							J	C	U S			

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-12

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gneissosity, M= Schistosity, S= Shear, V= Vein; ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
15							J	Ca	P R	5	98	80
							J	Ch	P R			
							J	Ch	P R			
							J	C	U S			
							J	Ch	P R			
							J	C	P S			
							J	Ch	I R			
16							J	C	I R	3	98	87
							J	Ch	U S			
							J	Ch	I R			
17							J	Ch	U S	2	106	100
							J	C	P R			
18							J	Si	U S			
		18.3 -13.7 End of Hole at: 18.3 m										
19												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-13

CLIENT: PWGSC	PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension	DATE HOLE STARTED: Dec. 20/2009 FINISHED: Dec. 20/2009
LOCATION:	DATUM: Chart
DIRECTION AZIMUTH: DIP (from horiz):	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 468779.76m N 5364946.63m	GROUND ELEVATION: 4.59 m
MANUFACTURER'S DRILL DESIGNATION: HT-700	TOTAL DEPTH OF HOLE: 6.1 m
DRILLING CONTRACTOR: Foundex	DRILLING METHOD SOIL: Vaccum Truck ROCK: HQ Core
LOGGED BY: JW	DRILLING FLUID: Water CASED TO: m
CHECKED BY: GWS	HOLE DIA.: HQ3

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) J = Joint B= Bedding D= Drill Break F= Foliation G= Gnessosity M= Schistosity S= Shear V= Vein ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY (%) 25 50 75	R.Q.D. (%) 25 50 75
0		FILL, gravels and cobbles with sand.											
1													
2													
3													
4													

DISCONTINUITY CODES:	
JOINT INFILL:	C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay
ROUGHNESS:	R: Rough S: Smooth Sl: Slickenside
SHAPE:	P: Planar C: Curved I: Irregular
WEATHERING:	F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-13

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) J = Joint B= Bedding D= Drill Break F= Foliation G= Gneissosity M= Schistosity S= Shear V= Vein ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
5												
6		6.1 -1.5 End of Hole at: 6.1 m 1. Hole terminated in a boulder at 6.1 m.										
7												
8												
9												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

APPENDIX II

Photographs

Core Photos: DH09-06

Box 1 From 0.00m to 4.88m
Box 2 From 4.88m to 7.90m
Box 3 From 7.90m to 13.11m
Box 4 From 13.11m to 18.28

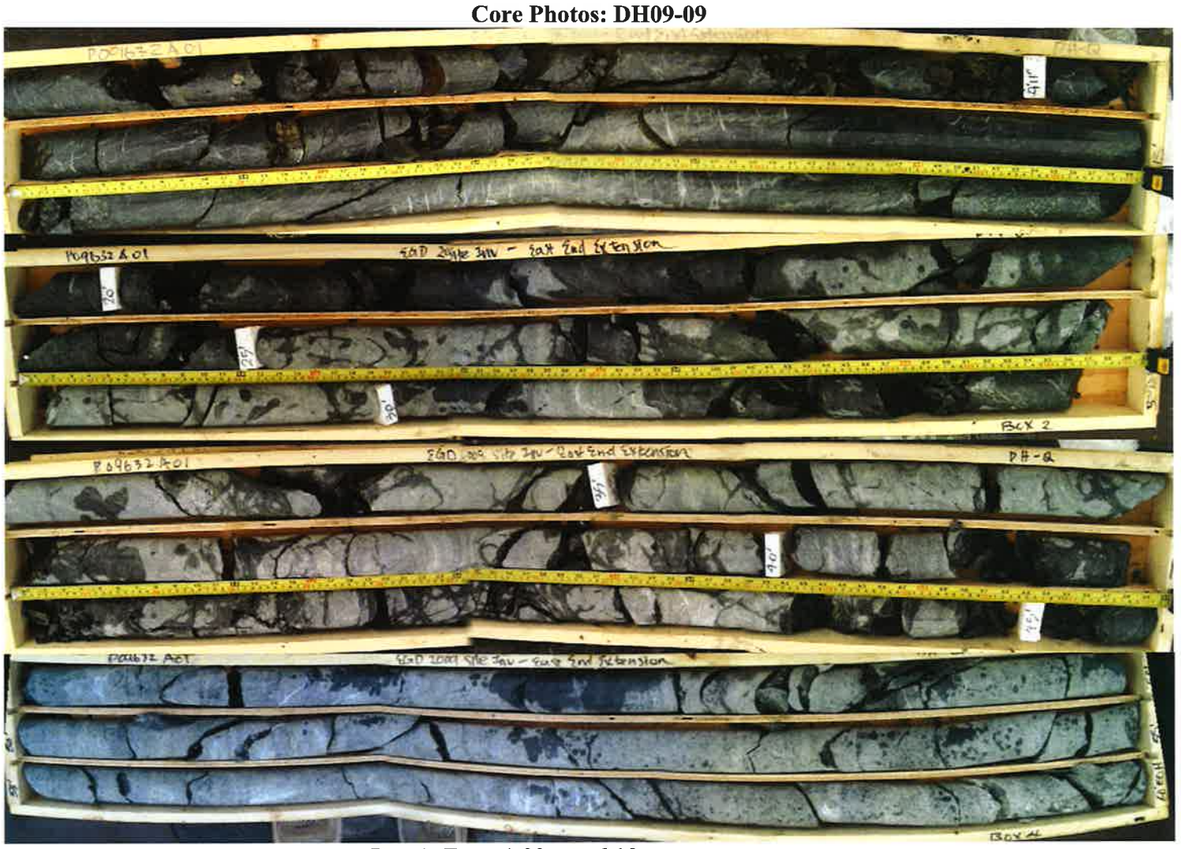
Core Photos: DH09-07

Box 1 From 0.00m to 7.70m
Box 2 From 7.70m to 11.73m
Box 3 From 11.73m to 15.32m
Box 4 From 15.32m to 18.36m

Core Photos: DH09-08

Box 1 From 3.05m to 7.21m
Box 2 From 7.21m to 10.82m
Box 3 From 10.82m to 14.58m
Box 4 From 14.58m to 19.25m

Core Photos: DH09-09



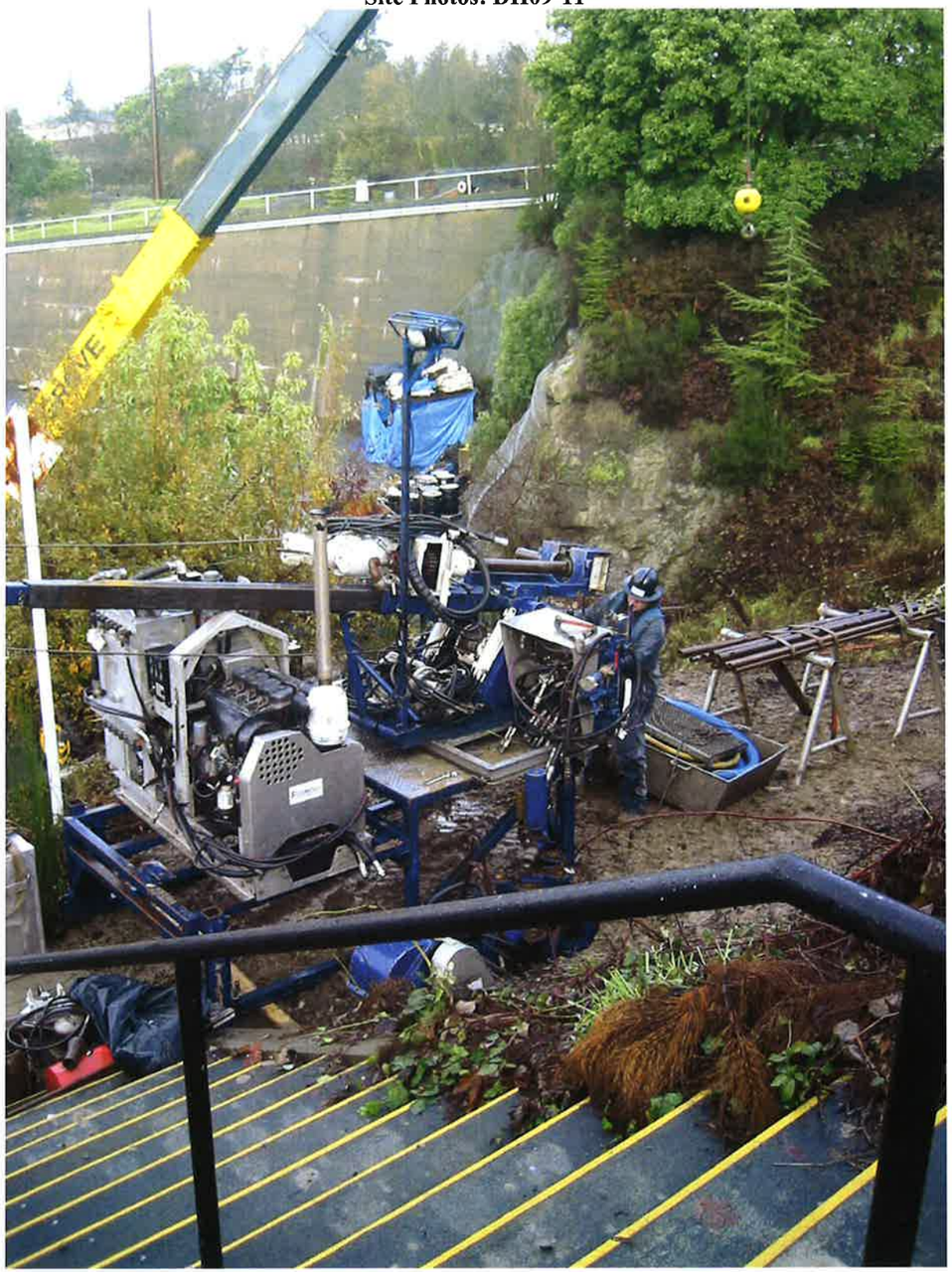
Box 1 From 1.90m to 6.10m
Box 2 From 6.10m to 10.01m
Box 3 From 10.01m to 13.72m
Box 4 From 13.72m to 18.29

Site Photos: DH09-06

Site Photos: DH09-07

Site Photos: DH09-10

Site Photos: DH09-11



APPENDIX III

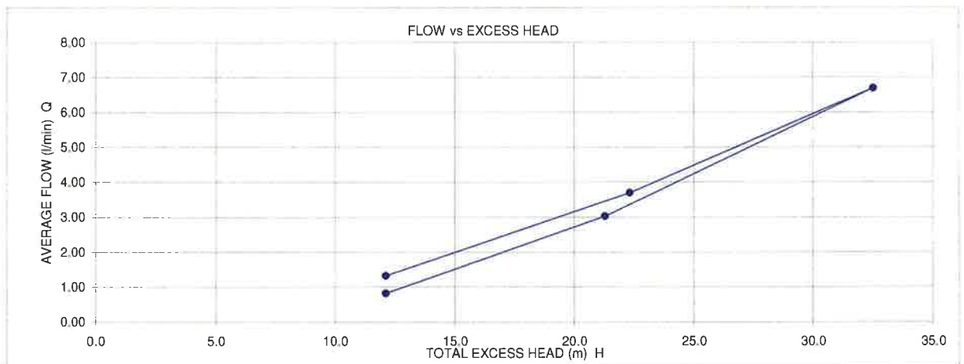
Pressure Packer Test Results

PRESSURE PACKER TEST - CONSTANT HEAD TEST

DATE OF TEST	**8-Dec-09**	DEPTH OF HOLE AT TIME OF TEST (m) along dip		**18.29**
DRILL HOLE NO.	**DH09-06**	TEST SECTION from - to (m)	**11.89**	**18.29**
TEST NO	**1**	LENGTH OF TEST SECTION (m) along dip (L)		**6.40**
PACKER TYPE	**Single**	STATIC GROUNDWATER LEVEL (m) vertical below gr. level (1)*		**0.92**
INFLATION PRESSURE (psi)	**200**	HEIGHT OF GAUGE ABOVE GROUND LEVEL (m) (2)		**1.00**
CASING DETAILS		INCLINATION OF HOLE FROM HORIZONTAL (deg)		**90**
DIAMETER OF HOLE (mm) (D)	**96.5**	TRUE DEPTH OF DRILL HOLE (m)		**18.29**
I.D. of DRILLING RODS (mm)	**65.0**			

*IF GROUNDWATER LEVEL UNKNOWN OR BELOW TEST SECTION, USE DEPTH TO CENTRE OF TEST SECTION

INJECTED FLOW RATE (l/min)	INJECTION PRESSURE (m)	FRICTION HEAD LOSS (m)		TOTAL EXCESS HEAD (m) (H)	COMMENTS
	(3)	BASIC PACKER (4)	RODS (5)	(1+2+3-4-5)	
0.82	10.2	0	0	12.1	
3.03	19.4	0	0	21.3	
6.69	30.6	0	0	32.5	
3.69	20.4	0	0	22.3	
1.32	10.2	0	0	12.1	



CALCULATIONS - BULK HYDRAULIC CONDUCTIVITY (K) (m/s)

Flow Rate (l/min)	K (m/s)	K = Q*ln(2L/D) / (2pi*L*H)			
0.82	1.4E-07				
3.03	2.9E-07				
6.69	4.2E-07				
3.69	3.4E-07				
1.32	2.2E-07				
AVERAGE	**2.8E-07**				

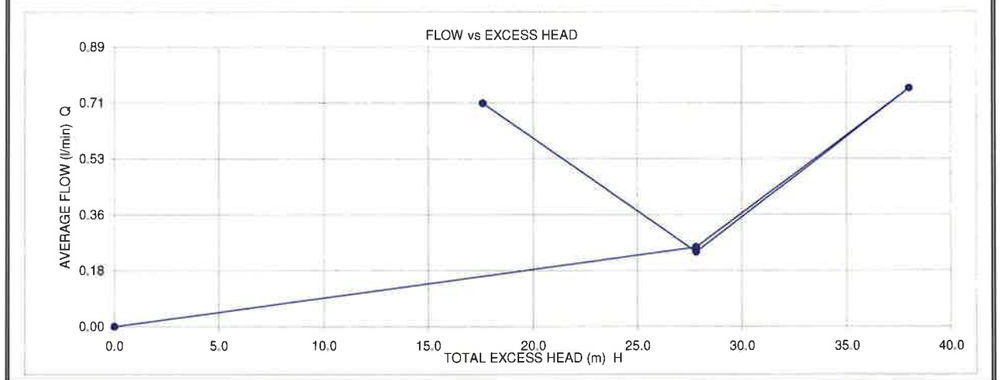
Klohn Crippen Berger	**Project No.:**	**P09632A01**		
	Project:	**EGD East End Extension**		
	Details:	**2009 Drilling Program**		
	Field Eng.:	**AW**	**Checked:**	**GWS**
	Date:	**21/01/2010**		

PRESSURE PACKER TEST - CONSTANT HEAD TEST

DATE OF TEST	**10-Dec-09**	DEPTH OF HOLE AT TIME OF TEST (m) along dip		**18.36**
DRILL HOLE NO.	**DH09-07**	TEST SECTION from - to (m)	**15.01**	**18.36**
TEST NO	**1**	LENGTH OF TEST SECTION (m) along dip (L)		**3.35**
PACKER TYPE	**Single**	STATIC GROUNDWATER LEVEL (m) vertical below gr. level (1)*		**6.43**
INFLATION PRESSURE (psi)	**200**	HEIGHT OF GAUGE ABOVE GROUND LEVEL (m) (2)		**1.00**
CASING DETAILS		INCLINATION OF HOLE FROM HORIZONTAL (deg)		**90**
DIAMETER OF HOLE (mm) (D)	**96.5**	TRUE DEPTH OF DRILL HOLE (m)		**18.36**
I.D. of DRILLING RODS (mm)	**65.0**			

*IF GROUNDWATER LEVEL UNKNOWN OR BELOW TEST SECTION, USE DEPTH TO CENTRE OF TEST SECTION

INJECTED FLOW RATE (l/min)	INJECTION PRESSURE (m)	FRICTION HEAD LOSS (m)		TOTAL EXCESS HEAD (m) (H)	COMMENTS
	(3)	BASIC PACKER (4)	RODS (5)	(1+2+3-4-5)	
0.71	10.2	0	0	17.6	
0.24	20.4	0	0	27.8	
0.76	30.6	0	0	38.0	
0.25	20.4	0	0	27.8	
0.00	10.2	0	0	0.0	



CALCULATIONS - BULK HYDRAULIC CONDUCTIVITY (K) (m/s)

Flow Rate (l/min)	K (m/s)	K = Q*ln(2L/D) / (2pi*L*H)			
0.71	1.4E-07				
0.24	2.9E-08				
0.76	6.7E-08				
0.25	3.0E-08				
AVERAGE	**5.2E-08**				

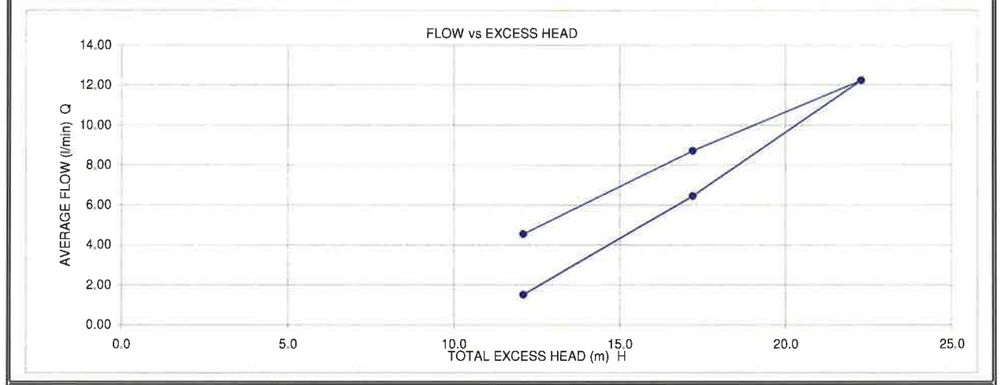
Klohn Crippen Berger	**Project No.:**	**P09632A01**		
	Project:	**EGD East End Extension**		
	Details:	**2009 Drilling Program**		
	Field Eng.:	**AW**	**Checked:**	**GWS**
	Date:	**21/01/2010**		

PRESSURE PACKER TEST - CONSTANT HEAD TEST

DATE OF TEST	**10-Dec-09**	DEPTH OF HOLE AT TIME OF TEST (m) along dip		**18.36**
DRILL HOLE NO.	**DH09-07**	TEST SECTION from - to (m)	**7.62**	**18.36**
TEST NO	**2**	LENGTH OF TEST SECTION (m) along dip (L)		**10.74**
PACKER TYPE	**Single**	STATIC GROUNDWATER LEVEL (m) vertical below gr. level (1)*		**6.00**
INFLATION PRESSURE (psi)	**200**	HEIGHT OF GAUGE ABOVE GROUND LEVEL (m) (2)		**1.00**
CASING DETAILS		INCLINATION OF HOLE FROM HORIZONTAL (deg)		**90**
DIAMETER OF HOLE (mm) (D)	**96.5**	TRUE DEPTH OF DRILL HOLE (m)		**18.36**
I.D. of DRILLING RODS (mm)	**65.0**			

*IF GROUNDWATER LEVEL UNKNOWN OR BELOW TEST SECTION, USE DEPTH TO CENTRE OF TEST SECTION

INJECTED FLOW RATE (l/min)	INJECTION PRESSURE (m)	FRICTION HEAD LOSS (m)		TOTAL EXCESS HEAD (m) (H)	COMMENTS
	(3)	BASIC PACKER (4)	RODS (5)	(1+2+3-4-5)	
1.51	5.1	0	0	12.1	
6.44	10.2	0	0	17.2	
12.24	15.3	0	0	22.3	
8.71	10.2	0	0	17.2	
4.54	5.1	0	0	12.1	



CALCULATIONS - BULK HYDRAULIC CONDUCTIVITY (K) (m/s)

Flow Rate (l/min)	K (m/s)	K = Q*ln(2L/D) / (2pi*L*H)			
1.51	1.7E-07				
6.44	5.0E-07				
12.24	7.3E-07				
8.71	6.8E-07				
4.54	5.0E-07				
AVERAGE	**5.2E-07**				

Klohn Crippen Berger

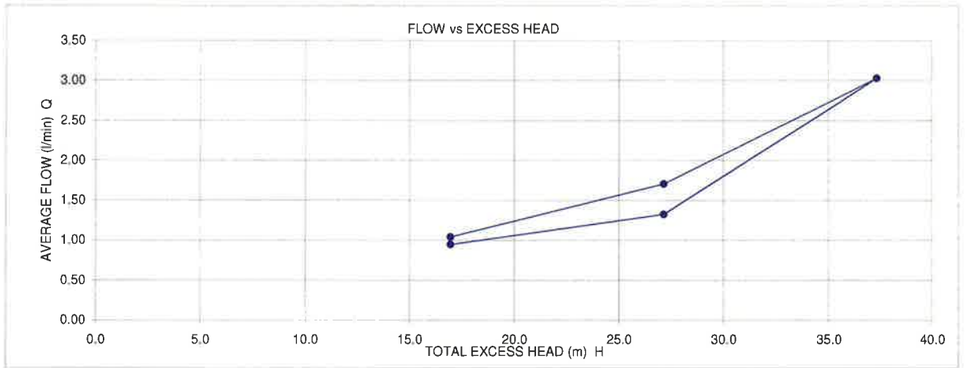
Project No.:	**P09632A01**		
Project:	**EGD East End Extension**		
Details:	**2009 Drilling Program**		
Field Eng.:	**AW**	**Checked:**	**GWS**
Date:	**21/01/2010**		

PRESSURE PACKER TEST - CONSTANT HEAD TEST

DATE OF TEST	**12-Dec-09**	DEPTH OF HOLE AT TIME OF TEST (m) along dip		**19.25**
DRILL HOLE NO.	**DH09-08**	TEST SECTION from - to (m)	**16.15**	**19.25**
TEST NO	**1**	LENGTH OF TEST SECTION (m) along dip (L)		**3.10**
PACKER TYPE	**Single**	STATIC GROUNDWATER LEVEL (m) vertical below gr. level (1)*		**5.76**
INFLATION PRESSURE (psi)	**200**	HEIGHT OF GAUGE ABOVE GROUND LEVEL (m) (2)		**1.00**
CASING DETAILS		INCLINATION OF HOLE FROM HORIZONTAL (deg)		**90**
DIAMETER OF HOLE (mm) (D)	**96.5**	TRUE DEPTH OF DRILL HOLE (m)		**19.25**
I.D. of DRILLING RODS (mm)	**65.0**			

*IF GROUNDWATER LEVEL UNKNOWN OR BELOW TEST SECTION, USE DEPTH TO CENTRE OF TEST SECTION

INJECTED FLOW RATE (l/min)	INJECTION PRESSURE (m)	FRICTION HEAD LOSS (m)		TOTAL EXCESS HEAD (m) (H)	COMMENTS
	(3)	BASIC PACKER (4)	RODS (5)	(1+2+3-4-5)	
1.04	10.2	0	0	17.0	
1.70	20.4	0	0	27.1	
3.03	30.6	0	0	37.3	
1.32	20.4	0	0	27.1	
0.95	10.2	0	0	17.0	



CALCULATIONS - BULK HYDRAULIC CONDUCTIVITY (K) (m/s)

Flow Rate (l/min)	K (m/s)	K = Q*ln(2L/D) / (2pi*L*H)			
1.04	2.2E-07				
1.70	2.2E-07				
3.03	2.9E-07				
1.32	1.7E-07				
0.95	2.0E-07				
AVERAGE	**2.2E-07**				

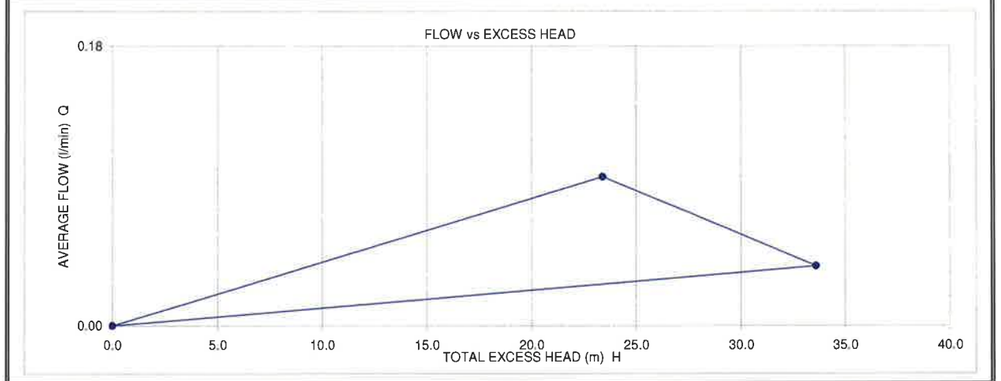
Klohn Crippen Berger	**Project No.:**	**P09632A01**		
	Project:	**EGD East End Extension**		
	Details:	**2009 Drilling Program**		
	Field Eng.:	**AW**	**Checked:**	**GWS**
	Date:	**21/01/2010**		

PRESSURE PACKER TEST - CONSTANT HEAD TEST

DATE OF TEST	**13-Dec-09**	DEPTH OF HOLE AT TIME OF TEST (m) along dip		**18.29**
DRILL HOLE NO.	**DH09-09**	TEST SECTION from - to (m)	**13.41**	**18.29**
TEST NO	**1**	LENGTH OF TEST SECTION (m) along dip (L)		**4.88**
PACKER TYPE	**Single**	STATIC GROUNDWATER LEVEL (m) vertical below gr. level (1)*		**2.03**
INFLATION PRESSURE (psi)	**200**	HEIGHT OF GAUGE ABOVE GROUND LEVEL (m) (2)		**1.00**
CASING DETAILS		INCLINATION OF HOLE FROM HORIZONTAL (deg)		**90**
DIAMETER OF HOLE (mm) (D)	**96.5**	TRUE DEPTH OF DRILL HOLE (m)		**18.29**
I.D. of DRILLING RODS (mm)	**65.0**			

*IF GROUNDWATER LEVEL UNKNOWN OR BELOW TEST SECTION, USE DEPTH TO CENTRE OF TEST SECTION

INJECTED FLOW RATE (l/min)	INJECTION PRESSURE (m)	FRICTION HEAD LOSS (m)		TOTAL EXCESS HEAD (m) (H)	COMMENTS
	(3)	BASIC PACKER (4)	RODS (5)	(1+2+3-4-5)	
	10.2	0	0		
0.09	20.4	0	0	23.4	
0.04	30.6	0	0	33.6	
	20.4	0	0		
0.00	10.2	0	0	0.0	



CALCULATIONS - BULK HYDRAULIC CONDUCTIVITY (K) (m/s)

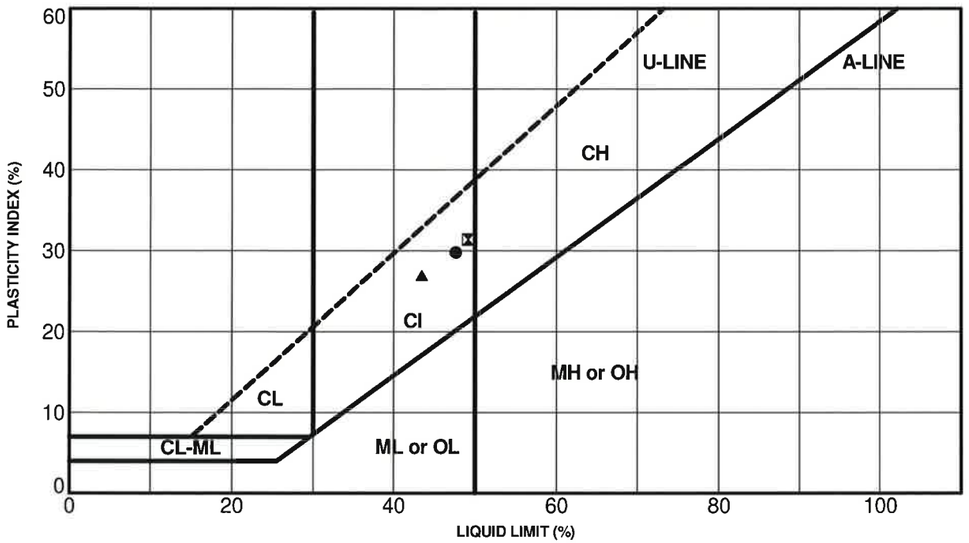
Flow Rate (l/min)	K (m/s)	K = Q*ln(2L/D) / (2pi*L*H)			
0.09	1.0E-08				
0.04	2.8E-09				
AVERAGE	**2.6E-09**				

Klohn Crippen Berger	**Project No.:**	**P09632A01**		
	Project:	**EGD East End Extension**		
	Details:	**2009 Drilling Program**		
	Field Eng.:	**AW**	**Checked:**	**GWS**
	Date:	**21/01/2010**		

APPENDIX IV

Laboratory Test Results

PLASTICITY CHART



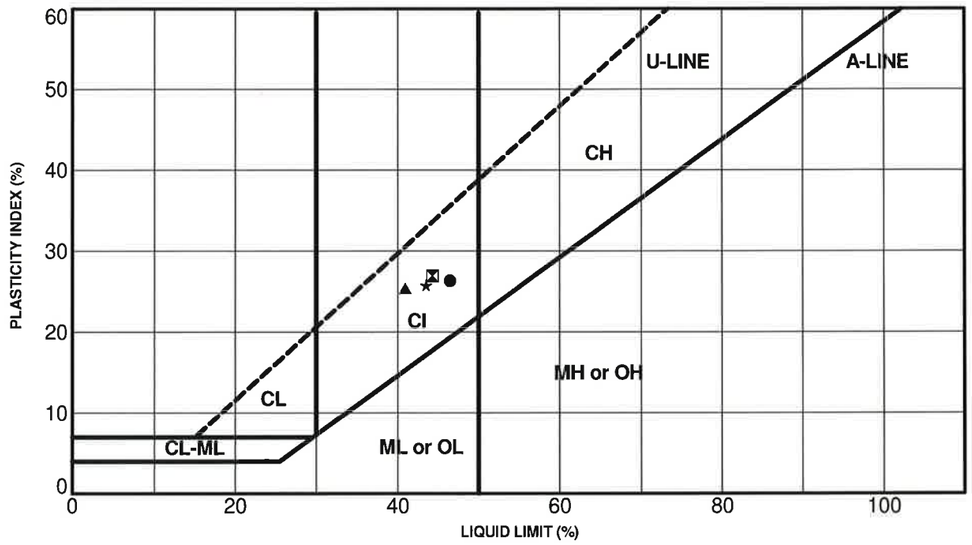
	HOLE	SAMPLE	DEPTH (m)	W_L	W_P	PI	% FINES	REMARKS/SAMPLE DESCRIPTION
●	DH09-10	SPT #2	4.0	48	18	30		13' - 14.6'
⊠	DH09-10	SPT #3	5.8	49	18	31		19' - 21'
▲	DH09-10	SPT #4	7.6	43	16	27		25 - 27'

Klohn Crippen Berger

PROJECT NO.: P09632A01
PROJECT: EGD East End Extension
LOCATION: Esquimalt, Victoria, BC
FIGURE:
DRAWN BY: NG **CHECKED BY:** BY

KCB_ATTERBERG-SI P09632A01 EGD EEE T0954 DEC 17, 2009 GPJ SIEVE GDT 2/18/10

PLASTICITY CHART



	HOLE	SAMPLE	DEPTH (m)	W_L	W_P	PI	% FINES	REMARKS/SAMPLE DESCRIPTION
●	DH09-11	SPT#1	1.5	46	20	26		5'
⊠	DH09-11	Grab #1	2.7	44	17	27		9', Grab sample 1
▲	DH09-11	SPT#2	6.1	41	16	25		20'
★	DH09-11	SPT#3	7.9	43	18	26		26'

Klohn Crippen Berger

PROJECT NO.: P09632A01
PROJECT: EGD East End Extension
LOCATION: Esquimalt, Victoria, BC
FIGURE:
DRAWN BY: CR **CHECKED BY:** WSH

ENVIRONMENTAL ASSESSMENT SCREENING

East End Extension Project

Conducted in Compliance with the

CANADIAN ENVIRONMENTAL ASSESSMENT ACT

Prepared for:

Public Works and Government Services Canada

Prepared by:

GOLDER ASSOCIATES LIMITED

Table of Contents

East End Extension Project 1
CANADIAN ENVIRONMENTAL ASSESSMENT ACT *(s. 5.(1))* 2
PROJECT INFORMATION 2
Project Description 2
Purpose of the Project – Justification/Need *(s.16.(2)(a))* 2
Alternatives to the Project *(s. 16.(2)(c))* 2
Scope of Project *(s. 15.)* 3
Project Components *(s. 15.(3))* 3
Existing Environment and Other Background Information 5
Methods 5
General Description 5
Physical Environment 5
Air: 5
Climate: 5
Geology/Terrain: 5
Contaminated Sites: 6
Surface Water: 9
Groundwater: 10
Seawater: 11
Biological Environment 11
Fish and Fish Habitat: 11
Vegetation: 11
Sensitive Ecosystems: 11
Wildlife and Wildlife Habitat: 12
Rare/Endangered Species: 12
Socio-Economic Environment: 12
Overview: 12
Aboriginal (First Nations): 12
Archaeology: 13
Surrounding Area 15
Scope of Assessment *(s. 16.(3))* 16
COMMUNICATIONS 18
First Nations and Public (s. 16.(1)(c), s. 18.(3)) 18
Federal Coordination *(s. 12.(1)(3))* 18
DISCUSSION OF ENVIRONMENTAL EFFECTS, SIGNIFICANCE AND MITIGATION *(s.16.(1); s. 20.(2))* 19
Accidents and Malfunctions 28
Significance and Residual Effects *(s. 16. (1)(b))* 29
Cumulative Effects *(s. 16.(1)(a))* 29
Follow-up (s. 14.(c); s. 16.(2)(c)) 30
Summary 30
CEAA DETERMINATION *(s. 20.(1))* 32
REFERENCES 33
Legislation 35
Site Visit 35
Personal Communication 35

Tables (in text)

Table 1: Project Components / Activities
Table 2a: Estimated Soil Classification Volumes for AEC 3
Table 2b: Estimated Soil Classification Volumes for AEC 14
Table 3: IDF Data for Victoria
Table 4: Checklist for Scoping VECs/VSCs Pertinent to this Project
Table 5: Effects Analysis and Mitigation Measures: Physical Components
Table 6: Effects Analysis and Mitigation Measures: Biological Components
Table 7: Effects Analysis and Mitigation Measures: Socio-economic Components

Appendices

Appendix A: Figure Plan and Photographs
Appendix B: Background Documents
Appendix C: Correspondence
Appendix D: Mitigation Monitoring Report Form
Appendix E: Borehole and Testhole Logs

Figures (located in Appendix A)

Figure 1 Key Plan Final
Figure 2: Proposed Development Final
Figure 3: AEC 3 and 14th Location Plan Final

Photographs (located in Appendix A)

Photo 1: Overview of Project Area from South
Photo 2: Water bar on road edge North of Project Area
Photo 3: Concrete curb on road to East and South of Project Area
Photo 4: Storm drain cover at toe of slope
Photo 5: Seepage through retaining wall along North side of dock craneway
Photo 6: Vegetation North of existing steps
Photo 7: Vegetation South of existing steps

Environmental Assessment Screening Report

Conducted in Compliance With

The Canadian Environmental Assessment Act

Project Title:	East End Dock Extension	
Location:	Esquimalt Graving Dock, Esquimalt, BC.	
Project/Activity Summary:	Public Works and Government Services Canada (PWGSC) proposes to construct an extension of the east end of the Esquimalt Graving Dock (EGD).	
Project Type:	Undertaking in relation to a physical work?	Yes
	Physical activity not related to a physical work (If yes, refer to Inclusion List Regulations.)	
EA Type:	Screening Level EA	
EA Start Date:	January 18, 2010	
Prepared For:	PWGSC	
Prepared By:	Golder Associates Limited	
Project No.:	10-1478-0004	
Lead Responsible Authority (Lead RA):	PWGSC	
Lead RA Sect. 5 CEAA trigger:	PWGSC may provide federal lands for the purpose of enabling this project to be carried out, may provide financial assistance to the proponent for the purpose of enabling the project and is the proponent for the project.	
Lead RA file no.:	025527.001	
Other Responsible Authority(s) (RA(s)):	N/A	
Other RA Sect. 5 CEAA Trigger(s):	N/A	
Other RA file no.:	N/A	
CEAR Reference Number:	10-01-52637	

Lead RA Contact Name:	Katrina Johnston
Title:	Senior Environmental Specialist
Address:	401-1230 Government Street, Victoria, BC.
Phone: **Fax:**	(250) 363-8623 (250) 363-3573
Email:	Katrina.johnston@pwgsc-tpsgc.gc.ca

EA Contact Name:	Katrina Johnston
Title:	Senior Environmental Specialist
Address:	401-1230 Government Street, Victoria, BC.
Phone: **Fax:**	(250) 363-8623 (250) 363-3573
Email:	Katrina.johnston@pwgsc-tpsgc.gc.ca

CANADIAN ENVIRONMENTAL ASSESSMENT ACT *(S. 5.(1))*

The Federal government is required to undertake Environmental Screenings of projects in accordance with the *Canadian Environmental Assessment Act* (CEAA). CEAA states responsibilities and procedures for the environmental assessment of projects involving the Federal government. The Act also establishes a process for determining the environmental effects of projects. CEAA is applicable to any project where a federal authority performs one or more of the following CEAA triggers in respect of a project:

- is the proponent of a project *(Section 5.(1)(a))*;
- grants money or any other form of financial assistance to the project *(Section 5.(1)(b));*
- leases, sells or disposes of land to enable a project to be carried out *(Section 5.(1)(c));* or,
- exercises a regulatory duty in relation to a project, such as issuing a permit or license, that is included in the Law List prescribed by the regulations to the Act *(Section 5.1(d))*.

PROJECT INFORMATION

Project Description

The Esquimalt Graving Dock (EGD) is located in Esquimalt, British Columbia at 825 Admirals Road (Figure 1, Appendix A). The EGD is a vessel repair and maintenance facility with a large solid bottom Dry Dock. The Dry Dock can be divided into three sections using floating caissons ballasted with concrete and sea water. A tunnel on the north side of the Dry Dock is used to fill and empty the Dry Dock and this connects to separate tunnels enabling each section to fill independently through culverts in the floor.

PWGSC proposes to construct a 30 m long extension of the Dry Dock to create additional berthing length for vessel maintenance in Section 3 of the Dry Dock (the Project; Figure 2). This Project will have a footprint of approximately 1150 m^2 and is within a serviced lot. The proposed construction includes relocation or removal of services and structures in the Project area; excavation of bedrock; and construction of dock base, dock walls and a retaining wall. This extension will allow the docking of a number of the larger vessels, including those from the BC Ferries fleet in only one section. The extended facilities will also better accommodate the DND frigate mid life refit project, This will leave approximately 750 feet of Dry Dock for other refit and repair work. Construction for the Project is expected to start in the summer of 2010. The location of Project works, as well as the description of the Project design was extrapolated from figures provided by Klohn Crippen Berger (Klohn). The set of figures used for the assessment are labelled as the East End Extension Plan, Project Number : P09522A01, and are dated December 18th, 2008

Purpose of the Project – Justification/Need *(s.16.(2)(a))*
The purpose of the Project is to expand the EGD so that it can accommodate longer ships.

Alternatives to the Project *(s. 16.(2)(c))*
An alternative to expanding the EGD to the east would be expanding into the water to the west. This alternative would be more expensive and interfere with ongoing ship repair.

Scope of Project *(s. 15.)*

Project Components *(s. 15.(3))*

The Project components are summarized in Table 1.

Table 1: Project Components / Activities

Project Phase	Project Components	
	Principle Project	**Accessory works / Discussion**
Site Preparation	• Clearing and grubbing. • Development of a temporary service bridge to re-route services during construction. • Removal of the existing asphalt roadway and associated infrastructure at the east end of the Dry Dock. • Excavation of soft overburden soils (including fill material and clay in the dock excavation area and removal of blasted bedrock within the development footprint to facilitate the construction of the Dry Dock extension and concrete retaining wall. • Excavation of soft overburden soils (including fill material and clay) in the upslope excavation area and removal of blasted bedrock within upslope excavation area. • Diversion of surface water and existing storm sewers.	• Clearing and grubbing is expected to be completed using handheld equipment. • Excavation, drilling and blasting will require the use of heavy mechanized equipment and transport vehicles.
Construction	• Installation of a stair case along the slope east of the dock. • Installation of final infrastructure in the dock excavation area (including dock base, dock walls, retaining wall, utilities and connection to existing tunnel and drain systems in the dock bottom)	• Shotcrete and soil nails will most likely be used to provide temporary support for the hill slope soils. The final concrete wall structure will be cast directly against the shotcrete face. • This work will require the use of heavy equipment.

Project Phase	Project Components	
	Principle Project	**Accessory works / Discussion**
	• Installation of final infrastructure in the upslope area (including a retaining wall against the upslope areas within the project development footprint, east of the new dock footprint). • Diversion of surface water and reconstruction of storm sewers.	
Operation	• Ship repair and maintenance of the dock.	• The 30 m extension will facilitate extended docking periods for the DND frigate mid life refit project, as well as allow the docking of a number of the larger vessels from the BC Ferries fleet in only one section.
Decommissioning / Abandonment	• Not expected to occur in the foreseeable future.	• N/A

Existing Environment and Other Background Information

Methods

A review of previous reports on the Project area and of online databases was conducted to gather background information. A two hour field reconnaissance was also undertaken and was completed on February 23, 1010 by Rowland Atkins (Geomorphologist), Michelle Sevenhuysen (Environmental Engineer) and Virginia Chant (Biologist).

Information in the Aboriginal and Archaeological sections was taken from the Archaeological Overview Assessment (AOA) report prepared for the Project area by Golder (2010a) on behalf of PWGSC. This report also incorporates the results of an AOA and Archaeological Impact Assessment (AIA) that was undertaken for five Areas of Environmental Concern (AEC) located within the Esquimalt Graving Dock facility by Golder (2010b) on behalf of PWGSC. One of these AECs, AEC 14, is located partially within, and immediately adjacent, to the Project area.

General Description

Physical Environment

Air:

Air emissions exist at EGD due to ship repair activities. Air emissions are monitored by an air quality monitoring station (PWGSC 2010).

Climate:

The Project area is situated within the Moist Maritime subzone of the Coastal Douglas Fir Biogeoclimatic Zone (CDFmm) (MOF 2008). The CDFmm subzone is located on the leeward side of the Vancouver Island and Olympic Mountain ranges which results in the subzone experiencing warm, dry summers and mild, wet winters (Green and Klinka 1994).

Average annual precipitation for the Project Area is 839 mm with more than 96% of this falling as rain based on climate normals for the Esquimalt climate station for the period 1961-1990 (EC climate normal data accessed online, Station 1012710, accessed February 26, 2010). Most of the precipitation occurs in the winter months (November to February) with a relatively dry period in the summer (May to August). The extreme 24 hr rainfall recorded during this period (1961-1990) is 101.6 mm in the winter and 53.1 mm recorded in the summer.

Geology/Terrain:

The terrain within the Project Area consists of a bowl-shaped, steep bedrock slope covered by a thin veneer of soil, typically less than 2 m, upslope of a flat lying paved area (Photograph 1, Appendix A). The flat lying paved area is underlain by 2-3 m of soil which is underlain by bedrock according to cross-sections provided by Klohn and further discussed in the Soil Stratigraphy Section. The bowl is open to the west and is bounded by the South Jetty and Graving Dock Access Roads. The steep bedrock slope has slope gradients that vary from 100% to 150% along the north edge of the paved area to 20% to 40% adjacent to the roadway that forms the eastern and southern perimeter of the Project Area. The typical slope gradient is 40% to 60% within the bowl.

During the field reconnaissance no surface evidence of slope instability (tension cracks, j-rooted trees, surface slumps) were observed on the slopes of the bowl. However, the central and northern sector of the bowl had been contoured and vegetation had been cleared as part of a recent drilling program (KCBL 2010). A rock slope failure is known to have occurred at the southwest end of the painted retaining wall adjacent to the refuelling station.

Contaminated Sites:

Background

Two areas of environmental concern (AECs) are located to the east of the EGD Dry Dock and within the proposed Project footprint. These areas consist of "AEC 3", including the generally level area at the head of the Dry Dock and a linear area to the southeast of the Dry Dock (Figure 3), and "AEC 14", including the steep bedrock slope and soil overburden, east of the retaining wall, at the east and southeast end of Dry Dock (Figure 3). Several subsurface investigations have been completed in the areas of AEC 3 and AEC 14, to assess soil and groundwater quality. The following studies include those reports where surfical and/or subsurface soil samples were collected in the areas of AEC 3 and AEC 14:

- SEACOR Environmental Inc. Supplemental Site Investigation Esquimalt Graving Dock, Esquimalt, BC. March 31, 2003;
- Hemmera. Ecological & Human Health Risk Assessment PWGSC Esquimalt Graving Dock, Esquimalt, BC. July 2003;
- SEACOR Environmental Inc. Addendum to Ecological and Human Health Risk Assessment PWGSC Esquimalt Graving Dock, Esquimalt, BC. February 25, 2005;
- SEACOR Environmental Inc. 2007 Addendum to Ecological and Human Health Risk Assessment PWGSC Esquimalt Graving Dock, Esquimalt, BC. March 26, 2007;
- SLR Consulting (Canada) Ltd. Phase 2/3 Environmental Site Assessment Report, Esquimalt Graving Dock Uplands, 825 Admirals Road, Esquimalt, BC; (SLR 2009a, 2009b)
- SLR Consulting (Canada) Ltd. Updated Remedial Risk Management and Options Analysis, Esquimalt Graving Dock, 825 Admirals Road, PWGSC. December, 2009; and,
- Klohn Crippen Berger. Esquimalt Graving Dock East End Extension – Geotechnical Data Report, February 25, 2009.

Soil Stratigraphy

The soil stratigraphy observations are based on investigations by SLR Consulting (Canada) Ltd. (SLR 2009a) and Klohn Crippen Berger (Klohn 2010). Borehole/test hole logs available from SLR and Klohn and are attached as Appendix E.

Based on the reports identified above, the flat paved area to the east of the Dry Dock (AEC 3) consists of a thin layer of asphalt to approximately 0.08 metres below ground surface (m bgs), underlain by concrete to 0.3 m bgs, which in turn is underlain by sand and gravel fill with cobbles to approximately 0.9 m bgs. The fill material is underlain by layers of silt, clay and sand to approximately 2.0 m to 3.0 m bgs, beneath which bedrock was typically encountered.

The soil stratigraphy to the area east of the retaining wall (AEC 14) consists of a layer of topsoil and grass ranging in depth from approximately 0.03 m to 0.05 m bgs, underlain by sand with some silt or silt with some sand to approximately 0.35 m bgs. SLR collected samples within this area by means of hand excavated test pits, with the deepest sample collected at 4.3 m bgs. Klohn completed two mud rotary

drill holes in this area which extended below the maximum depth of sampling in this area by SLR (and other consultants). Sample locations are shown on Figure 3, in Appendix A. Silt with traces of some clay was found to extend from 4.5 m to 5.0 m bgs, underlain by silty clay or clay with some silt to approximately 9.5 m bgs, where a thin layer of sand was encountered overlying bedrock. Bedrock was encountered between 9.1 m and 10.5 m bgs. The top of the bedrock surface, east of the retaining wall, is typically above the hightide level.

Site Observations

A field reconnaissance of the areas was conducted by Ms. Michelle Sevenhuysen of Golder on February 23, 2010. General observations included surficial debris (pieces of brick, small metal debris, refuse) scattered along the toe and on the surface of the slope (AEC 14); shell fragments were also observed to the north of the stairway along the road and mid-slope. The sloped surface was generally vegetated; although a portion of the slope surface appeared to have been disturbed, as vegetation had been flattened and soil was exposed. No other indications of potential contamination (such as staining or odours) were observed during the field reconnaissance.

Unexploded Ordnance

Golder understands based on discussions with PWGSC that an unexploded ordnance (UXO) was historically uncovered during excavation works in an area north of the Project area. The area which was previously part of DND barracks was also historically used as an unapproved disposal area. The Golder report entitled *Underwater Unexploded Ordnance (UXO) Historical Survey, MARPAC Area of Responsibility*, dated June 15, 2004, was reviewed for information related to UXOs within the Project area; however, no relevant information was indentified. Golder contracted Ecolog ERIS to review available databases for information on the disposal of material, especially UXO, at the Site. The review identified the National Defence & Canadian Forces Waste Disposal Sites database; however, no information on historical activities related to disposal was identified

Golder undertook a review of historical photographs for the EGD facility to ascertain if dumping of waste materials was evident in this area of the Site. No such observations were made; however, few photographs focused on this specific area.

Several phases of sampling and/or drilling have been undertaken in this area and Golder is not aware that these investigations have encountered suspect materials indicating disposal of debris that may be associated with UXO.

Soil Quality

Based on previous environmental investigations in the areas of AEC 3 and AEC 14, and additional investigations completed by SLR during the Phase II/III Environmental Site Assessment Report in 2009 (SLR 2009a), the following key findings were concluded:

AEC 3: Two zones of soil contamination were delineated within the area of AEC 3, within the approximate estimated footprint of the east dock extension. An area of metals contaminated soil (arsenic and nickel) was identified from the existing capstan centre in the approximate centre of Dry Dock edge, extending west to the concrete retaining wall (Figure 2, Appendix A). The metals contamination was found to extend to a maximum depth of 0.75 m bgs. A second small zone of polycyclic aromatic hydrocarbon (PAH) contamination in soils was indentified on the northeast portion of AEC 3 to a maximum depth of 0.75 m bgs. Both areas of contamination had metals and/or PAHs at concentrations

greater than Canadian Council for Ministers of the Environment (CCME) industrial land use (IL) guidelines and/or BC Contaminated Sites Regulation (CSR) IL standards. Contamination in both locations was found to be associated with fill material (SLR 2009a). The summary tables of soil analytical data from SLR are included in Appendix E.

Groundwater samples were analyzed for PAHs (3 samples) and/or metals (2 samples) in previous investigations. None of the parameters exceeded the applicable CCME aquatic life guidelines for the protection of marine aquatic life (AWm) and/or CSR AWm standards.

In Klohn's "Class 'C' Construction Cost Estimate", issued on January 15, 2010, approximately 10,900 m^3 of soil overburden was estimated to be generated from construction of the dock extension (Klohn 2010) Based on SLR's previous estimates of inferred contaminant zones and associated volumes, Golder estimates that approximately 525 m^3 of contaminated soil will be generated as a result of the Project.

SLR estimated that an area of approximately 2,110 m^2 is impacted by PAH and metal contamination within AEC 3 (approximately 3,270 m^3). Of this estimated contaminant soil area, Golder infers that an area of 190 m^2, or 140 m^3 (with a thickness of approximately 0.75 m) is located within the footprint of the Project (Klohn 2010). Contaminated soil estimates are outlined in Table 2a below.

Table 2a: Estimated Soil Classification Volumes for AEC 3

Standards	Parameter	Area (m2)	Volume (m3)
Waste (Schedule 7 Column IV / CSR IL / CCME IL)	PAHs and Metals	190	140

AEC 14: Three zones of contamination were identified within AEC 14 to the east of the concrete retaining wall, within the approximate estimated footprint of the east dock extension (Figure 3, Appendix A). The areas were generally associated with metals contamination, mainly arsenic, chromium, copper, lead and zinc, with the exception of one sample which exceeded applicable guidelines/standards for PAHs in surficial soils (0.15 m bgs). SLR identified that metals contamination, predominantly associated with fill materials, extended to a maximum depth of 0.4 m bgs. (SLR 2009a) The summary tables of soil analytical data from SLR are included in Appendix E.

Groundwater was not encountered in this area by SLR (SLR 2009a).

SLR estimates that an area of approximately 1,760 m^2 is impacted with metals contaminants exceeding the applicable standards (and limited PAH contamination) within AEC 14 (approximately 850 m^3). Of this estimated contaminant soil volume, Golder estimates that an area of 950 m^2, or 385 m^3 is located within the preliminary footprint of the Project (Klohn 2010). Soil estimates are outlined in Table 2b below.

Table 2b: Estimated Soil Classification Volumes for AEC 14

Standards	Parameter	Area (m2)	Volume (m3)
Waste (Schedule 7 Column IV / CSR IL / CCME IL)	Metals (limited PAHs)	950	385

Metals and limited PAH contamination in soil within AEC 3 was considered by SLR to have been sufficiently delineated vertically; however, the lateral extent of contamination had not been investigated on the south and southeast portions of AEC 3. Where excavation for construction purposes extends into soils southeast of the Dry Dock (within AEC 3), additional *in-situ* discrete sampling and/or ex-situ sampling of stockpiles may be required to assess soil quality for segregation and assessment of disposal requirements. SLR considered that utilities may make excavation of soil and replacement of utilities complex within AEC 3. In SLRs Remediation/Risk Management Options Analysis report (SLR 2009b) it was considered that excavation of contaminated soil for remediation purposes may prove feasible if undertaken as part of any expansion / refurbishment.

SLR identified that the extent of soil contamination in AEC 14 had been sufficiently delineated in fill materials to a maximum depth of approximately 0.5 m bgs with widespread surficial (lateral) metals contamination. SLR reported that potential constraints to remediation of AEC 14 may include archaeological constraints, as the area reportedly contains archaeologically significant material. (Golder 2010b)

Surface Water:

Surface water is limited to runoff from the catchment area contained within the proposed Project Area. No streams cross the Site. Surface water from land adjacent to the Project Area is diverted away from the Project Area by an asphalt waterbar to the north (Photograph 2, Appendix A) and a concrete curb to the east and south (Photograph 3, Appendix A). These surface drainage features isolate the Project Area from surface runoff derived from adjacent areas. Surface drainage is presently captured on the asphalt covered flat section of the Site by catch basins and directed into storm sewers (Photograph 4, Appendix A). These storm sewers discharge to the Harbour. Storm sewer pipes are located within the Project Area based on the KCBL project drawings and observations of catch basins and manholes during the field assessment. Surface runoff contained within these storm sewers is derived from adjacent terrain and buildings.

Based on the proposed Project Area, the surface area receiving precipitation that could drain into the excavation for the east end extension is estimated to be 4,650 m^2. This estimate includes areas providing direct runoff but excludes water brought into the Project area by existing storm sewer systems. The near-surface bedrock, thin soils and typical slope gradient suggest that the time for precipitation to fall on the upper slope and runoff to the catch basins (time of concentration, TOC) is approximately 5 minutes. A rainfall event with a recurrence interval of 25 years was used to assess surface water interactions with the Project. Intensity-Duration-Frequency (IDF) data for the Greater Victoria area available from Environment Canada are summarized in Table 3.

Table 3: IDF Data for Victoria

Station Name	2-year, 5 minute rainfall (mm/hr)	25 year, 5 minute rainfall (mm/hr)	Distance from Project Area (km)
Victoria Marine 1018642	25	35	24.5 (west)
Saanich Camosun 1016941	22	34	7.0 (north)
Victoria Gonzales 1018610	21	39	7.5 (east)
Victoria UVic 1018FF6	24	40	7.5 (east)
Project Area (estimate)	23	37	N/A

Due to the rain shadow effect of the Olympic Mountains and Sooke Hills, there is a gradient in rainfall from west to east and from north to south across Victoria. Analysis of the IDF data suggests that the 25 year, 5 minute rainfall event for the Project Area is 37 mm/hr. This storm would produce approximately 3 mm of rainfall across the Site. Due to the shallow soils, near surface bedrock, and paved or covered surfaces developed as part of EGD, it is reasonable to consider that the majority of this rainfall becomes runoff. Within the construction area, soil cover will be removed leaving exposed bedrock. Assuming that the rainfall becomes runoff, the 25-year 5 minute rainfall event would produce approximately 14 m^3 of runoff at an average inflow rate of approximately 50 l/s (litre/second). This rainfall event provides sufficient water to cover the proposed excavation area (1050 m^2) in water to a depth of approximately 0.015 m. For comparison, the average annual rainstorm (2-year, 5 minute) produces approximately 10 m^3 of runoff at an average inflow rate of 35 l/s.

The estimated runoff volume and discharge should be managed by collecting and diverting the runoff to either the existing storm sewer system or through the water management facilities at the graving dock. If the work is constructed during the summer dry season, surface runoff volumes and discharge rates would likely be less than that estimated above.

Groundwater:

Groundwater has been monitored by a series of consultants (Seacor 2003 and 2007, Hemmera 2009, KCBL 2010) within the Project Area. No additional groundwater data was collected for this assessment. Groundwater seepage was not observed on the upper slope of the Project during the field assessment but was observed from a drain pipe in the retaining wall of the road access upslope of the flat, asphalt covered area at the head of the existing dock at an approximate elevation of +4.7 m Chart Datum (+2.8 m Geodetic) (Photograph 5, Appendix A).

Seacor decommissioned monitoring wells within the Project area in 2007 (Seacor 2007). Seacor (2003) reported a hydraulic conductivity of $1x10^{-5}$ m/s for the surficial layer of soil below the asphalt. The elevation of these soils varies typically between +4.5 Chart Datum (+2.6 m Geodetic) to +2.0 m Chart Datum (+0.1 m Geodetic) based on available drawings. KCBL (2010) reported hydraulic conductivities of less than $5.2x10^{-7}$ m/s for the bedrock below the surficial soil. The KCBL data was obtained from wells drilled into the bedrock to depths ranging from -18.3 m to -19.3 m below existing grade (+4.5 m Chart Datum). The depth of these wells was therefore between -13.8 m and -14.8 m Chart Datum and extended to below the proposed depth of excavation.

The existing dock consists of concrete gravity structures placed into an excavated depression in an historic bay. Part of the south side of the dock (Sections 1 and 2) includes fill material placed under the south jetty in an area that was originally open water prior to construction of the dock based on a 1925 survey plan. A clay plug (the clay puddle) was installed during construction of the south side of the dock from Section 2 to the west end of Section 3 to act as a water seal. The proposed excavation for the East End Extension will extend to -11.4 m Chart Datum (-13.3 m Geodetic) based on available drawings. The excavation will result in exposed bedrock walls on the north, east and south sides of the Project area and an exposed bedrock floor. The north and south walls of the excavation will be approximately 15 m high and 30 m wide, the east wall will be approximately 15 m high and 40 m wide and the floor of the excavation will be approximately 30 m by 40 m.

For the assessment of potential groundwater seepage, freshwater seepage was assumed to be possible from exposed bedrock surfaces and from the exposed soil faces. The exposed soil faces are on the north side of the dock and typically above mean sea level. Hydraulic conductivity for the soils was based on the Seacor (2003) data. Hydraulic conductivity for the exposed bedrock was based on the KCBL (2010)

data. Analysis of these data suggests that groundwater seepage through the exposed soil faces in the excavation may be of the order of 0.2 l/min. The potential groundwater seepage through the exposed bedrock faces in the excavation may be of the order of 0.2 l/min (litre/minute) when groundwater is present. Thus the estimated potential groundwater seepage is 0.4 l/min. This estimated seepage is negligible compared with the estimated surface runoff from a 25 year storm event and may be addressed by a site drainage plan developed for surface water runoff.

Seawater:

The potential for seawater infiltration into the excavation through groundwater was also assessed. Groundwater seepage along the south wall of the proposed excavation could possibly be derived from the harbour due to the configuration of the surrounding terrain, the harbour and the existing dock. Assuming that groundwater entering the excavation for the East End Extension from the southern side is due to seawater infiltration through the joints in the bedrock, the potential seawater volume delivered by groundwater over one typical tidal cycle (12 hours) was estimated. The estimated volume was approximately 13 litres (0.02 litres/min). This estimated seepage is negligible (an order of magnitude less) compared with the estimated surface runoff from the 25 year storm event. This potential seawater seepage may also be addressed by a site drainage plan developed for surface runoff.

Biological Environment

Fish and Fish Habitat:

From the field reconnaissance, it was determined that no fish habitat exits within the Project area. The Project area is located approximately 100 m from Esquimalt Harbour which is a marine environment frequented by fish.

Vegetation:

During the field reconnaissance, it was observed that the vegetation in the Project has been cleared or disturbed in the past and now consists of both native and non-native species. The west side of the Project area contains no vegetation as the area is paved. In the vegetated portion of the Project area north of the existing steps, there are several native trees including arbutus (*Arbutus menziesii*) and Garry oak (*Quercus garryana*) and several native shrub species including oceanspray (*Holodiscus discolor*) and Oregon grape (*Mahonia sp.*) (Photograph 6, Appendix A). There area also several non-native trees, a large grassed area and an area with invasive Himalayan blackberries (*Rubus armeniacus*). To the south of the steps, there are also several native trees including arbutus, Garry oak, Douglas fir (*Pseudotsuga menziesii var. menziesii*) and maple (*Acer sp.*) (Photograph 7, Appendix A). Most of the understory consists of horsetails and invasive ivy (*Hedera helix*). Throughout vegetated portion of the Project area is invasive Scotch broom (*Cytisus scoparius*).

Sensitive Ecosystems:

A search of the Sensitive Ecosystem Atlas of Eastern Vancouver Island and the Gulf Islands (SEI) reveals there are no sensitive ecosystems in the Project area. The field visit confirmed that the Project area is disturbed and the remaining vegetation would not be classified as sensitive under the SEI.

Wildlife and Wildlife Habitat:

No wildlife has been recorded in the Wildlife Species Inventory (an inventory of wildlife documented during formal surveys) in or adjacent to the Project area (MOE 2010a). PWGSC staff indicated there is an osprey (*Pandion haliaetus*) nest on a light stand at the end of South Jetty approximately 450 m from the Project area (pers. comm., Melissa Piasta, June 23, 2009). No other raptor or heron nests have been recorded in the Wildlife Tree Stewardship Atlas near the Project area (FBCN 2010).

During the field reconnaissance, a deer trail was observed in the Project area. No other wildlife signs or wildlife were observed during the field reconnaissance. As the Project area (and surrounding area) has been highly modified, limited wildlife habitat exists. Small birds, such as passerine birds, may nest in the shrubs and trees within the Project area.

Rare/Endangered Species:

Numerous species have been listed by the federal and provincial governments as being at risk. Following MOE's Terms of Reference for an Urban Bio-Inventory for sites less than 2 hectares with no sensitive issues, exiting listed species inventories were searched to determine if there are any listed species in or adjacent to the Project area (MOE 2001).

The CDC's Internet Mapping Application (MOE 2010b) was searched to determine whether occurrences of listed species or ecosystems (both "non-sensitive" and "sensitive") have been documented at or within 1 km of the Project area. The sensitivity of the species refers to whether information on the species occurrence can be released to the public.

No non-sensitive listed species have been recorded in the Project area and the closest recorded occurrence is approximately 1 km away. No sensitive species occurrences overlap the Project area.

PWGSC commissioned a plant Species at Risk inventory of the EGD property in 2004. According to the report, no plant Species at Risk were found at EGD (Douglas Ecological Consultants Ltd. 2004).

The Natural Areas Atlas was searched for potential sharp tailed snake habitat (a listed species that occurs on Southern Vancouver Island) in the Project area (CRD 2010). No habitat is recorded in the Project area and the closest potential habitat is approximately 200 m away.

Socio-Economic Environment:

Overview:

The EGD is a solid-bottom Dry Dock ship repair facility that operates 24 hours a day, year round. Within the Project area, a paved area to the west serves as a roadway for vehicles associate with ship repair and a storage area.

Aboriginal (First Nations):

The Project area is located within the asserted traditional territories of the Esquimalt Nation and the Songhees Nation.

Archaeology:

A great deal of archaeological research and assessment has taken place in the southern Strait of Georgia region, particularly in Victoria and the Lower Mainland. The research undertaken has contributed to the development of a regional chronology that spans over 8,500 years (Matson 1976, 1992). Comparatively little is known about the early occupation of southern Vancouver Island. However, the archaeological record over the past 5,000 years or so reveals an increasing reliance on salmon, along with the corresponding development of complex societies, with evidence of wealth accumulation, hereditary status, social stratification, semi-sedentism and population aggregation.

Over 40 archaeological sites have been found along the shores of Esquimalt Harbour. These include shell middens, lithic sites, burials, cairns, habitation structures (plank house remains) and village sites, subsistence features (roasting pits), wet sites (archaeological sites found below water table and in the intertidal zone), and historical sites. The density and diversity of archaeological sites within Esquimalt Harbour indicate that the Harbour was an important locale for pre-contact populations. The waters, shorelines, and upland areas provided aboriginal peoples with shelter, food, water, fuel, and other essential resources.

A search of the Provincial Heritage Register on February 17, 2010 indicates that no known archaeological sites are located within the Project area. However, 11 archaeological sites have been recorded within one kilometre of the Project area. The closest site is DcRu-6; located 20 m to the south of the Project area (refer to Figure 3, Appendix A).

DcRu-6 is situated around the shore of Pilgrim Cove, including the boulevard on the north side of the South Jetty access road, and consists of a habitation feature and shell midden associated with precontact human burials. Initially recorded in 1959, DcRu-6 measures approximately 144 m by 36 m. Four archaeological investigations have been undertaken since the site was initially recorded (Golder 1999, Millennia 2003, Millennia 2005, Golder 2009), resulting in the recovery of significant intact cultural deposits, including house floor and posthole features, as well as bone, antler, and lithic artifacts (Millennia 2005). According to the Provincial Heritage Registry, the site is considered to be less than 50% intact.

At the request of PWGSC, Golder (1999) conducted an archaeological inventory at select DND Properties on Vancouver Island in 1999. Included in this inventory was the Naden Property, which includes lands south and east of the EGD and west of Admirals Road. Previously recorded archaeological site DcRu-6 was revisited and the site boundary was delineated through shovel testing. DcRu-6 is a significant shell midden and habitation feature site located around the edge of Pilgrim Cove. Recommendations were provided for the protection of this archaeological site that included avoidance, stabilization of eroding cultural deposits, and long term site monitoring.

Millennia (2003) conducted an archaeological inventory and mitigative data recovery at the EGD following the discovery of human remains during the construction of the South Jetty Access Road. Millennia recovered shell midden and human remains during the data recovery program at DcRu-760 (now included as part of DcRu-6). Observed cultural materials suggest that a permanent or semi-permanent village was located at this site (Millennia 2003). Excavation resulted in the recovery of evidence of house features, as well as over 200 artifacts indicative of a late Locarno Beach occupation that was radiocarbon dated to 2090 ± 80 BP. Millennia was unable to determine the total number of dwellings present, or their size and orientation, due to the limited area of the site exposed during excavation. Human remains from at least six individuals were also collected during the mitigation and

were reinterred adjacent to the site. To minimize disturbances to this significant archaeological site, the access road was re-engineered to cap the archaeological deposits.

As part of the inventory, all of the approximately 220 cubic metres of soils and sediments exhumed during construction was passed through a 1.91 cm (¾ inch) wire mesh screen to recover any remaining cultural materials, including human remains. Portions of the screened material were then used as top soil along the boulevard on the north side of the South Jetty Access Road (Millennia 2003). The remainder was used as fill in the "gully portion" of the sloped area to the east of the graving dock.

Millennia conducted further archaeological monitoring at DcRu-6 in 2005. Work was initiated after possible shell midden deposits were observed at the base of the steep slope on the south side of the graving dock during the excavation of a trench to replace an existing drainage pipe (Millennia 2005). Millennia screened the impacted cultural deposits and monitored the excavation of the remaining trench. Disturbed and intact cultural material was observed during the monitoring program. Millennia describes the stratigraphy at DcRu-6 as layers of fill lying atop undisturbed cultural deposits (Millennia 2005:12-16). The undisturbed cultural deposits appeared at 60 cm depth below surface (dbs) and extended to the bottom of the trench at 135 cm dbs. Bone, antler, and lithic artifacts were recovered during monitoring, including a rare elk antler comb (Millennia 2005:21). Given the small area examined, and the inability to excavate evaluative test units, Millennia could not assess the significance of the cultural deposits. As a result, Millennia recommended that an AIA be conducted in advance of any future work on both the north and south sides of the EGD that may result in disturbance to surface soils and sediments (Millennia 2005: 22).

Archaeological monitoring of a geo-environmental testing program was undertaken by Golder (2009) adjacent to the Project area. Shell fragments representing disturbed midden were observed in hand auger tests located north of the stairs along the vegetated slope adjacent to the east end of the Project area. Low density shell deposits were observed to 22 cm dbs, the maximum depth of the tests. It is likely these deposits represent materials from DcRu-6 exhumed and screened during the construction of the South Jetty Access Road (Millennia 2003).

At the request of PWGSC, Golder archaeologists Dana Dalmer, B.A., and Shauna Huculak assisted by Bill Schroeder (Songhees Nation) conducted an AIA of AEC 14, a location that includes the EEE Project area, on March 3rd and 4th, 2010. Esquimalt Nation was asked to provide a representative to participate in the AIA fieldwork, but no community members were available.

The AIA was conducted specifically in advance of proposed remediation of contaminated soils at AEC 14 (Golder 2010b). Portions of AEC 14 encompass the EEE Project area, specifically the entire east slope where EEE developments such as the concrete retaining wall and staircase are proposed (Figure 3, Appendix A).

The objectives of the 2010 AIA at AEC 14 were to identify the horizontal and vertical extent of archaeological deposits associated with DcRu-6 that had been redeposited in 2003 during construction of the South Jetty Access Road and to determine if intact archaeological deposits were located on the slope east of the graving dock (Figure 3, Appendix A). During the course of the 2010 AIA, AEC 14 and the EEE Project area were inspected for surface evidence of archaeological resources; in addition, a total of 34 shovel tests were excavated within AEC 14, including on the slope east of the graving dock on the north and south sides of the staircase.

As a result of this AIA, the boundary of the redeposited shell midden from DcRu-6 was established (Figure 3, Appendix A. In 2003, when the shell midden was redeposited on the east slope behind the graving dock, the redeposited shell midden from DcRu-6 covered an approximately 33 m north-south by

5 m east-west area. Based on preliminary results from the 2010 AIA, the redeposited shell midden now extends horizontally 39 m north-south by 7 m east-west and is as deep as 1 m below surface (Golder 2010b) (Figure 3, Appendix A). PWGSC indicates that as much as 20 m of the west facing slope east of the graving dock will be removed during expansion of the dock facility. As currently proposed, these works will not impact cultural deposits associated with the redeposited materials from DcRu-6.

For the area immediately to the south of the graving dock, ground disturbing activities associated with the removal of asphalt for the EEE will impact subsurface soils. Due to the proximity of this portion of the development to previously recorded archaeological site DcRu-6, this area is considered to have a high potential to yield intact archaeological deposits.

Non-archaeological, unprocessed shell was observed across the ground surface of the entire slope, beyond the location of the redeposited shell midden associated with DcRu-6. However, except for the intact and redeposited shell midden from DcRu-6, no archaeological or historical deposits were identified in the AIA (Figure 3, Appendix A).

Provided the current development footprint assessed during the AIA does not change. Impacts to archaeological sites, materials and features including the redeposited archaeological shell midden from DcRu-6 are anticipated only for those portions of the development located south of the present dock facility (Golder 2010b).

Surrounding Area

The area immediately adjacent to the Project area consists of other sections of EGD including the Dry Dock to the west and the pumphouse and office buildings to the north. Outside of EGD, there are residential areas to the north and east, Department of National Defence to the south and Esquimalt Harbour to the west.

Scope of Assessment *(s. 16.(3))*

Table 4: Checklist for Scoping VECs/VSCs Pertinent to this Project

Valued Ecosystem Components	Potential Effect (of project on component)	Potential Effect (of component on project)
Physical Components		
Air Quality *(dust, emissions)*	X	
Weather/Climate/Microclimate *(wind, precipitation, temperature, fog)*		X
Soil *(erosion, compaction, settling, stability, sediments/contamination)*	X	X
Geology/Geophysics *(fractures, chemical reactions, subsidence)*	X	
Permafrost		
Surface Water (*quantity, quality, shoreline/bottom alteration, flow variation, flood, drought, current, tides, wave action, littoral process)*		X
Ground Water *(quantity, quality, flow, water table)*		X
Renewable and Non-Renewable Resources		
Biological Components		
Fish/Fish Habitat *(population change, productive capacity, habitat modifications)*		
Vegetation	X	
Mammals *(population change, productive capacity, habitat modification)*	X	
Amphibians and Reptiles *(population change, productive capacity, habitat modifications)*		
Birds *(population change, productive capacity, habitat modification)*	X	
Migratory Corridor/Buffer Zone		
Estuaries/Salt Marshes		
Wetlands/Bogs/Ponds *(area changes, productive capacity, water quality, water quantity, aquatic vegetation)*		
Rare/Endangered Species (SARA)		
Socio-Economic Components		
Aesthetics		
Land Use *(official plan, zoning)*		
Transportation Network	X	
Navigation		
Recreation		
Tourism		

Valued Ecosystem Components	**Potential Effect (of project on component)**	**Potential Effect (of component on project)**
Cultural Resources (Historic values)		
Aboriginal *(traditional lands/resources)*	X	
Agriculture		
Aquaculture		
Human Health and Safety	X	
Noise/Vibration	X	
Potable Well Water		
Employment		
Economy/Taxes		
Community /Social Services		
Archaeology	X	
Public Concern		

COMMUNICATIONS

First Nations and Public (s. 16.(1)(c), s. 18.(3))

Local First Nations whose asserted traditional territories encompasses the Project area were invited to participate in the field component of the AIA for the five AECs that was used to inform this EIA. Leadership from the Esquimalt and Songhees Nations was contacted prior to the assessment and a representative from the Songhees Nation took part in the AIA of the five AEC's; the Esquimalt Nation was unable to provide a representative. During the AIA for the five AEC's, disturbed and redeposited shell midden associated with DcRu-6 was identified on the slope east of the EEE Project area. Design avoidance was implemented in this location to avoid impacts to known archaeological deposits south of the EEE Project area.

In 2003, portions of the screened archaeological material from DcRu-6 was placed along the boulevard on the north side of the South Jetty Access Road, as well as in the "gully portion" of the sloped area to the east of the graving dock (Millennia 2003). Considering that fragments of human bone may be associated with these soils and sediments, PWGSC had provided assurances to the Esquimalt and Songhees Nations that these locations would not be further disturbed. During the AIA of the five AECs, it was confirmed during archaeological testing conducted adjacent to the location of these redeposited materials that these soils had not eroded down slope from their original location (Golder 2010b). As these disturbed deposits would not be affected by either the proposed EEE Project or the AEC Project, local First Nations were not engaged regarding this portion of the archaeological site.

Public consultation was not undertaken as the Project is located within the EGD boundary and potentially noisy work that may be in excess of existing ongoing activities (such as blasting) will be conducted during the daytime hours. PWGSC has an Emergency Management System in place which includes a communication plan and system for addressing concerns and comments from the public.

Federal Coordination *(s. 12.(1)(3))*

No communication with other federal authorities was undertaken for this Project.

DISCUSSION OF ENVIRONMENTAL EFFECTS, SIGNIFICANCE AND MITIGATION
(S.16.(1); S. 20.(2))

The potential for project interaction with VECs and VSCs was analyzed based on: information provided by the proponent; a review of project related activities; an appraisal of the environmental setting; temporal and/or spatial conflict; personal knowledge and professional judgment. Measures to mitigate identified potential adverse interactions were then recommended. Significance of any residual effect was ascertained based on an evaluation of the effect's magnitude, geographic extent, duration/frequency, irreversibility, and ecological context. The analysis also considers public concern, accidental and cumulative effects. Refer to the Checklist for Scoping Valued Ecosystem and Social Components Pertinent to this Project (Table 4).

The significance of residual effects was rated as follows:

(0) None = No potential effect to VEC or VSC.
(1) Insignificant = No effect to VEC or VSC after implementation of required mitigation measures.
(2) Significant = Effect could threaten sustainability of VEC or VSC, even after implementation of required mitigation measures. Further study or follow-up program should be considered.
(3) Unknown (+) or (-) = Effect on the identified VEC or VSC is unknown.

Table 5,6,and 7 address the potential effects, the significance of effects and the recommended mitigation measures for the VECs / VSCs that were identified in Table 4.

In addition to the mitigation measures in these tables, work shall conform to EGD's Environmental Best Management Practices.

Table 5: Effects Analysis and Mitigation Measures: Physical Components

Valued Ecosystem Component	Description of Potential Project Interaction with VEC/VSC	Required Mitigation	Residual Effects	Significance of Residual effects [1]	Further Study or Follow up
Air Quality	Operation of trucks and other machinery used during the Project will result in short-term, localized exhaust emissions. Blasting of bedrock may result in short-term, localized particulate being released into the surrounding area.	• Ensure all machinery and vehicles utilized for the Project are in best working order in order to reduce air emissions. • Ensure machinery is turned off, when its use is not required. • Utilize best management practices for blasting of bedrock to ensure particulates remain at the site.	None	0	No
Weather /Climate/ Microclimate	Weather and Climate has the potential to affect construction and operations. Excessive rain or strong wind conditions could cause soil erosion and sedimentation.	• Prepare and implement a sediment and erosion control plan as part of an Environmental Management Plan. • Limit soil excavation during periods of excessive rain or strong winds.	None	0	No
Soils	Construction will result in the removal of soil contaminated with metals and polycyclic aromatic hydrocarbons (PAHs). Soil may be temporarily stockpiled on Site prior to off-Site disposal. Excavation and handling of contaminated soils could potentially result in the transfer of contamination to adjacent areas of the Site if handled in-appropriately.	• Develop a soil and groundwater management plan as part of an Environmental Management Plan to outline proper excavation, handling and disposal of potentially contaminated soils. During excavation of overburden material, monitoring by a qualified person is recommended to assist with segregation of inferred zones of contamination (waste quality material) within each AEC (Figure 3, Appendix A) from inferred native soils, according to existing information on contaminant zones and by olfactory indications of contamination during excavation (*i.e.*, odour, vapours, anthropogenic debris, etc.).	None	0	No

[1] Significance of Residual Impacts rated as follows:
0 = None, 1 = Insignificant, 2 = Significant, 3 = Unknown, Positive (+), Negative (-).

Valued Ecosystem Component	Description of Potential Project Interaction with VEC/VSC	Required Mitigation	Residual Effects	Significance of Residual effects [1]	Further Study or Follow up
	Excavation works may result in the generation of contaminated soil derived dust.	• It is also recommended that materials beneath the current inferred zones of contamination be analysed to assess contaminant concentrations in this material (*i.e.*, collection of confirmatory soil samples). • If soil is to be disposed off Site, soils will likely require additional analysis prior to disposal. This testing shall include analysis of the toxicity characteristic leaching potential (TCLP) for contaminated soils. • Contaminated soil that is to be temporarily stockpiled on site shall be managed in such a way as to limit the release/spread of contaminants to the surrounding area. Measures include placement of soil on either a concrete or asphalt sealed surface or on polythene sheeting and covered with sheeting to reduce exposure to elements (*i.e.*, precipitation which may result in leaching of contaminants from the soil) and direction of surface water away from the soil stockpiling area. • Appropriate controls shall be implemented to control dust during excavation. • Soil to be transported off-Site shall be taken to a permitted facility (where necessary) for appropriate disposal.			

Valued Ecosystem Component	Description of Potential Project Interaction with VEC/VSC	Required Mitigation	Residual Effects	Significance of Residual effects [1]	Further Study or Follow up
		• To mitigate against potential impacts to archaeological deposits, monitoring by a professional archaeologist during excavation and segregation is recommended for those portions of the development located south of the present dock facility (DcRu-6), shown on Figure 2, in Appendix A. If potential archaeological material is found within inferred contaminated soils, disposal of the material will need to be postponed until assessment by a qualified archaeologist has been undertaken. • Appropriate risk management measures may be required to mitigate potential risks associated with the contaminated material, if it is deemed necessary to retain the material on Site due to the presence of archaeologically significant deposits.			
Geology/ Geophysics	Exposed rock slope may experience failure.	• Construction of the retaining wall has been proposed to address this issue; therefore, no additional mitigation measures are required.	None	0	No
Surface Water	Surface water runoff has the potential to drain into the excavation from the catchment area. The small size of the catchment (<0.5 ha) and proximity of bedrock to the ground surface means that runoff will occur quickly following precipitation. Storm sewers crossing the excavation area will need to be relocated.	• Develop a surface water handling and management plan as part of an Environmental Management Plan. • Surface runoff from Project Area will be managed by Contractor. • Surface runoff in the storm sewers will be managed during the excavation. • Runoff shall be managed by collecting and diverting it to either the existing storm sewer system or through the water management facilities at EGD. • Conduct excavation in the relatively drier summer period if possible.	None	0	No

Valued Ecosystem Component	Description of Potential Project Interaction with VEC/VSC	Required Mitigation	Residual Effects	Significance of Residual effects [1]	Further Study or Follow up
Ground Water	Removal of the surficial soil from the flat area and during excavation means that groundwater impacts will likely be limited and negligible compared with the surface runoff estimated above. Existing groundwater information indicates that groundwater conductivity rates are low compared with surface water, but are high for bedrock due to the fractured nature of the rock. The potential for ingress of seawater into the excavation is low based on available data	• Develop a groundwater management plan as part of an Environmental Management Plan to outline proper removal, handling and disposal of groundwater. • Contractor will manage onsite groundwater seepage.	None	0	No

Table 6: Effects Analysis and Mitigation Measures: Biological Components

Valued Ecosystem Component	Description of Potential Project Interaction with VEC/VSC	Required Mitigation	Residual Effects	Significance of Residual effects	Further Study or Follow up
Vegetation	Some native and invasive vegetation will be removed during site preparation activities and the amount of vegetated area will be reduced. The removal of native vegetation will cause a small negative impact, while the removal of invasive vegetation will have small positive impact.	• Delineate areas to be cleared to ensure that unnecessary vegetation removal does not occur. • Invasive plant species removed during clearing shall be taken to a proper disposal facility to prevent further spread. • After construction, replant disturbed areas with native vegetation.	Small permanent negative residual effect due to decrease in vegetated area. Small permanent negative residual effect due to decrease in native vegetation. Small permanent positive residual effect from the removal of invasive species	-1 and +1	No
Birds	Project area may provide nesting habitat for small birds such as passerine birds. Project may cause a small permanent loss of habitat and could cause harm to birds if they are nesting during vegetation removal.	• To be in compliance with the federal *Migratory Birds Convention Act* and the provincial *Wildlife Act*, vegetation clearing shall be completed outside of the bird nesting window, which is March 15 to August 15 (EC 2008). If this is not possible, pre-clearing bird nesting surveys shall be completed by a qualified biologist.	Small permanent negative residual effect due to loss of bird nesting habitat.	-1	No
Mammals	A deer trail was observed in the Project area which indicates they frequent the area. Deer may avoid the area during construction. The loss of vegetation is not expected to impact deer population.	• No mitigation required.	None	0	No

Table 7: Effects Analysis and Mitigation Measures: Socio-economic Components

Valued Social Component	Description of Potential Project Interaction with VEC/VSC	Required Mitigation	Residual Effects	Significance of Residual effects	Further Study or Follow up
Transportation	The transportation network for vehicles requiring access around the East End Extension may be temporarily closed or the access temporarily restricted during construction activities.	• Prepare and implement a Traffic Management Plan as part of an Environmental Management Plan for diverting traffic during times of construction activities.	None	0	No
Aboriginal (First Nations)	Leadership from the Esquimalt and Songhees Nations was contacted prior to the assessment and provided with a description of the Project. Esquimalt and Songhees Nations were invited to participate in the AIA. There is not expected to be an impact from the proposed Project. PWGSC may consult with First Nations on this Project if the development footprint changes. There is not expected to be an impact from the proposed Project. PWGSC may consult with First Nations on this Project if the development footprint changes.	• No mitigation measures are required unless Project footprint changes.	None	0	No
Archaeology	Previous archaeological impact assessment indicate the presence of disturbed cultural deposits 10 m outside the Project area, and intact cultural deposits adjacent to the south edge of the Project area, that are all associated with previously recorded archaeological site DcRu-6. Construction plans provided by PWGSC indicate that as much as 20 m of the west facing slope east of the graving dock will be removed during expansion of the dock facility, these works will not impact cultural deposits.	For the slope east of the graving dock, Golder recommends: • No further archaeological work provided that the current Project footprint is not altered. If unexpected impacts to the slope occur during Project related activities (*i.e.*, blasting) and archaeological deposits are inadvertently disturbed, it is recommended that a professional archaeologist be contacted immediately. • No construction access to the east of the project area.	None	0	Archaeological monitoring during pavement removal in the area on the south side of the graving dock, behind the original shoreline is recommended (see Figure 3,

Valued Social Component	Description of Potential Project Interaction with VEC/VSC	Required Mitigation	Residual Effects	Significance of Residual effects	Further Study or Follow up
	For the area south of the graving dock, ground disturbing activities associated with the removal of asphalt will impact subsurface soils. Due to the proximity to archaeological site DcRu-6 this area is considered to have a potential to yield archaeological deposits.	For the proposed asphalt removal on the south side of the dock Golder recommends: • Construction monitoring by a qualified archaeologist during ground disturbing activities. For all other areas within the Project area, Golder recommends: • No further archaeological work. Even the most thorough investigation may not identify all archaeological materials that may be present. PWGSC is advised that if unanticipated archaeological materials or features (including but not limited to, stone or bone artifacts, human remains, or unusual objects or features of a possible ceremonial nature) are encountered during construction or related activities, all work in the immediate area shall cease, and a qualified archaeologist shall be contacted.			Appendix A).
Human Health and Safety	Human Health has the potential to be affected during the Project. Potential exists for human health and safety to be impacted by machinery such as trucks and construction equipment working and entering and exiting the project site. The possibility exists for collisions between onsite equipment and workers and offsite machinery and the public. In addition, an UXO may have been historically uncovered in an area north of the Project area. UXO's can cause physical harm if triggered.	• Prepare and implement a Traffic Management Plan as part of an Environmental Management Plan to divert traffic away from and/or safely through any construction areas, and to restrict public access from active construction areas. • Prepare and implement a Health and Safety Management Plan to deal with specific procedures and protocols for working around construction to reduce the potential for accidents during construction.	None	0	No

Valued Social Component	Description of Potential Project Interaction with VEC/VSC	Required Mitigation	Residual Effects	Significance of Residual effects	Further Study or Follow up
	Workplace Health and Safety (WCB) outlines general duties and obligations of the employer, employees and others at the work site during construction operations.	• It is recommended that, as with any work on areas formerly occupied by or adjacent to military bases, contractors be vigilant during excavation to identify suspect material including potential UXOs.			
Noise	Construction activities, such as blasting, have the potential to increase noise. Operation of trucks or other machinery used during all of the project component activities will result in short-term, localized noise emissions.	• Equipment shall be in good working condition. • Use machinery which limits excessive noise. • Ensure work activities are limited to the township of Esquimalt construction hours of operation by-law. • Use blast mats to reduce noise from blasting.	None	0	No

Accidents and Malfunctions

Due to use of machinery on this project site, there is a risk of fuel and other hydrocarbon spills to the project area. Soils that may become contaminated due to spills will need to be assessed, managed and disposed of in accordance with the BC *Environmental Management Act* and associated regulations, including the Contaminated Sites Regulation and Hazardous Waste Regulation. The contractor shall provide a Spill Prevention and Emergency Response Plan that shall include but not be limited to the following mitigation measures and details:

- Keep equipment and machinery well maintained and in good working order to avoid any mechanical or equipment failures;
- All equipment and machinery used shall be equipped with emergency response spill kit and shall be inspected daily for leaks;
- Details as to what spill response materials will be on site, for what purpose they are intended; in what volume, and in what location will they be stored on site;
- Spill reporting procedures and contacts including telephone numbers;
- Response procedures detailing the steps to be undertaken for spills; and,
- Storage and disposal procedures for contaminated soils and materials.

The general intentions of the Spill Prevention and Emergency Response Plan can be met by using machinery that is in good repair and free of external oil and grease or other substances that may cause adverse environmental effects. Furthermore, any on-site refuelling shall be monitored and an effective communication protocol shall be followed to minimize potential for accidental release or overfilling of the equipment.

In addition to a Spill Prevention and Emergency Response Plan, general mitigation and control measures to prevent potential adverse effects from accidents and malfunctions include:

- Established best practices and SOPs for refuelling and petroleum/oil/liquid (POL) storage shall be followed.

Significance and Residual Effects *(s. 16. (1)(b))*

For the physical components of this project, no residual effects are expected to take place as effects can be mitigated.

For the biological components, it is expected that small permanent negative residual effects will take place as a result of the decrease in native vegetation and overall vegetated area, as well as a decrease in potential bird nesting habitat. A small positive permanent residual effect will take place as a result of the removal of invasive species.

For the socio-economic component of this Project, no residual effects are expected to take place as effects can be mitigated. Archaeological residual effects are not expected as a qualified archaeologist will be on site to mitigate impacts to archaeological deposits, if presented, during excavation on the south side of the EEE Project area in an area considered to have archaeological potential (see Figure 2, Appendix A) .

Cumulative Effects *(s. 16.(1)(a))*

Several other projects are proposed within EGD including:

- North parking lot expansion which includes blasting, rock removal and paving of bedrock at the north end of the north parking lot;
- Remediation of five areas of environmental concern (AEC);
- Relocation of the guardhouse; and,
- Construction of the E&N Trail.

An EA is currently being completed for the north parking lot expansion, and an EA has already been completed for the construction of the E&N Trail. An AOA/AIA has been completed for the proposed Esquimalt Graving Dock projects.

A review of the various documents revealed there may be some cumulative effects associated with the physical, biological and socio-economic components of the Project:

Physical cumulative effects:

The north parking lot expansion and proposed remediation of the five AEC's will results in removal of contaminated soils. Excavation and removal of material as part of this Project will contribute to this overall reduction in contaminated soil at EGD. The cumulative effects; therefore, are expected to be positive, by reducing contaminant volume and thus human and ecological exposure to contaminants.

With regards to the surface and ground water component there is no cumulative impacts expected since the site is isolated hydrologically from the surrounding ground. As well, surface drainage is not expected to change once the project is finished.

Biological cumulative effects:

The north parking lot expansion and E&N Trail will permanently reduce vegetated areas and wildlife habitat. Along with the permanent reduction of vegetation and wildlife for this Project, it is expected that there will be an insignificant cumulative effect.

Socio-economic cumulative effects:

Development of EEE and the remediation of the five AECs will have an insignificant cumulative effect on archaeological resources at EGD. Impacts to archaeological deposits associated with previously recorded archaeological site DcRu-6 that may be present in the south portion of the EEE Project area and with AEC 14, will result in negative effects to any archaeological material present. These Project actions have already been subject to AOA and AIA studies, and construction monitoring has been recommended to mitigate project impacts. This Project is not expected to contribute to cumulative effects associated with First Nations

Follow-up (s. 14.(c); s. 16.(2)(c))

A formal follow up program as defined under CEAA is not required. A monitoring program during construction is recommended to verify that required mitigation measures were implemented throughout the project.

Summary
A summary of mitigation measures for this Project can be found in Appendix D.

Plans to be completed as part of an Environmental Management Plan include, but are not limited to, the following.

- Sediment and erosion control plan;
- Soil and groundwater management plan;
- Surface water handling and management plan;
- Groundwater management plan;
- Traffic Management Plan;
- Health and Safety Management Plan; and,
- Spill Prevention and Emergency Response Plan.

All plans are to be prepared by the contractor and submitted to PWGSC for review prior to the start of construction.

Signatures

Prepared by: _____ Date: June 11th, 2010

Clara Dixon, B.Sc.
Environmental Scientist
Golder Associates Limited

_____ Date: June 11, 2010

Virginia Chant, B.Sc., Env. Tech, BIT
Biologist
Golder Associates Limited

_____ Date: June 11, 2010

Rowland Atkins, P.Geo., M.Sc.
Senior Geomorphologist
Golder Associates Limited

for _____ Date: June 11, 2010

Sophia Anderson , BA., B.Sc., BIT
Environmental Scientist
Golder Associates Limited

_____ Date: June 11, 2010

Shauna Huculak, M.A., R.P.C.A.
Archaeologist
Golder Associates Limited

The above has completed this environmental assessment screening report to the best of their ability or knowledge.

Reviewed by: _____ Date: June 11, 2010

Dave Munday
Senior Environmental Specialist
Associate, B.Sc., M.Ba., R.P.Bio.
Golder Associates Limited

Reviewed by: _____ Date: June 11/2010

Katrina Johnston, BSc.
Senior Environmental Specialist
Public Works and Government Services Canada

The above have reviewed the environmental assessment screening report and agree that it meets the requirement of the Canadian Environmental Assessment Act.

Accepted by: _____ Date: June 14, 2010

Doug Ferrier, BSc.
Project Manager, Esquimalt Graving Dock EEE
Public Works and Government Services Canada

The above has read and understood this environmental assessment screening report and accepts responsibility for ensuring the implementation of mitigative measures and for ensuring the design and implementation of follow-up programs, if any, identified in this report.

Environmental Assessment Screening Report

CEAA DETERMINATION *(S. 20.(1))*

The project has been screened in accordance with CEAA requirements. In accordance with Section 20(1) of CEAA, on the basis of this report, it has been determined that the responsible authority (RA) shall take one of the following courses of action in respect of the project:

[X] The project is not likely to cause significant adverse environmental effects: the project may proceed provided the RA ensures the implementation of appropriate mitigation measures identified in this report. *Section 20.1(a)*

[ ] The project is likely to cause significant adverse environmental effects that cannot be justified. The project will not proceed. *Section 20.1(b)*

[ ] Refer the project to the Minister of the Environment for referral to a mediator or a review panel for the following reason:

- [ ] it is uncertain as to whether the project, taking into account the implementation of any mitigation measures that the RA considers appropriate, is likely to cause significant adverse environmental effects, *Section 20.1(c)(i)*;
- [ ] the project, taking into account the implementation of any mitigation measures that the RA considers appropriate, is likely to cause significant adverse environmental effects and *Section 20.1(b)* does not apply, *Section 20.1(c)(ii)*;
- [ ] public concern warrants a reference to a mediator or review panel *Section 20.1(c)(iii)*.

Approved by: _____ Date: June 14/2010

Jim Milnes, Operations Manager, EGD

The above has read and understood this environmental assessment screening report and on behalf of Fisheries and Oceans Canada has the authority to approve the foregoing CEAA determination.

REFERENCES

Capital Regional District (CRD). 2010. Natural Areas Atlas. Available at: http://www.crd.bc.ca/maps/natural/atlas.htm

Douglas Ecological Consultants Ltd. 2004. Species at Risk Inventory at PWGSC, Esquimalt Graving Dock.

Green R. N. and Klinka, K. 1994. A Field Guide to Site identification and Interpretation for the Vancouver Forest Region. Ministry of Forests.

Golder Associates Ltd. 1999. Archaeological Inventory at Select Department of National Defense Properties CFB Esquimalt. Report on file with the Archaeology Branch, Ministry of Tourism, Culture and the Arts, Victoria, BC.

Golder Associates Ltd. 2004. Underwater Unexploded Ordnance (UXO) Historical Survey, MARPAC Area of Responsibility, June 15, 2004.

Golder 2009. Archaeological Monitoring of Geo-environmental testing at the Esquimalt Graving Dock, Esquimalt, BC. Non-permit report on file with the Archaeology Branch, Ministry of Tourism, Culture and the Arts, Victoria, BC.

Golder Associates Ltd. 2010a Archaeological Overview Assessment for the Esquimalt Graving Dock East End Extension Project, Esquimalt, BC.

Golder Associates Ltd. 2010b. Archaeological Overview/Impact Assessment for the Esquimalt Graving Dock Remediation of Five AEC Locations, Esquimalt, BC.

Federation of BC Naturalists (FBCN). 2010. Wildlife Tree Stewardship Atlas. Available at: http://www.shim.bc.ca/atlases/wits2/main_public.html

Hemmera. Ecological & Human Health Risk Assessment PWGSC Esquimalt Graving Dock, Esquimalt, BC. July 2003.

Hemmera. 2009. Draft Detailed Quantitative Human Health Risk Assessment and Quantitative Ecological Risk Assessment Esquimalt Graving Dock Uplands Esquimalt BC. Report submitted December 2009 to PWGSC.

Klohn Crippen Berger Ltd. (KCBL). 2010. Esquimalt Graving Dock East End Extension – Geotechnical Data Report. Report submitted to PWGSC February 25, 2010.

Klohn Crippen Berger. (2010) Esquimalt Graving Dock East End Extension – Class "C" Construction Cost Estimate, January 15, 2010.

Klohn Crippen Berger. (2008) East End Extension Plan Figures. December 19th, 2008. Figure No. SK9522-02, SK9522-01, SK9522-04, SK9522-03.

Matson, R.G.1976. Prehistoric Adaptations at the Glenrose Cannery Site DgRr-6 Fraser Delta, BC Canada. National Museum of Man. Mercury Series. Archaeological Survey Paper 52. Ottawa.

Matson, R.G.1992. The Evolution of Northwest Coast Subsistence in Long-term Subsistence Change in Prehistoric North America, Research in Economic Anthropology Supplement 6, pp. 367-428. JAI Press Inc. Greenwich.

Ministry of Environment (MOE). 2001. Terms of Reference for an Urban Bio-Inventory. Available at: http://www.env.gov.bc.ca/wld/BMP/bmpintro.html

MOE. 2010a. Wildlife Species Inventory. Available at: http://www.env.gov.bc.ca/wildlife/wsi/index.htm

MOE. 2010b. CDC's Internet Mapping Application. Available at: http://www.env.gov.bc.ca/atrisk/ims.htm

Millennia Research Ltd. 2003 Esquimalt Graving Dock: South Jetty Access Road Mitigative Data Recovery, DcRu-760.Non-permit report on file with the Archaeology Branch, Ministry of Tourism, Culture and the Arts.

Millennia Research Ltd. 2005. Esquimalt Graving Dock Drainage: Results of Archaeological Monitoring at DcRu-760. Non-permit report on file with the Archaeology Branch, Ministry of Tourism, Culture and the Arts.

Ministry of Forests and Range (MOF). 2008. Biogeoclimatic Ecosystem Classification Subzone/Variant Map: South Island Forest District. Accessed on June 22, 2009. Available at: ftp://ftp.for.gov.bc.ca/HRE/external/!publish/becmaps/PaperMaps/field/DSI_SouthIsland_Field.pdf

PWGSC 2010. PWGSC Esquimalt Graving Dock Website. Accessed on February 24th, 2010. http://www.tpsgc-pwgsc.gc.ca/pac/cse-egd/env/programme-program-eng.html.

Seacor. 2003. Supplemental Site Investigation Esquimalt Graving Dock Esquimalt, BC. Report submitted to PWGSC March 31, 2003.SEACOR Environmental Inc. Addendum to Ecological and Human Health Risk Assessment PWGSC Esquimalt Graving Dock, Esquimalt, BC. February 25, 2005

Seacor. 2007. Completion of Risk Management Activities at the Esquimalt Graving Dock Uplands: Decommissioning of Monitoring Wells and Completion of Statement of Conditions. Victoria, BC. Report submitted to PWGSC March 31, 2007.

SLR Consultants (Canada) Inc. (2009a). Phase 2/3 Environmental Site Assessment, Esquimalt Graving Dock Uplands, 825 Admirals Road, Esquimalt, BC. December 2009.

SLR Consultants (Canada) Inc. (2009b). Updated Remedial / Risk Management Options Analysis, PWGSC Esquimalt Graving Dock Uplands, 825 Admirals Road, Esquimalt, BC. December 2009.

Legislation

Canadian Environmental Assessment Act, 2000.
Canadian Environmental Protection Act, 2000.
Canada Fisheries Act, 1985
Contaminated Sites Regulation
Environmental Management Act
Hazardous Waste Regulation
Migratory Birds Convention Act, 1994.
Species at Risk Act, 2003.
Wildlife Act, 1996.

Site Visit

A site visit was conducted on February 16th, 2010. Field notes from the Site visit are included in Appendix A.

Personal Communication

The Golder team has communicated with the following persons throughout the implementation of this CEAA Screening:

- Katrina Johnston - Senior Environmental Specialist for Public Works and Government Services Canada (PWGSC);
- Doug Ferrier -Project Manager for Esquimalt East End Extension Public Works and Government Services Canada (PWGSC); and,
- Kristen Ritchot – Environmental Services coordinator for Public Works and Government Services Canada (PWGSC).

Appendix A
Figures/Plans/Photographs

1 0 1

SCALE 1:50,000 KILOMETRES

PROJECT PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
ENVIRONMENTAL ASSESSMENT
ESQUIMALT GRAVING DOCK EAST END EXTENTION
ESQUIMALT, B.C.

TITLE

KEY PLAN

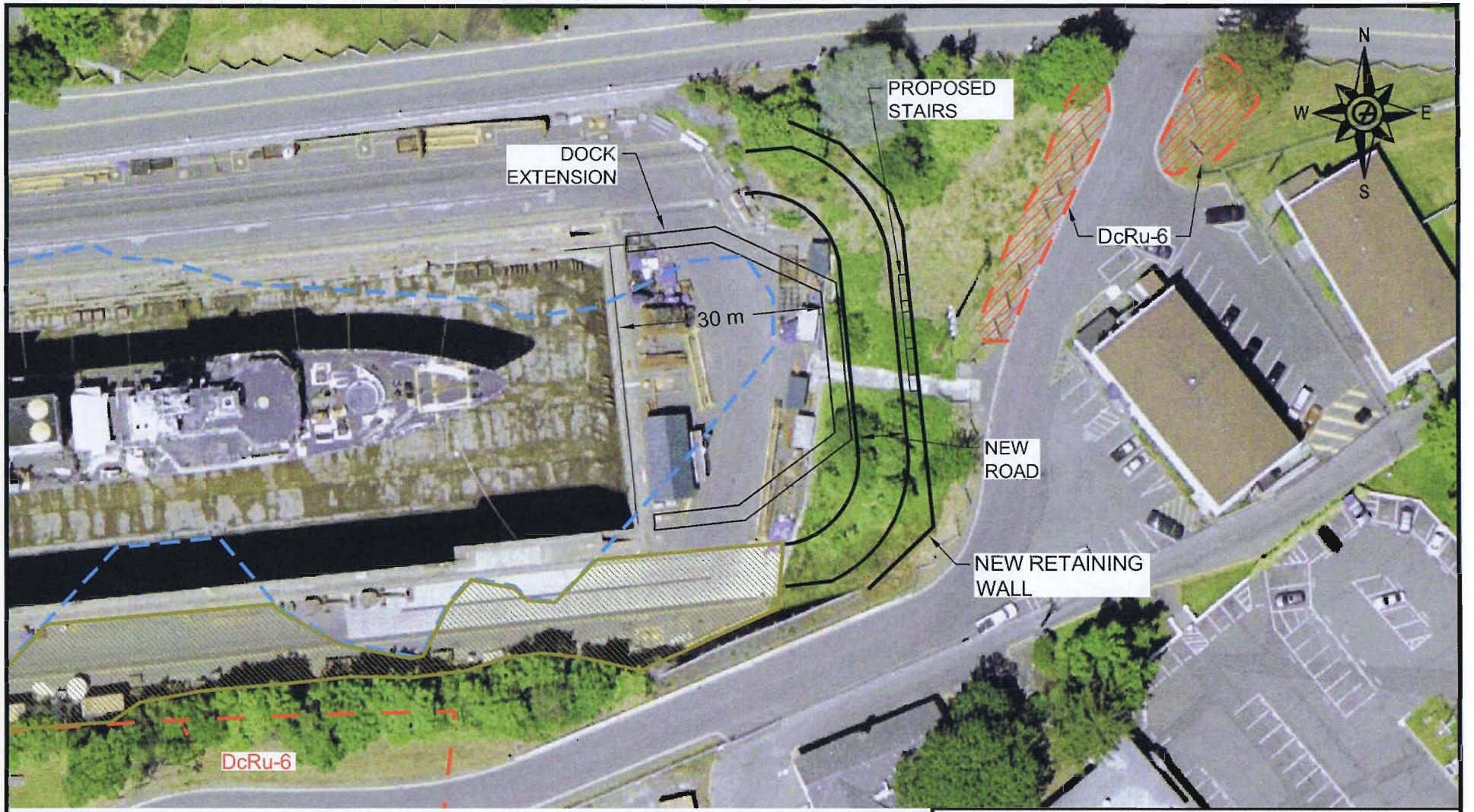
PROJECT No. 10-1478-0004			FILE No. K1014780004-01	
DESIGN	VC	18 FEB 10	SCALE AS SHOWN	REV. 0
CADD	AW	23 FEB 10		
CHECK	VC	7 JUN 10	FIGURE 1	
REVIEW	BH	7 JUN 10		

Golder Associates
Victoria, BC

REFERENCE
1:50,000 NTS 92B06 Scanned Basemap courtesy of NRCAN

N:\Active\2010\1478\10-1478-0004 PWGSC Env Screening EEE Esquimalt\Vic Drafting\ Drawing file: K1014780004-01.dwg Jun 08, 2010 - 9:37am

N:\Active\2010\1478\10-1478-0004 PWGSC Env Screening EEE Esquimalt\Vic Drafting\ Drawing file: P1014780004-02.dwg Jun 07, 2010 - 3:49pm



LEGEND

- Archaeological Site
- Redeposited Midden Deposits from DcRu-6*
- 1939 Shoreline
- Archaeological Construction Monitoring Recommended

20 0 20
SCALE 1:800 METRES

NOTE

1. All locations are approximate.
* Golder 2010: Archaeological Overview / Impact Assessment for the Esquimalt Graving Dock Remediation of Five AEC Locations, Esquimalt, BC

REFERENCE

Base map courtesy of Capital Regional District's *Natural Areas Atlas*

PROJECT PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
ENVIRONMENTAL ASSESSMENT
ESQUIMALT GRAVING DOCK EAST END EXTENSION
ESQUIMALT, B.C.

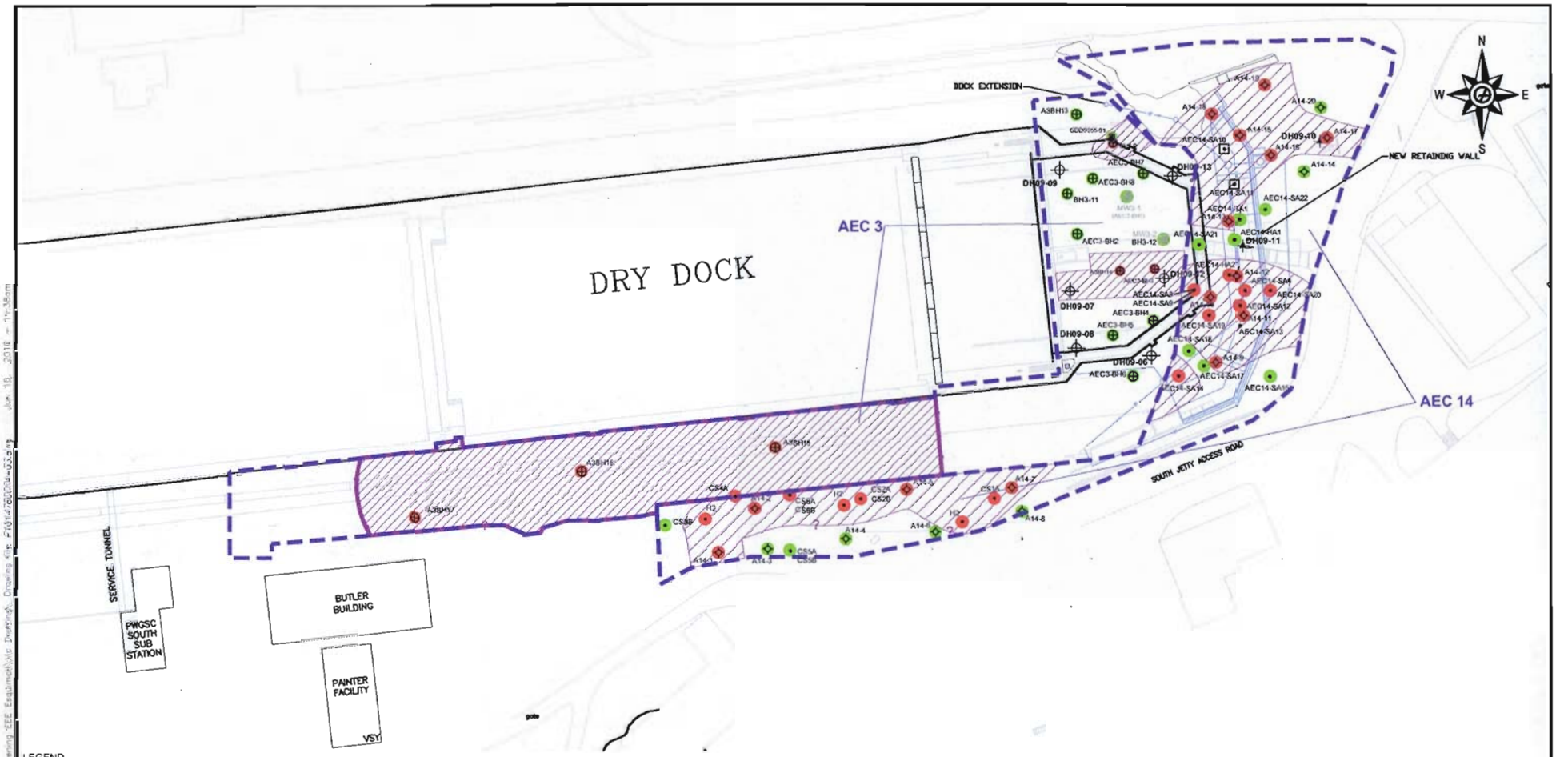
TITLE

PROPOSED DEVELOPMENT

Golder Associates
Victoria, BC

PROJECT No. 10-1478-0004			FILE No.	P1014780004-02
DESIGN	VC	18 FEB 10	SCALE AS SHOWN	REV. 0
CADD	AW	24 FEB 10		
CHECK	VC	7 JUN 10		
REVIEW	BH	7 JUN 10		

FIGURE 2



LEGEND

- Area of Environmental Concern (AEC) (SLR, 2009/2010)
- Inferred Zone of Contamination (SLR, 2009/2010)
- Hand Auger Location (SLR, 2009)
- 2002 Results were within CSR Standards and CCME IL Guidelines, CWS PHC Guidelines and/or CSR IL Standards (Seacor, 2002)
- Contaminant Concentrations Meet CSR IL Standards and CCME IL Guidelines
- Contaminant Concentrations exceed CCME IL Guidelines, CWS PHC Guidelines and/or CSR IL Standards
- Borehole Location (Seacor, 2002 & 2003, SLR, 2009)
- Diamond Core Hole 2010 (Klohn Crippen Berger)
- Mud Rotary Drill Hole 2010 (Klohn Crippen Berger)
- Surficial Soil Sample Locations (Seacor, 2002, 2003 & 2007 and Hemmera, 2003)

REFERENCE

1. Klohn Crippen Berger (2010). Esquimalt Graving Dock East End Extension - Geotechnical Data Report, PWGSC, February 25. Figure 1.
2. SLR Consulting (Canada) Ltd. (2009/2010). Phase 2/3 Environmental Site Assessment, Esquimalt Graving Dock Uplands, 825 Admirals Road, Esquimalt, B.C. Drawing No. 24 & 27.

PROJECT: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA
ENVIRONMENTAL ASSESSMENT
ESQUIMALT GRAVING DOCK EAST END EXTENTION
ESQUIMALT, B.C.

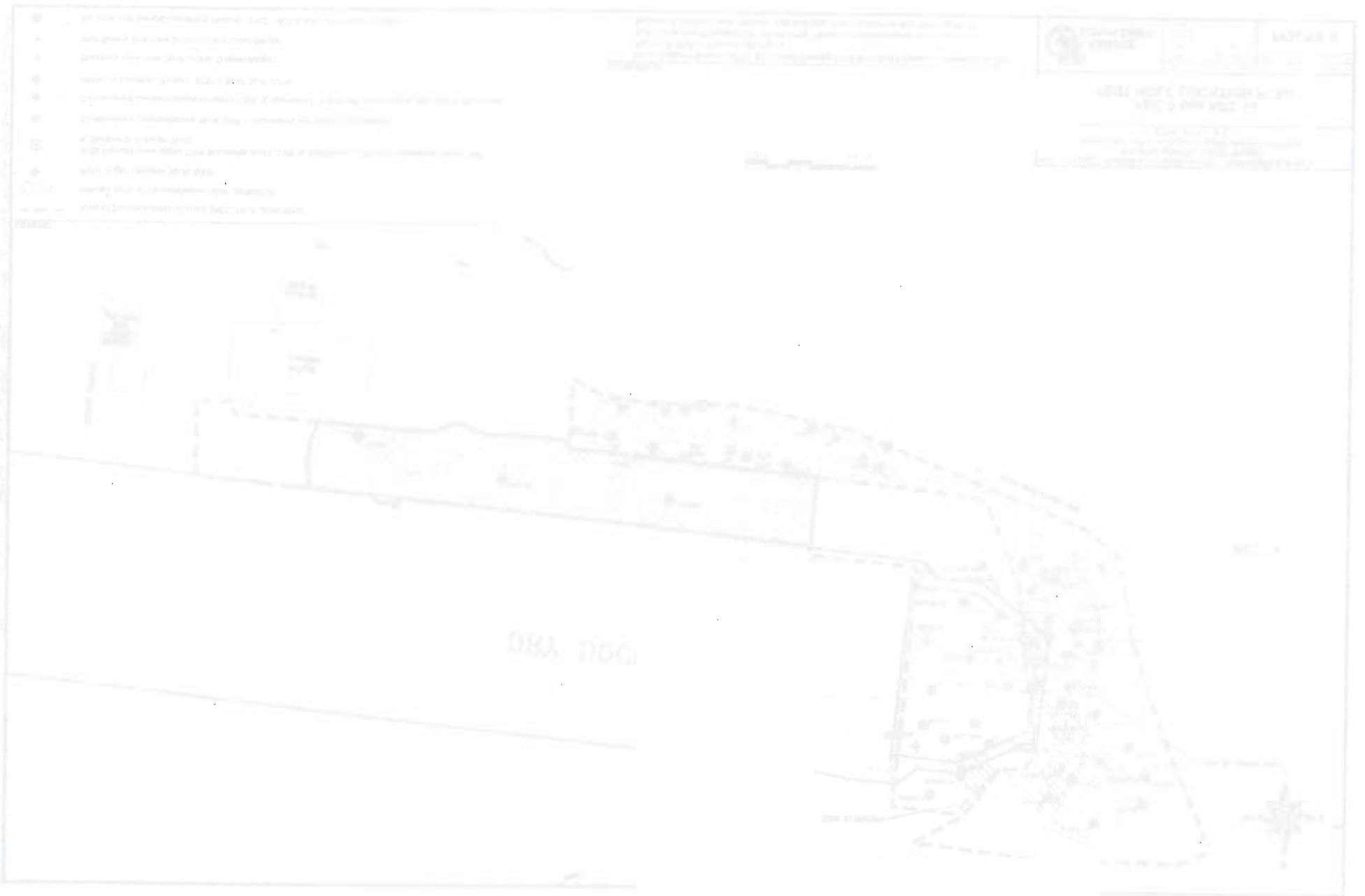
TITLE

AEC 3 and AEC 14
TEST HOLE LOCATION PLAN

Golder Associates
Victoria, BC

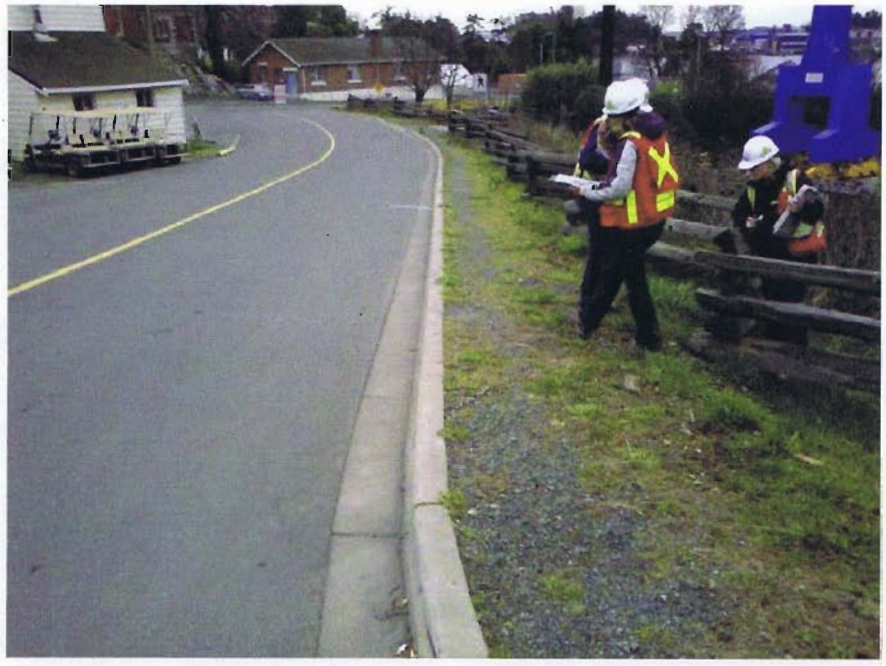
PROJECT No.	10-1478-0004		FILE No.	P1014780004-03	
DESIGN	SA	4 MAR 10	SCALE	AS SHOWN	REV. 0
CADD	AN	4 MAR 10			
CHECK	SA	4 JUN 10			
REVIEW	TW	4 JUN 10			

FIGURE 3



Photograph 1: Overview of Project Area from South.

Photograph 2: Water bar on road edge to north of Project Area.



Photograph 3: Concrete curb on road to east and south of Project Area.

Photograph 4: Storm drain cover at toe of slope.

Photograph 5: Seepage through retaining wall along north side of dock craneway.

Photograph 6: Vegetation north of the existing steps

Photograph 7: Vegetation south of existing steps.

n:\final\2010\1478\10-1478-0004 pwgsc env screening eee esquimalt\final report\appendix a - figures plans photographs\appendix a - photographs.docx

Appendix E

Borehole Logs from Previous Investigations

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A3 BH13
SURFACE ELEVATION: 2.72 m
UTM COORDINATES 5364941 N 468768 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100	COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
0					**ASPHALT**				concrete	
					CONCRETE					
					SAND AND GRAVEL				sand	
		A3 BH13-1 /2			(FILL) some cobble, trace silt, compact, coarse, angular gravel, brown, moist					
									backfilled with drill cuttings	2
1										
					bedrock at 1.2 m					
					End of borehole at 1.2 m					

DRILLING METHOD: Vacuum Extraction/Daylighting

DRILL DATE: 8 September 2009 LOGGED BY: DGP

Notes: ■ GRAB SAMPLE

SLR Consulting (Canada) Ltd.

SLR JOB NO: 201.88351.04

CLIENT: **PWGSC**

PROJECT: **Esquimalt Graving Dock Uplands**
825 Admirals Road
Esquimalt, BC

BOREHOLE LOG

BOREHOLE NO: **A3 BH14**

SURFACE ELEVATION: 2.80 m

UTM COORDINATES
5364927 N
468769 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 – 10 – 100	COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
					ASPHALT				concrete	
					CONCRETE				sand	
		A3BH14-1			**SAND AND GRAVEL** (FILL) some cobble, trace silt, compact, coarse, angular gravel, brown, moist	15				2
1		A3BH14-2 / 3			**SILT & CLAY** trace sand, trace gravel, occassional small wood debris, brown, moist	0			backfilled with drill cuttings	
		A3BH14-4				10				1
2		A3BH14-5 / 6			**SAND** medium, grey, moist	20				
					bedrock at 2.4 m End of borehole at 2.4 m					

DRILLING METHOD: SONIC Drilling

DRILL DATE: 8 September 2009 LOGGED BY: DGP

Notes: GRAB SAMPLE
SONIC CORE SAMPLE

SLR
Consulting (Canada) Ltd.

SLR JOB NO: 201.88351.04

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

BOREHOLE LOG

BOREHOLE NO: A3 BH15
SURFACE ELEVATION: 2.58 m

UTM COORDINATES
5364902 N
468704 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100	COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
0					**ASPHALT**				concrete	
		A3BH1-1			**SAND & GRAVEL** (FILL) medium to coarse sand, some cobble, brown, moist				pea gravel	
		A3BH1-2 / 3			**SILT & CLAY** trace sand, trace gravel, trace shell fragments, brown, moist				backfilled with drill cuttings	2
1										
		A3BH1-4			**SAND** medium to coarse, some shell fragments, trace gravel, brown, moist					1
		A3BH1-5								
					bedrock at 2.0 m End of borehole at 2.0 m					

DRILLING METHOD: Vacuum Extraction/Daylighting

Notes: ■ GRAB SAMPLE

DRILL DATE: 10 September 2009 LOGGED BY: JE

SLR Consulting (Canada) Ltd.

SLR JOB NO: 201.88351.04

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

BOREHOLE LOG

BOREHOLE NO: A3 BH16

UTM COORDINATES
5364887 N
468661 E

SURFACE ELEVATION: 2.64 m

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 – 10 – 100	COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
0					**ASPHALT**		concrete			
					SAND & GRAVEL (FILL) medium to coarse sand, brown, moist	0			pea gravel	2
		A3BH2-1								
1					**SILT & CLAY** trace sand, trace gravel, trace shell fragments, brown, moist					1
		A3BH2-2			**GRAVEL** some medium to coarse sand, brown, moist	0				
2										0
		A3BH2-3			wet from 2.4 m	25			backfilled with drill cuttings	
3										-1
		A3BH2-4				25				
4		A3BH2-5				20				
					bedrock at 4.3 m End of borehole at 4.3 m					

DRILLING METHOD: SONIC Drilling

DRILL DATE: 10 September 2009 LOGGED BY: JE

Notes: GRAB SAMPLE
SONIC CORE SAMPLE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A3 BH17
SURFACE ELEVATION: 2.65 m
UTM COORDINATES 5364881 N 468627 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100	COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
0					**ASPHALT**					2
		A3BH17-1 / 2			**SAND & GRAVEL** (FILL) medium to coarse sand some cobble, brown, moist	0				
1		A3BH17-3				0				1
					GRAVEL somemedium to coarse sand, trace shell fragments, grey, moist					
2		A3BH17-4				0				0
					SAND & GRAVEL medium to coarse sand, trace shell fragements, brown, moist					
		A3BH17-5				0				
3					**GRAVEL** some medium to coarse sand, trace clay, trace shell fragments				cement	-1
					no sample recovery from 3.0 m to 4.9 m due to rocks					
4										-2
					wet from 4.9 m					
5		A3BH17-6				10				
										-3
6		A3BH17-7				0				
					End of borehole at 6.1 m					

DRILLING METHOD: SONIC Drillling

Notes: ■ SONIC CORE SAMPLE

DRILL DATE: 20 October 2009 LOGGED BY: JR

Sheet 1 of 1

SLR CANADA V5.1 AEC 3_2009.GPJ SLR_CAN V5.1.GDT 8/12/09

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-1
SURFACE ELEVATION: 8.29 m
UTM COORDINATES 5364869 N 468691 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
					TOPSOIL AND GRASS					
					SAND some silt, some shell, trace organics (re-work native?), dark brown, moist					
0.05		A14-1 /2								
0.10										
0.15					some gravel at 0.15 m, brown				backfilled with hand auger cuttings	
0.20		A14-1-3								
0.25					trace gravel at 0.25 m					8
0.30		A14-1-4								
0.35					End of borehole at 0.4 m					

DRILLING METHOD: Hand Auger

DRILL DATE: 11 September 2009 LOGGED BY: JE

Notes: ■ GRAB SAMPLE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO. 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-2
SURFACE ELEVATION: 4.88 m
UTM COORDINATES 5364881 N 468699 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
					TOPSOIL AND GRASS organics and leaf litter					
		A14-2-1			**SAND** (FILL) some silt, some organics, dark brown, moist					
0.05					**SAND AND GRAVEL** (FILL) trace silt, trace organics, trace cobble, brown, moist				backfilled with hand auger cuttings	
		A14-2-2								
0.10					rock at 0.12 m End of borehole at 0.1 m					

DRILLING METHOD: Hand Auger

Notes: ■ GRAB SAMPLE

DRILL DATE: 11 September 2009 LOGGED BY: JE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-3
SURFACE ELEVATION: 8.59 m
UTM COORDINATES: 5364874 N, 468699 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
					TOPSOIL AND GRASS					
					SAND some silt, trace organics, trace shells (re-work native?), dark brown, moist					
0.05		A14-3-1								
0.10									backfilled with hand auger cuttings	
0.15					some gravel, some shells at 0.15 m, brown, moist					
		A14-3-2								
0.20					a piece of blue plastic observed at 0.20 m					
		A14-3-3								
0.25					End of borehole at 0.3 m					

DRILLING METHOD: Hand Auger

Notes: ■ GRAB SAMPLE

DRILL DATE: 11 September 2009 LOGGED BY: JE

Sheet 1 of 1

SLR CANADA V5.1 AEC 14_2009.GPJ SLR_CAN V5.1.GDT 10/12/09

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-4
SURFACE ELEVATION: 8.92 m
UTM COORDINATES: 5364871 N, 468716 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
					TOPSOIL AND GRASS					
					SAND some silt, some organics (re-work native?), brown, moist					
0.05		A14-4-1								
					trace gravel, trace shell, trace organics at 0.07 m, brown					
0.10		A14-4-2								
0.15					some gravel at 0.15 m				backfilled with hand auger cuttings	
0.20		A14-4-3								
0.25										
0.30					rock at 0.30 m End of borehole at 0.3 m					

DRILLING METHOD: Hand Auger

DRILL DATE: 11 September 2009 LOGGED BY: JE

Notes: ■ GRAB SAMPLE

BOREHOLE LOG

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE NO: A14-5
SURFACE ELEVATION: 4.44 m
UTM COORDINATES: 5364886 N, 468726 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
					TOPSOIL AND GRASS vegetation and organics					
0.05					**SAND** (FILL) some silt, some gravel, some organics, dark brown, moist					
		A14-5-1			a couple pieces of broken glass were observed, brown, moist					
0.10									backfilled with hand auger cuttings	
					SAND AND GRAVEL (FILL) trace silt, trace organics, trace cobble, brown, moist					
0.15		A14-5-2								
0.20					End of borehole at 0.2 m					

DRILLING METHOD: Hand Auger

Notes: ■ GRAB SAMPLE

DRILL DATE: 11 September 2009 LOGGED BY: JE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-6
SURFACE ELEVATION: 9.53 m
UTM COORDINATES: 5364877 N, 468733 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
					TOPSOIL AND GRASS					
					SAND some silt, some organics, trace gravel, trace shells (re-work native?), dark brown, moist					
0.05		A14-6-1/2								
0.10									backfilled with hand auger cuttings	
0.15										
0.20		A14-6-3								
0.25					End of borehole at 0.3 m					

DRILLING METHOD: Hand Auger

Notes: ■ GRAB SAMPLE

DRILL DATE: 11 September 2009 LOGGED BY: JE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-7
SURFACE ELEVATION: 5.61 m
UTM COORDINATES 5364885 N 468747 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
0					**TOPSOIL AND GRASS** vegetation and organics					
					SAND (FILL) some silt, some organics, dark brown, moist					
0.05										
		A14-7-1								
0.10									backfilled with hand auger cuttings	
0.15					trace organics, trace glass, barnacle observed at 0.15 m, brown, moist					
0.20		A14-7-2								
0.25					rock at 0.25 m End of borehole at 0.3 m					

DRILLING METHOD: Hand Auger

Notes: ■ GRAB SAMPLE

DRILL DATE: 11 September 2009 LOGGED BY: JE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-8
SURFACE ELEVATION: 9.80 m

UTM COORDINATES
5364880 N
468747 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
0					**SAND AND GRAVEL** (FILL) sand and gravel, brown, moist					
0.05		A14-8-1							backfilled with hand auger cuttings	
0.10										
0.15					rock (rip rap) at 0.15 m End of borehole at 0.2 m					

DRILLING METHOD: Hand Auger

Notes: ■ GRAB SAMPLE

DRILL DATE: 11 September 2009 LOGGED BY: JE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-9
SURFACE ELEVATION: 7.35 m
UTM COORDINATES 5364908 N 468787 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
0					**TOPSOIL AND GRASS** surface ivy and rootlets					
					SAND some silt, some organics (re-work native?), dark brown, moist					
0.05		A14-9-1								
0.10									backfilled with hand auger cuttings	
0.15		A14-9-2								
0.20					rock at 0.20 m End of borehole at 0.2 m					7

DRILLING METHOD: Hand Auger

DRILL DATE: 11 September 2009 LOGGED BY: JE

Notes: ■ GRAB SAMPLE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-10
SURFACE ELEVATION: 5.53 m
UTM COORDINATES 5364925 N 468791 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
					TOPSOIL AND GRASS surface ivy and rootlets					
0.05		A14-10-1			**SAND** (FILL) some organics, dark brown, moist				backfilled with hand auger cuttings	
0.10					some gravel, brown, moist					
0.15		A14-10-2								
					rock at 0.18 m End of borehole at 0.2 m					

DRILLING METHOD: Hand Auger

DRILL DATE: 11 September 2009 LOGGED BY: JE

Notes: ■ GRAB SAMPLE

SLR Consulting (Canada) Ltd

SLR JOB NO: 201.88351.04

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

BOREHOLE LOG

BOREHOLE NO: A14-11
SURFACE ELEVATION: 8.39 m
UTM COORDINATES 5364918 N 468797 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
					TOPSOIL AND GRASS surface ivy and rootlets					
0.05		A14-11-1/2			**SAND** (FILL) some organics, dark brown, moist					
0.10									backfilled with hand auger cuttings	
0.15					some silt, trace gravel at 0.15 m (re-work native?), brown, moist					
0.20		A14-11-3								
0.25					End of borehole at 0.3 m					8

DRILLING METHOD: Hand Auger

DRILL DATE: 11 September 2009 LOGGED BY: JE

Notes: ■ GRAB SAMPLE

BOREHOLE LOG

SLR JOB NO: 201.88351.04

CLIENT: PWGSC

PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

BOREHOLE NO: A14-12

SURFACE ELEVATION: 7.68 m

UTM COORDINATES
5364925 N
468794 E

DRILLING METHOD: Hand Auger

DRILL DATE: 11 September 2009

LOGGED BY: JE

Notes: GRAB SAMPLE

Sheet 1 of 1

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
0					**TOPSOIL AND GRASS** surface ivy and rootlets		backfilled with hand auger cuttings			
0.05					**SAND** (FILL) some organics, dark brown, moist					
0.10		A14-2-1/2			some silt, trace gravel at 0.18 m (re-work native?), brown, moist					
0.15										
0.20										
0.25		A14-2-3								
0.30										
0.35					End of borehole at 0.4 m					

LR CANADA V5.1 AEC 14_2009.GPJ SLR_CAN V5.1.GDT 10/12/09

BOREHOLE LOG

SLR

SLR JOB NO: 201.88351.04

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

BOREHOLE NO: A14-13
SURFACE ELEVATION: 6.90 m
UTM COORDINATES: 5364939 N, 468790 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
0.05					**TOPSOIL AND GRASS** grass and organics					
0.10		A14-13-1			**SAND** (FILL) some organics, dark brown, moist				backfilled with hand auger cuttings	
0.15					End of borehole at 0.2 m					

DRILLING METHOD: Hand Auger

DRILL DATE: 11 September 2009 LOGGED BY: JE

Notes: ■ GRAB SAMPLE

SLR Consulting (Canada) Ltd

SLR JOB NO: 201.88351.04

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

BOREHOLE LOG

BOREHOLE NO: A14-14
SURFACE ELEVATION: 11.16 m
UTM COORDINATES 5364951 N 468801 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
					TOPSOIL AND GRASS					
					SAND (FILL) some organics, trace gravel, dark brown, moist					
0.05		A14-14-1								
0.10					some silt, trace shell below 0.1 m (re-wrok native?)				backfilled with hand auger cuttings	
0.15		A14-14-2								11
0.20					rock at 0.2 m End of borehole at 0.2 m					

DRILLING METHOD: Hand Auger

DRILL DATE: 11 September 2009 LOGGED BY: JE

Notes: ■ GRAB SAMPLE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-15
SURFACE ELEVATION: 7.09 m
UTM COORDINATES 5364952 N 468794 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
0.05		A14-15-1/2			**SAND** (FILL) trace silt, trace organics, trace gravel, brown, moist					
0.10					some silt, trace clay, trace shell at 0.09 m (re-work native?) a piece of charcoal was observed at 0.10 m				backfilled with hand auger cuttings	7
0.15		A14-15-3								
0.20					End of borehole at 0.2 m					

DRILLING METHOD: Hand Auger

Notes: ■ GRAB SAMPLE

DRILL DATE: 11 September 2009 LOGGED BY: JE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-16
SURFACE ELEVATION: 8.64 m
UTM COORDINATES 5364953 N 468796 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
					TOPSOIL AND GRASS					
0.05		A14-6-1/2			**SAND** (FILL) some organics, trace gravel, trace cobble, dark brown, moist					
0.10					some silt, trace clay, trace organics at 0.12 m (re-work native?), brown, moist				backfilled with hand auger cuttings	
0.15										
		A14-16-3								
0.20										
0.25					End of borehole at 0.3 m					

DRILLING METHOD: Hand Auger

DRILL DATE: 11 September 2009 LOGGED BY: JE

Notes: ■ GRAB SAMPLE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-17
SURFACE ELEVATION: 13.29 m
UTM COORDINATES: 5364952 N, 468811 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
0					**TOPSOIL AND GRASS**					
					SAND (FILL) some organics, trace shell, trace gravel, trace cobble, dark brown, moist					
0.05		A14-17-1								
0.10					some silt observed at 0.10 m (re-work native?), brown				backfilled with hand auger cuttings	
0.15		A14-17-2								
0.20					End of borehole at 0.2 m					13

DRILLING METHOD: Hand Auger

Notes: GRAB SAMPLE

DRILL DATE: 11 September 2009 LOGGED BY: JE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-18
SURFACE ELEVATION: 8.01 m
UTM COORDINATES 5364955 N 468786 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
0					**SAND** some silt, trace gravel, trace organics (re-work native?), brown, moist					8
0.05		A14-18-1								
0.10					earwig observed at 0.10 m					
					trace clay observed at 0.12 m					
0.15									backfilled with hand auger cuttings	
0.20		A14-18-2								
0.25					End of borehole at 0.3 m					

DRILLING METHOD: Hand Auger

Notes: ■ GRAB SAMPLE

DRILL DATE: 11 September 2009 LOGGED BY: JE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-19
SURFACE ELEVATION: 12.56 m
UTM COORDINATES: 5364969 N, 468797 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
0					**TOPSOIL AND GRASS**					
0.05		A14-19-1			**SAND** (FILL) some organics, dark brown, moist					
0.10		A14-19-2/3			**SILT AND CLAY** trace organics, trace gravel, trace wood (re-work native?), brown, moist				backfilled with hand auger cuttings	
0.15										
0.20		A14-19-4								
0.25					End of borehole at 0.3 m					

DRILLING METHOD: Hand Auger

DRILL DATE: 11 September 2009 LOGGED BY: JE

Notes: ■ GRAB SAMPLE

SLR

CLIENT: PWGSC
PROJECT: Esquimalt Graving Dock Uplands
825 Admirals Road
Esquimalt, BC

SLR JOB NO: 201.88351.04

BOREHOLE LOG

BOREHOLE NO: A14-20
SURFACE ELEVATION: 12.99 m
UTM COORDINATES 5364960 N 468809 E

DEPTH (m)	SAMPLE TYPE	SAMPLE ID	SPT COUNT	SOIL TYPE	SOIL DESCRIPTION	FIELD TEST DATA: ORGANIC VAPOUR LEVEL (ppmv) 1 10 100 1000	WELL COMPLETION	WATER LEVEL	WELL COMPLETION NOTES	ELEVATION (m)
					TOPSOIL AND GRASS					
					SAND AND GRAVEL (FILL) trace organics, trace cobble, trace shells, dark brown, moist					
0.05										
		A14-20-1/2								
0.10									backfilled with hand auger cuttings	
0.15					**SAND** some silt, trace gravel (re-work native?), brown, moist					
		A14-20-3								
0.20					rock at 0.23 m End of borehole at 0.2 m					

DRILLING METHOD: Hand Auger

DRILL DATE: 11 September 2009 LOGGED BY: JE

Notes: ■ GRAB SAMPLE

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-06

CLIENT: PWGSC	PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension	DATE HOLE STARTED: Dec. 8/2009 FINISHED: Dec. 9/2009
LOCATION:	DATUM: Chart
DIRECTION AZIMUTH: DIP (from horiz):	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 468775.47m N 5364911.08m	GROUND ELEVATION: 4.56 m
MANUFACTURER'S DRILL DESIGNATION: HT-700	TOTAL DEPTH OF HOLE: 18.28 m
DRILLING CONTRACTOR: Foundex	DRILLING METHOD SOIL: Vaccum Truck ROCK: HQ Core
LOGGED BY: AW	DRILLING FLUID: Water CASED TO: m
CHECKED BY: GWS	HOLE DIA.: HQ3

Column headings: DEPTH (m); SYMBOL; LITHOLOGY; PIEZOMETER DETAILS; PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2; ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical; ROCK MASS WEATHERING; DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES: J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gnessosity, M= Schistosity, S= Shear, V= Vein; ANGLE TO 30 60); JOINT INFILL; JOINT PLANARITY; JOINT ROUGHNESS; JOINT FREQUENCY (JOINTS PER METRE) 6 12 18; CORE RECOVERY (%) 25 50 75; R.Q.D. (%) 25 50 75

Depth (m)	Lithology	Discontinuity	Joint Infill	Joint Planarity	Joint Roughness	Joint Frequency	Core Recovery (%)	R.Q.D. (%)
0 – 1.5	FILL, gravels and cobbles with clay							
1.5 (3.0) – 2.7	METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets, moderately weathered, medium weak, all joints highly oxidized to dark brown/black colour [Wark Gneiss] 1.92 - 2.21m: joint dipping at 20 deg to core axis, rusty with highly fracture rock on one side of the joint 2.32m: highly weathered calcite vein 2.37m: highly crushed zone dipping at 20 deg to core axis 2.42m: highly fractured with clayey infills	J	R R R R	I I I I	R R R R	12	85	25
2.7 (1.8) – 4	METADIORITE, slightly to moderately weathered, weak to medium strong 2.84 - 3.06m: highly fractured with fragments size of coarse sand to fine to coarse gravel 3.06 - 3.29m: highly crushed zone with fragments size of fine to coarse sand 3.29 - 3.47m: joint dipping at 30 deg to core axis, infilled with fine to coarse grained sand sized fragments					2	100	0

DISCONTINUITY CODES: JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay SHAPE: P: Planar C: Curved I: Irregular
ROUGHNESS: R: Rough S: Smooth Sl: Slickenside WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-06

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
5		5.08 - 5.30m: joint parallel to core axis					J J J J J J J J J	C C Ca Py R Py C C C	I R P R I R I R P R I SL I R I R P R	0	100	0
6		6.27 - 6.64m: two joints at 20 deg to core axis, moderately fractured along joint, joint irregular, smooth to slickensided					J	C	I R	10	100	58
7		7.14 - 7.29m: joint at 30 deg to core axis with calcite infill, planar, slickensided					J J	C C Ca	P R I R P R			
8		7.61 - 8.18m: highly fracture at about 20 deg to core axis, infilled with calcite, chlorite, irregular, smooth to slickensided					J	C	P R	12	100	61
		8.2 -3.6 DYKE, light yellowish green, weak, slightly weathered						Ca	I R			
9												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-06

(continued from previous page)

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		9.1 -4.6 METADIORITE, slightly to moderately weathered, weak to medium strong					J	C	I R		100	100
		9.40 - 9.54m: joint at 30 deg to core axis, highly fractured aroun the joint, infilled with calcite, pyrite, joint irregular, slickensided					J	C	I R			
								C	I R			
							J	Ca	I R			
10								Py Ch Ca	I R	12	100	78
		10.24 - 10.34m: joint at 20 to core axis, irregular, slickensided, infilled with clay, calcite and chlorite					J	C	I R			
		10.47 - 10.66m: joint at 30 deg to core axis, infilled with calite, chlorite, joint planar, slickensided						C	I R			
11		11.01 - 11.50m: joint parallel to core axis, infilled with clay, chlorite and rust, joint undulating, slickensided						Ca	P S	12	98	38
		11.50 - 12.18m: many healed joints with altered light yellow quartz/calcite veins						Ca	I R			
							J	Cl	I R			
12							J	Ca	I R			
		12.2 -7.6 12.06 - 12.16m: highly weathered with clay and decomposed rock fragments on joints (chloritic sand sized fragments)										
		FAULT ZONE, highly fractured, highly weathered to coarse sand to coarse gravel sized rock fragments, decomposed at 12.59m; upper contact perpendicular to core axis, lower contact at about 40 degrees to core axis 12.6 -8.0								100	75	0
		METADIORITE, moderately to highly weathered, highly fractured, partly healed										
13										0	59	0
14												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-06

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
15				2.80E-07						100	93	13
		15.2 -10.7 METADIORITE, slightly to moderately weathered 15.44 - 15.55m: highly fractured zone					J	Ca Ca Cl	P S I S I R			
16										100	93	40
17							J	Ca	P S			
							J	Ch Ca Ca	P R I R	9	100	84
18							J	Ch Ca	P S P R			
		18.3 -13.7 End of Hole at: 18.3 m						Ca	I R			
19												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-07

CLIENT: PWGSC	PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension	DATE HOLE STARTED: Dec. 9/2009 FINISHED: Dec. 11/2009
LOCATION:	DATUM: Chart
DIRECTION AZIMUTH: DIP (from horiz):	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 468759.6m N 5364923.74m	GROUND ELEVATION: 4.7 m
MANUFACTURER'S DRILL DESIGNATION: HT-700	TOTAL DEPTH OF HOLE: 18.36 m
DRILLING CONTRACTOR: Foundex	DRILLING METHOD SOIL: Vaccum Truck ROCK: HQ Core
LOGGED BY: AW	DRILLING FLUID: Water CASED TO: m
CHECKED BY: GWS	HOLE DIA.: HQ3

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES: J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gnessosity, M= Schistosity, S= Shear, V= Vein) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY (%) 25 50 75	R.Q.D. (%) 25 50 75
0		FILL, cobble and gravel with brown and sandy clay infills											
1											0	32	0
2											0	22	0
3		3.1 / 1.6 FILL, clay, some gravel, some sand, soft, non-plastic, some wood											
		3.3 / 1.4 FILL, gravel, trace sand, up to 3cm, angular to subangular, loose, brown											
		3.5 / 1.2 METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets and healed fractures, joints planar, smooth, moderately and highly weathered, highly oxidized, weak [Wark Gneiss]									0	34	0
4													

DISCONTINUITY CODES: JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay SHAPE: P: Planar C: Curved I: Irregular
ROUGHNESS: R: Rough S: Smooth Sl: Slickenside WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-07

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gneissosity, M= Schistosity, S= Shear, V= Vein; ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
5		4.90 - 5.08m: highly fractured, joints highly oxidized to orange brown, joints generally at 70 deg to core axis, joints irregular, rough										
		5.30 - 5.72m: highly fractured, irregular fracture pattern, two prominent joints at 35 deg to core axis, joint surfaces highly oxidized					J			17	100	26
6								R	I S			
		6.10 - 6.17m: highly fractured, crushed with fragment at the coarse grained sand, highly weathered					J	R Ca	P S			
		6.45 - 6.53m: highly fractured zone						R	P SL			
								R	P S			
7								C	P S	8	100	89
								R	P S			
							J	R	P S			
							J	C	I R			
								R Ca	P SL			
8		7.83 - 8.00m: highly fractured, highly weathered with calcite, chlorite with rusty stain										
		8.00 - 8.18m: moderately fractured					J	R Ca	P SL			
		8.18 - 8.27m: highly fracture, at about 70 deg to core axis					J	R Ca	P S			
		8.33 - 8.62m: joint at 10 deg to core axis, irregular, smooth, with calcite and pyrite blotches								15	100	7
		8.70 - 9.05m: highly fractured, highly weathered					J	R Cl	P S			
9												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-07

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)					J = Joint B= Bedding D= Drill Break F= Foliation G= Gneissosity M= Schistosity S= Shear V= Vein					
		9.05 - 9.33m: highly weathered, very weak, crushed rock zone coarse to fine gravel sized fragments										
		9.3 -4.6										
		METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets, moderately weathered with calcite veins at 60 deg to core axis [Wark Gneiss]					J	R	P S			
		9.53 - 9.97m: moderately to highly fractured, highly fractured zone						R Ca	P R P S			
10										15	100	47
								Py Ca	I S			
									I S			
								Py Ch Ca	P SL			
		10.55 - 10.72m: highly fractured, joints smooth, slickensided, infilled with 2mm of decomposed rock						Py Ca	P SL			
		10.8 -6.1										
		10.72 - 10.75m: highly fractured zone to coarse gravel sized rock fragments										
11		METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets, weak, moderately fractured, moderately weathered, joints at 60 to 70 deg to core axis and at 30 deg to core axis [Wark Gneiss]										
		10.95 - 11.14m: highly fractured zone								100	100	0
12												
		12.06 - 12.12m: highly fractured zone										
		12.12 - 12.13m: decomposed rock fragments along joint										
		12.28 - 12.38m: highly fractured to fine gravel size					J	R Si	I S			
							J	R	I S			
								C	P S			
		12.78 - 12.87m: highly fractured, highly weathered zone										
13		12.99 - 13.07m: highly weathered		5.20E-07			J J J J J	R Py Ca R Cl R Cl R Ca	I R P S I R I R I R	18	100	64
		13.25 - 13.28m: highly weathered					J	R Ca	I S I S			
		13.8 -9.1					J		I S			
		METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets, weak to moderately					J	Py Ca	I S			
14												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath

CBL_ROCK-SI_WITH DISCONTINUITIES 2009 EGD EEE DRILL LOGS - ROCK R1.GPJ ROCK-LOG.GDT 2/25/10

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-07

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)					J = Joint B= Bedding D= Drill Break F= Foliation G= Gneissosity M= Schistosity S= Shear V= Vein					
		strong, slighty to moderately weathered, moderately fractured [Wark Gneiss]						C	I R			
		13.85 - 13.90m: highly fractured zone						C	I R			
								C	I SL			
		14.44 - 14.82m: joints dipping at 60 to 80 deg to core axis, irregular. Rough/smooth, infilled with rust, clay and calcite						C	I R	8	100	28
15							J	R Ca	I S			
							J	C	P S			
								R Si	I R			
		15.53 - 15.54m: highly fractured, highly weathered						Ca	I R			
								Ca	I R			
		15.56 - 15.57m: highly fractured zone						Ch Ca	I S			
							J	Ca	I S			
16		15.94 - 16.11m: highly fractured zone, rock fragments smaller than coarse gravel								0	100	0
								Ca	I S			
								Ca	P SL			
								Ca	I S			
								R Ca	I S			
		16.52 - 16.82m: highly fractured, highly weathered, with fragments size of fine gravel		9.20E-08				R Ca	I R			
17												
		17.00 - 17.20m: highly fractured zone infilled with gravel sized fragments										
		17.20 - 18.27m: intact with healed joints						Py Ca	I S			
								Ca	I R			
								Ca	I S	9	100	83
								Ca	I S			
								Ca	I S			
18								C	I S			
								C	I S			
		18.27 - 18.36m: highly weathered with joints parallel to core axis, infilled with coarse grained sand sized fragements and clay and calcite, planar, rough joints						C	I S			
		18.4 -13.7 End of Hole at: 18.4 m										
19												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-08

CLIENT: PWGSC	PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension	DATE HOLE STARTED: Dec. 11/2009 FINISHED: Dec. 13/2009
LOCATION:	DATUM: Chart
DIRECTION AZIMUTH: DIP (from horiz):	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 468760.84m N 5364912.51m	GROUND ELEVATION: 4.71 m
MANUFACTURER'S DRILL DESIGNATION: HT-700	TOTAL DEPTH OF HOLE: 19.26 m
DRILLING CONTRACTOR: Foundex	DRILLING METHOD SOIL: Vaccum Truck ROCK: HQ Core
LOGGED BY: AW	DRILLING FLUID: Water CASED TO: m
CHECKED BY: GWS	HOLE DIA.: HQ3

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY (%) 25 50 75	R.Q.D. (%) 25 50 75
0		FILL, cobbles and gravesl with brown and grey stiff clay											
1													
2													
3													
3.8													
4		METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, moderately fractured, moderately weathered, joints highly									13	82	22

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weatl

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-08

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY / JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)					J = Joint B= Bedding D= Drill Break F= Foliation G= Gneissosity M= Schistosity S= Shear V= Vein					
		oxidized to a dark brown to black colour. [Wark Gneiss]					J	C R Py Ca R Py	P R P SL I S			
		4.7 / 0.0 METADIORITE, similar to above, slightly to moderately weathered, all joints highly oxidized to dark orange brown colour					J	R	P S			
5		5.37 - 5.50m: joint at 40 deg to core axis, irregular, smooth with rust and calcite infill					J J J J	R R R Ca R Ca	P S P S I S P R	13	100	59
		5.7 / -1.0 DYKE, light yellowish green, moderately to highly weathered, upper contact at 40 deg to core axis, contact modrately fractured, highly oxidized with brown clay infill					J J	R R R	I S I S I R			
6		5.9 / -1.2 METADIORITE, similar to 3.75 to 4.73 m, slightly to moderately weathered, all joints highly oxidized to dark orange brown colour					J	R R Ca R C R	I S P S P R C R			
		6.3 / -1.5 METADIORITE, similar to 3.75 to 4.73 m, slightly to moderately weathered, all joints highly oxidized to dark orange brown colour 6.25 - 6.40m: joint at 20 deg to core axis, planar, rough, with rust and chlorite infill 6.45 - 6.61m: joint at 20 deg to core axis, irregular, rough with rust infill					J J J J J	R Ch R Ca R R Ca Py R	P R P R I R I R I R I R			
7		7.19 - 7.20m: highly fractured zone					J J J J	C R Ca R R Ca R	P R I S P R P S P S	11	100	72
		7.8 / -3.1 DYKE, light yellowish green, highly weathered, highly fractured, fractures highly oxidized, lower contact planar and slickensided										
8		8.0 / -3.3 7.97 - 8.03m: joint parallel to core axis, planar, rough					J J J J	R R R Py C	P R P R P R P R			
		METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, occasional yellowish calcite blotches, moderately fractured with irregular fracture pattern, moderately weathered, joints highly oxidized to a dark brown to black colour. [Wark Gneiss] 8.57 - 8.77m: joint at 30 deg to core axis, planar, smooth, with rust stains 8.77 - 9.00m: curved joint parallel to core axis, rough with calcite and chlorite infill					J J	R R Ca Ch	P S I S C R	20	100	84
9												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-08

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)					J = Joint B= Bedding D= Drill Break F= Foliation G= Gneissosity M= Schistosity S= Shear V= Vein						
10		9.3 / -4.6 METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, slghtly weathered [Wark Gneiss] 9.57 - 10.09m: moderately fractured zone with a curved joint parallel to core axis stained with rust					J J J J	R R Py Ca C C R Py	I P R P R P SL P S I R C I R		19	100	89
11		10.3 / -5.6 METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, moderately weathered [Wark Gneiss] 10.56 - 10.60m: highly fractured zone with clay infill											
		10.8 / -6.1 METADIORITE, coarse grained, greenish grey with light yellow alterations, thin quartz veinlets throughout, moderately weathered, moderately fractured [Wark Gneiss] 11.13 - 11.36m: highly fractured zone									100	90	19
12		11.5 / -6.8 METADIORITE, coarse grained, greenish grey with light yellow alterations, highly fractured, highly weathered with sand and clay sized decomposed rock fragments [Wark Gneiss]									100	89	0
		12.3 / -7.6 METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, moderately fractured with healed joints, slightly weathered [Wark Gneiss] 12.54 - 12.61m: highly fractured zone					J J J J J J	Ca C Ca Ca Ca Cl	I R P R I R I R I R P S P R				
13		13.2 / -8.5 13.14 - 13.18m: highly fractured zone DYKE, light yellowish green, joints generally at 50 to 70 deg to core axis, spaced 2 - 5 cm apart, planar, rough, infilled with calcite and chlorite, no oxidation					J J J J J J J	Ca Ca Ca Ca C Py C Cl C	I R P R P R I R I R I R P R P R P S		20	100	28
14		13.9 / -9.2 DYKE, similar to 13.18 to 13.86m											

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-08

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY / JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
		14.1 -9.4 METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, slightly weathered [Wark Gneiss]					J J	Ca Cl C Ca	P R I SL	100	100	38
		14.4 -9.7 FAULT ZONE, highly weathered to decomposed with rock fragment size of fine gravel and coarse sand\; lower contact at 90 deg to core axis.										
		14.6 -9.9 DYKE, similar to 13.18 to 13.86m										
		15.0										
15		-10.3 DYKE, similar to 13.18 to 13.86m, very weak, highly fractured								10	100	30
		15.4 -10.7 METADIORITE, coarse grained, greenish grey, thin quartz veinlets throughout, moderately to highly weathered, weak [Wark Gneiss]					J	Ca C C Ca	I R I R I R			
16										8	100	39
		16.2 -11.5 FAULT ZONE, highly weathered to decomposed METADIORITE with fine sand/silt sized rock fragments; upper contact at about 60 deg to core axis										
		16.6 -11.9 CORE LOSS										
17												
		17.2 -12.4 FAULT ZONE, clay/sand sized fault gouge										
		17.3 -12.6 METADIORITE, coarse grained, greenish grey, highly fractured with coarse gravel sized rock fragments, highly weathered		2.20E-07						100	61	0
18		18.0 -13.3 METADIORITE, coarse grained, greenish grey, moderately fractured, highly weathered										
		18.3 -13.5 METADIORITE, coarse grained, greenish grey, moderate to highly weathered 18.25 - 18.45m: highly fractured 18.55 - 18.99m: highly fractured								100	95	32
19												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-08

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gneissosity, M= Schistosity, S= Shear, V= Vein; ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
		18.99 - 19.26m: intact but moderately to highly weathered										
19.3 -14.6		End of Hole at: 19.3 m										
20												
21												
22												
23												
24												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-09

CLIENT: PWGSC	PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension	DATE HOLE STARTED: Dec. 13/2009 FINISHED: Dec. 13/2009
LOCATION:	DATUM: Chart
DIRECTION AZIMUTH: DIP (from horiz):	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 468757.45m N 5364947.76m	GROUND ELEVATION: 4.68 m
MANUFACTURER'S DRILL DESIGNATION: HT-700	TOTAL DEPTH OF HOLE: 18.29 m
DRILLING CONTRACTOR: Foundex	DRILLING METHOD SOIL: Vaccum Truck ROCK: HQ Core
LOGGED BY: AW	DRILLING FLUID: Water CASED TO: m
CHECKED BY: GWS	HOLE DIA.: HQ3

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA: SEE BOTTOM OF FORM FOR CODES. J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gnessosity, M= Schistosity, S= Shear, V= Vein. ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY (%) 25 50 75	R.Q.D. (%) 25 50 75
1		FILL, cobbles and gravesl with brown and grey stiff clay											
1.9													
2		2.8 METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets, moderately weathered, medium weak, all joints highly oxidized to dark brown/black colour [Wark Gneiss] 2.20 - 2.25m: highly fractured zone 2.46 - 2.58m: highly fractured, highly weathered zone 2.58 - 2.72m: joint parallel to core axis with rust stain 2.79 - 2.90m: highly fractured/crushed zone, rock fragments size of fine gravel					J J J J J J	R R R R R R R	I I P P P I	S S S S S S R	14	100	18
3		3.41 - 3.52m: highly weathered; also highly fractured from 3.52 to 3.61m					J J J J J J	R R R Ca R Ca	P P I I	R R R R			
3.8		0.9 DYKE, light yellowish green, weak, slightly weathered, contact at 60 deg to core axis					J J J	R R Ca	I I P	R R R	16	100	63
4													

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-09

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)											
		0.0 METADIORITE, coarse grained, dark greenish grey, medium strong, slightly to moderately weathered [Wark Gneiss]					J	Py Ca	I	R			
		4.57 - 4.62m: highly fractured zone											
5		5.0 -0.3 METADIORITE, coarse grained, dark greenish grey with increasing light yellowish dyke fingers, thin quartz veinlets perpendicular to core axis approximately every 5 cm, medium strong, slightly to moderately weathered [Wark Gneiss]					J	Ch Ca	I	R			
							J	Ca	I	R			
							J	Ca	I	R	6	100	90
							J	R	I	R			
							J	R	I	R			
6								Ca	P	R			
		6.14 - 6.19m: highly fractured zone, highly oxidized					J	R	P	R			
		6.39 - 6.47m: highly fractured zone, highly oxidized						R	P	R			
								R	P	R			
								R	P	R			
							J	Py Ca	I	S			
								Ch Ca	I	S			
							J	Py Ca	I	R	13	100	48
7							J	Py	I	R			
		7.1 -2.5 METADIORITE, similar description to 4.02 to 4.97m, highly weathered [Wark Gneiss]					J	Py Ch Ca	P	R			
							J	R Ca	P	S			
								R Ch Ca	P	S			
		7.6 -2.9 METADIORITE, similar description to 4.02 to 4.97m, slightly weathered from 7.62 to 8.01m and from 8.65 to 9.13m, moderately weathered from 8.01 to 8.65m						Py Ca	I	R			
8								C	P	R			
								Ca	I	S			
		8.12 - 8.13m: highly fractured zone					J	Ca	I	R	12	100	70
							J	Ca	I	SL			
								Ca	P	S			
								Ca	P	R			
								Ca	I	S			
9							J	Ca	P	SL			
								Ch Ca	P	SL			

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-09

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
		9.1 -4.5 METADIORITE, similar description to 4.02 to 4.97					J	Py Ca	I R			
		9.63 - 9.70m: highly fractured zone					J	Ca	I SL			
							J	Ch Ca	P SL			
							J	Ca	I R			
		9.79 - 9.83m: highly fractured zone								11	100	79
10							J	Ca	P R			
		10.23 - 10.43m: highly weathered, very weak						Ch Ca	I R			
		10.37 - 10.40m: decomposed rock zone					J	Ca	I SL			
		10.7 -6.0 DYKE, light yellowish green, weak, slightly weathered, lower contact highly fractured, slickensided, very weak					J	Py Ca	P S			
		10.8 -6.2 METADIORITE, coarse grained, dark greenish grey, medium strong, slightly to moderately weathered [Wark Gneiss]					J	Ch Ca	P SL			
11							J	C	I S			
							J	Ch Ca	I R			
								Ch Ca	I R	11	100	88
							J	Ch Ca	P R			
							J	Ch Ca	I S			
								Ch Ca	I S			
12							J	Ch Ca	P S			
		12.2 -7.5 METADIORITE, coarse grained, dark greenish grey, medium strong, moderately weathered [Wark Gneiss] Highly fractured from 12.32 - 12.33m, 12.42 - 12.46m, 13.52 - 13.62m Highly weathered from 12.42 - 12.50m, 12.99 - 13.23, 13.52 - 13.72m Crushed rock zone from 12.55 - 12.62m, 13.11 - 13.16m, 13.54 - 13.55m 12.72 - 12.92m: moderately fractured with no regular pattern					J	Ch Ca	P R			
								Cl	I SL			
							J	C	I S			
							J	Ca	I SL			
							J	Ch Ca	I R			
							J	Ch Ca	P S			
13							J	Ch Ca	P S	9	100	17
							J	Ch Ca	I R			
								Ch Ca	P S			
							J	Ca	P S			
								Ca	I R			
		13.7 -9.0 METADIORITE, coarse grained, dark greenish grey, medium strong, moderately weathered [Wark Gneiss]						Ch Ca	I R			
							J	Ca	P S			
14							J	Ch Ca	I S			

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-09

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30, 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)					J	Py Ca	I	SL			
								Ca	I	R			
							J	Py Ca	P	SL	14	100	57
								Ca	P	S			
							J	Ch Ca	I	SL			
							J	Ch Ca	P	SL			
15		14.88 - 14.98m: highly fractured zone with coarse gravel sized rock fragments					J	Py	P	R			
								Py	P	R			
							J	Py Ch Ca	I	S			
							J	Py Ca	I	S			
								Ch Ca	P	S			
								Ch Ca	I	SL			
				2.60E-09			J	Py Ch Ca	I	SL			
16							J	Py Ca	I	R	12	100	61
		16.38 - 16.39m: highly fractured zone					J	Ch Ca	I	S			
								Ca	I	R			
							J	Ch Ca	P	SL			
							J	Ch Ca	P	SL			
							J	C	P	S			
17							J	C	I	R			
							J	C	I	R			
							J	Ca	I	S			
							J	Py Ca	I	S			
							J	Ca	P	R	12	100	55
								Ca	P	R			
		17.65 - 17.66m: crushed rock zone with fragments size of coarse sand to fine gravel					J	Ca	I	S			
								Py Ca	P	R			
18							J	Ca	P	S			
								Ca	P	R			
		18.28 - 18.29m: crushed rock zone						Ca	P	SL			
		18.3 -13.6 End of Hole at: 18.3 m											
19													

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath

TEST HOLE LOG

STARTED: 12/14/2009 **FINISHED:** 12/14/2009

DRILL METHOD: Mud Rotary

GROUND ELEV. (m): 14.50

COORDINATES (m): N 5364953.49 E 468808.78

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS
					SILT (ML), some clay, some fine sand, trace coarse sand, occasional organics, stiff, brown
3	2/5/3	SPT	SPT 1		
4	3/5/7	SPT	SPT 2		
			Vane 1		[82kPa Peak / 42kPa Residual / 21kPa Remolded - Field Vane]
4.88					
5					9.62 CLAY (CL), some silt, trace fine sand, occasional organics, low to medium plastic, stiff, brown
		TUBE	Shelby 1		[75kPa Peak / 18kPa Residual - Lab Vane]
6	2/3/5	SPT	SPT 3		
			Vane 2		[110kPa Peak - Field Vane]
7.01					
7					7.49 CLAY (CL), some silt, medium to high plastic, very soft, grey
		TUBE	Shelby 2		[42kPa Peak / 12kPa Residual - Lab Vane]
8	0/1/2	SPT	SPT 4		

Continued Next Page

INSTRUMENT DETAILS

Su - kPa
20 60 100 140 180
VANE PEAK ◆ FIELD ■ LAB ▲ UC/2
REMOLD ◇ □ △ P.PEN/2
★ % FINES ● SPT N
W_P% W% W_L%
20 40 60 80

PROJECT NO.: P09632 A01

PROJECT: EGD East End Extension

LOCATION: Esquimalt, Victoria, B.C.

LOGGED BY: AW **CHECKED BY:**

SHEET 1 **OF** 2 **HOLE NO.:** KDH09-10 (V)

Klohn Crippen Berger

TEST HOLE LOG

STARTED: 12/14/2009 **FINISHED:** 12/14/2009

DRILL METHOD: Mud Rotary

GROUND ELEV. (m): 14.50

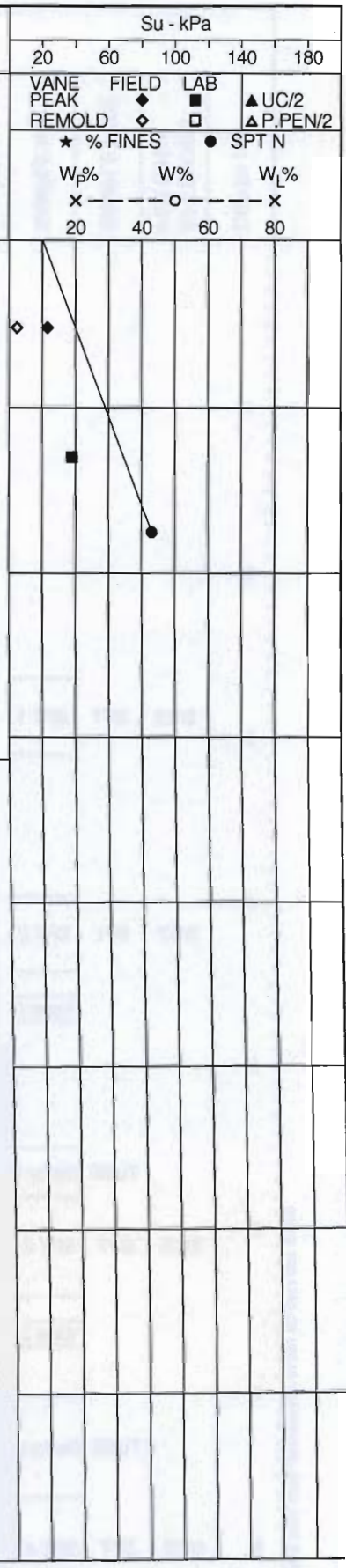
COORDINATES (m): N 5364953.49 E 468808.78

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
			Vane 3		[23kPa Peak / 16kPa Residual / 5kPa Remolded - Field Vane]	
		TUBE	Shelby 3a			
9					[38kPa Peak / 15kPa Residual - Lab Vane]	
		TUBE	Shelby 3b			
					9.75 / 4.75 SAND (SW), coarse grained, some fine to medium grained, some gravel, well graded, dense, subrounded to angular, grey	
10	10/20/23	SPT	SPT 5			
					10.52 / 3.98 BEDROCK {assumed}	
11					11.13 / 3.37 End of Hole at 11.13 m	
12						
13						
14						
15						
16						

1. Drilling was carried out by Foundex Explorations Ltd. Of Surrey, B.C.

2. The hole was backfilled with Cement-bentonite grout consisting of 1 bag cement, 1/2 bag bentonite geland 40 gallons of water.

3. Standard penetration tests (SPT) were conducted using an automatic trip hammer (63.5 kg, 762 mm drop), AWJ rods, and a split spoon sampler (51mm O.D., 38mm I.D.). * 0 blows indicates that the sampler was advanced from the weight of the hammer.



Klohn Crippen Berger

PROJECT NO.: P09632 A01

PROJECT: EGD East End Extension

LOCATION: Esquimalt, Victoria, B.C.

LOGGED BY: AW **CHECKED BY:**

SHEET 2 **OF** 2 **HOLE NO.:** KDH09-10 (V)

TEST HOLE LOG

STARTED: 12/17/2009 **FINISHED:** 12/18/2009

DRILL METHOD: Mud Rotary

GROUND ELEV. (m): 10.00

COORDINATES (m): N 5364932.83 E 468793.62

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
					Silt (ML), some sand, some gravel, trace clay, trace cobbles, low plastic, stiff, brown, some organics. [Fill]	
1.00						
9.00					Silt (ML), sandy, trace clay, trace gravel, low plastic, moist, grey with reddish brown pockets, some organics.	
1						
	0/0/1	SPT	SPT 1			
2						
2.13						
7.87					Silt (MH), clayey, trace sand, high plastic, moist, grey.	
			Vane 1		[23kPa Peak / 23kPa Residual - Field Vane]	
		GRAB	Grab 1		[83kPa Peak / 42kPa Residual / 20kPa Remolded - Field Vane]	
3			Vane 2			
					[25kPa Peak / 8kPa Residual - Lab Vane]	
4		TUBE	Shelby 1			
4.40						
5.60					Clay (CL), silty, trace sand, low plastic, very soft, high dry strength, grey. [49kPa Peak / 25kPa Residual / 15kPa Remolded - Field Vane]	
			Vane 3			
5						
6						
	0/0/0	SPT	SPT 2			
			Vane 4		[45kPa Peak / 22kPa Residual / 9kPa Remolded - Field Vane]	
7						
8						

Continued Next Page

Su - kPa

20 60 100 140 180

VANE PEAK ◆ FIELD ■ LAB ▲UC/2

REMOLD ◇ □ △P.PEN/2

★ % FINES ● SPT N

W_P% W% W_L%

20 40 60 80

Klohn Crippen Berger

PROJECT NO.: P09632 A01

PROJECT: EGD East End Extension

LOCATION: Esquimalt, Victoria, B.C.

LOGGED BY: JW **CHECKED BY:**

TEST HOLE LOG

STARTED: 12/17/2009 **FINISHED:** 12/18/2009

DRILL METHOD: Mud Rotary

GROUND ELEV. (m): 10.00

COORDINATES (m): N 5364932.83 E 468793.62

DEPTH (m)	SPT BLOWS PER 0.15m	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
	0/0/3	SPT	SPT 3		8.29	
					1.71 Sand (SP) coarse grained, some fine grained gravel, poorly graded, dense, greyish brown.	
					8.69	
					1.31 BEDROCK {assumed}	
9	50 (for 1cm)	SPT	~~SPT 4~~		9.15	
					0.85 End of Hole at 9.15 m	

1. Drilling was carried out by Foundex Explorations Ltd. Of Surrey, B.C.

2. The hole was backfilled with Cement-bentonite grout consisting of 1 bag cement, 1/2 bag bentonite geland 40 gallons of water.

3. Standard penetration tests (SPT) were conducted using an automatic trip hammer (63.5 kg, 762 mm drop), AWJ rods, and a split spoon sampler (51mm O.D., 38mm I.D.). * 0 blows indicates that the sampler was advanced from the weight of the hammer.

Su - kPa

20 60 100 140 180

VANE FIELD LAB

PEAK ◆ ■ ▲UC/2

REMOLD ◇ □ △P.PEN/2

★ % FINES ● SPT N

W_P% W% W_L%

× – – – – o – – – – ×

20 40 60 80

Klohn Crippen Berger

PROJECT NO.: P09632 A01

PROJECT: EGD East End Extension

LOCATION: Esquimalt, Victoria, B.C.

LOGGED BY: JW **CHECKED BY:**

SHEET 2 **OF** 2 **HOLE NO.:** KDH09-11 (U)

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-12

CLIENT: PWGSC	PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension	DATE HOLE STARTED: Dec. 19/2009 FINISHED: Dec. 19/2009
LOCATION:	DATUM: Chart
DIRECTION AZIMUTH: DIP (from horiz):	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 468778.13m N 5364926.36m	GROUND ELEVATION: 4.59 m
MANUFACTURER'S DRILL DESIGNATION: HT-700	TOTAL DEPTH OF HOLE: 18.29 m
DRILLING CONTRACTOR: Foundex	DRILLING METHOD SOIL: Vaccum Truck ROCK: HQ Core
LOGGED BY: JW	DRILLING FLUID: Polymer / Water CASED TO: m
CHECKED BY: GWS	HOLE DIA.: HQ3

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY (%) 25 50 75	R.Q.D. (%) 25 50 75
1		FILL, gravels and cobbles with clay											
2													
3		3.0 1.6 METADIORITE, coarse grained, dark greenish grey, thin quartz veinlets, moderately weathered, medium weak, all joints highly oxidized to dark brown/black colour [Wark Gneiss]					J J J J	R Cl C Cl R	I P P P P	R R S S R	0 7	100 60	100 9
4		3.8 - 3.9m: Zone of broken rock											

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-12

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY / JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)					J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gneissosity, M= Schistosity, S= Shear, V= Vein					
		4.4 0.2 METADIORITE, slightly to moderately weathered, weak to medium strong					J	R	P S			
							J	C	P R			
							J	C	P R	9	113 >>	92
								R	I R			
							J	Cl	I R			
5							J	R	P R			
								R Ca	U R			
							J J	R	P R			
							J	R	I S	10	104 >>	79
									R			
							J	R	U R			
								Ca	R S			
							J	Ca	R S			
6							J	Ca	R R			
							J	R	R S			
								R	I S			
							J	Cl	S R			
							J	Cl	R R			
							J	Ca	I R			
							J	R	P S			
							J	Cl	U R			
							J	R	P S			
								R	P R			
							J	C	I S			
							J	Cl	P S			
7							J	R	P R	9	99	85
							J	R	U R			
							J	R	I R			
								Cl	I R			
								C	I R			
							J	Cl	I R			
		7.65m: Shear Zone - 1 cm thick silt infill in joint					J	Si	I R			
							J	Ch	P R			
							J	C	I R			
8							J	C	I R			
							J J	Ch	P S			
								Ch	U R			
							J	Cl	U S			
		8.47 - 8.53m: zone of broken rock, calcite in joints					J	Ch	U S	7	91	53
		8.67 - 8.76m: zone of broken rock										
								C	I R			
9							J	C	I R			
								C	I R			

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath

C3BL_ROCK-SI_WITH DISCONTINUITIES 2009 EGD EEE DRILL LOGS - ROCK R1.GPJ ROCK-LOG.GDT 2/25/10

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-12

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)					J = Joint B= Bedding D= Drill Break F= Foliation G= Gneissosity M= Schistosity S= Shear V= Vein						
10							J	Ca	P	S	5	93	77
							J	C	P	R			
								C	P	R			
							J	Ch	P	R			
							J	Ch	I	R			
							J	Ch	P	S			
							J	C	U	S			
		10.72 - 10.85m: zone of broken rock					J	C	U	S	9	81	17
11													
							J	Ch	P	S			
							J	Ch	I	R			
								Cl	P	S	5	97	66
								Ch	U	R			
							J	C	U	S			
12													
							J	Ch	U	S			
							J	C	I	R			
							J	C	I	S			
							J	C	I	R	4	107 >>	89
							J	C	I	R			
13							J	Ch	I	R			
							J	Ch	I	R			
							J	C	P	S	5	125 >>	36
							J	C	U	S			
14		13.87 - 13.95m: zone of broken rock											

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-12

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)					J = Joint B= Bedding D= Drill Break F= Foliation G= Gneissosity M= Schistosity S= Shear V= Vein					
15							J	Ca	P R	5	96	80
								Ch	P R			
							J	Ch	P R			
							J	C	U S			
								Ch	P R			
							J	C	P S			
								Ch	I R			
16							J	C	I R	3	98	87
							J	Ch	U S			
						J	J	Ch	I R			
								Ca	U S			
17							J	Ch	I R			
							J	Ch	U S	2	100 >>	100
18							J	C	P R			
		18.3 -13.7 End of Hole at: 18.3 m					j	Si	U S			
19												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-13

CLIENT: PWGSC	PROJECT NO.: P09632 A01
PROJECT: EGD East End Extension	DATE HOLE STARTED: Dec. 20/2009 FINISHED: Dec. 20/2009
LOCATION:	DATUM: Chart
DIRECTION AZIMUTH: DIP (from horiz):	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 468779.76m N 5364946.63m	GROUND ELEVATION: 4.59 m
MANUFACTURER'S DRILL DESIGNATION: HT-700	TOTAL DEPTH OF HOLE: 6.1 m
DRILLING CONTRACTOR: Foundex	DRILLING METHOD SOIL: Vaccum Truck ROCK: HQ Core
LOGGED BY: JW	DRILLING FLUID: Water CASED TO: m
CHECKED BY: GWS	HOLE DIA.: HQ3

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY	JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY (%) 25 50 75	R.Q.D. (%) 25 50 75
0		FILL, gravels and cobbles with sand.											
1													
2													
3													
4													

DISCONTINUITY CODES:
J = Joint, B= Bedding, D= Drill Break, F= Foliation, G= Gnessosity, M= Schistosity, S= Shear, V= Vein

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

SHAPE: P: Planar C: Curved I: Irregular

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weath.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DH09-13

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	PERMEABILITY (m/sec) 10-8 10-6 10-4 10-2	ROCK STRENGTH (MPa) (a)=axial; (d)=diametrical	ROCK MASS WEATHERING	DISCONTINUITY DATA (SEE BOTTOM OF FORM FOR CODES) J = Joint B= Bedding D= Drill Break F= Foliation G= Gneissosity M= Schistosity S= Shear V= Vein ANGLE TO 30 60	JOINT INFILL	JOINT PLANARITY JOINT ROUGHNESS	JOINT FREQUENCY (JOINTS PER METRE) 6 12 18	CORE RECOVERY % 25 50 75	R.Q.D. % 25 50 75
		(continued from previous page)										
5												
6		6.1 -1.5 End of Hole at: 6.1 m 1. Hole terminated in a boulder at 6.1 m.										
7												
8												
9												

DISCONTINUITY CODES:

JOINT INFILL: C: Clean Q: Quartz R: Rusty Ch: Chlorite Ca: Calcite P: Pyrite Si: Silt Cl: Clay

SHAPE: P: Planar C: Curved I: Irregular

ROUGHNESS: R: Rough S: Smooth Sl: Slickenside

WEATHERING: F: Fresh SW: Slightly Weathered MW: Moderatly Weathered HW: Highly Weatl

SLR Consulting (Canada) Ltd.
303-3960 Quadra Street, Victoria, BC V8X 4A3

July 3, 2020

Melissa Piasta
Environmental Services
Public Services and Procurement Canada
Esquimalt Graving Dock
825 Admirals Road
Victoria, BC V9A 2P1

SLR Project No.: 205.04024.00000

Dear Ms. Piasta,

RE: Soil Excavation Quality for the East End Dock Extension Construction Project at the Esquimalt Graving Dock, 825 Admirals Road, Victoria, BC

SLR understands that PSPC plans to extend the east end of the graving dock by approximately 30 metres (m) during the proposed East End Dock Extension (EEDE) construction project. The following memorandum presents the estimated soil quality for contractor costing review and purposes. SLR estimated a total soil cut volume of approximately 3,365 cubic metres (m^3) within the boundaries of the EEDE construction project which should be confirmed by the bidding contractors.

The soil excavation quality estimates were based on the following criteria:

- Soil quality was estimated based on limited samples collected within the footprint of the proposed EEDE construction project during previous environmental site investigations. Analysed soil samples had concentrations of one or more metal and/or polycyclic aromatic hydrocarbons (PAHs) greater than the BC Contaminated Sites Regulation (CSR) Industrial land use (IL) most stringent standards.
- Collecting additional soil quality data for spatial coverage would assist with soil classification and quantity refinement.
- The ground surface consists of an approximate 0.05 metre (m) thick asphalt layer that was underlain by an approximate 0.2 m thick concrete layer (in locations BH20-04, BH20-09, BH20-10 and BH-20-11). The asphalt/concrete surface was not accounted for in the soil volume estimates.
- Coarse materials including sand and gravel, gravel and cobbles, cobbles, and/or boulders were generally encountered under the asphalt/concrete to drilling refusal. A clayey silt was encountered in BH 20-09 from approximately 0.4 to 0.9 metres below grade (mbg) and underlain by sand until refusal at 1.4 mbg.
- Drilling refusal (e.g., inferred bedrock or boulders) was encountered across the EEDE area during the drilling investigations from approximately 0.8 to 4.4 mbg.
- The estimated volumes include boulders which should not be disposed as soil, therefore the volumes are potentially overestimated because of the amount of boulders underlying the site.

- The following three soil quality classes were identified in the soil to be excavated during the work:
  - IL+ (metals and PAH): soil characterized by samples with concentrations of metal constituents and PAH parameters greater than the CSR IL use most stringent standards.
  - IL+ (metals): soil characterized by samples with concentrations of metal constituents greater than the CSR IL use most stringent standards.
  - IL-: soil characterized by samples with concentrations of analyzed parameters less than the CSR IL most stringent standards.

To assist with the contractor's potential segregation of excavated material, SLR completed one metre slice diagrams, which indicate the approximate quality of soil on a metre depth basis. The analytical data is also provided.

The slice diagrams highlight the approximate footprint of soil classified as IL+ and the remaining soil is identified as IL-. The estimated volume of soil for each of the three quality classes is provided in Table 1.

Table 1: Soil Volume and Quality

Approximate Slice	Soil Classification	Estimated Volume (m^3)
0-1 mbg	IL+ (metals and PAH)	230
	IL+ (metals)	620
	IL-	635
1-2 mbg	IL+ (metals)	415
	IL-	750
2-3 mbg	IL+ (metals)	145
	IL-	290
3-4+ mbg	IL-	280
TOTAL	**IL+ (metals and PAH)**	**230**
	IL+ (metals)	**1,180**
	IL-	**1,955**
GRAND TOTAL	**-**	**3,365**

Yours sincerely,
SLR Consulting (Canada) Ltd.

BRITISH COLUMBIA INSTITUTE OF AGROLOGISTS 2723 Roberto Prieto 3-Jul-20 P.Ag.

Roberto Prieto
Environmental Scientist
rprieto@slrconsulting.com

Phyllis Bruleigh, M.S., P.Geo.
Technical Discipline Manager
pbruleigh@slrconsulting.com

Enc Slice Diagrams
Analytical Data

RAP/PB/TW/cn

N:\Victoria\Archives\Projects\PWGSC\205.04024.00000 EGD EEDE Spec Review\Deliverables\Letter Report\EEDE Soil Classification Memo.docx

SLICE DIAGRAMS

Soil Excavation Quality for the EEDE Construction Project
Esquimalt Graving Dock
SLR Project No.: 205.04024.00000

Location ID	Sample Depth (mbg)	Analytical Results (compared to CSR IL standards)		
		Metals (1)	PHC	PAH (1)
BH3-1	0.6-0.75	< stds	-	-
BH3-2	0.75-0.9	< stds	< stds	-
BH3-3	0.6-0.75	arsenic = 21 mg/kg	-	-
BH3-4	0.6-0.75	< stds	-	-
BH3-6	0.6-0.75	< stds	-	-
BH3-9	0.45-0.75	-	-	benz(a)anthracene = 21 mg/kg indeno(1,2,3-cd)pyrene = 15 mg/kg
BH3-11	0.33-0.78	-	-	< stds
BH3-12	0.3-0.6	-	-	< stds
A3BH13	0.3-0.61	< stds	-	< stds
A3BH14	0.25-0.76	chromium = 67 mg/kg	< stds	< stds
BH20-04	0.2-0.6	arsenic = 37.6 mg/kg chloride = 142 mg/kg	< stds	benz(a)anthracene = 26 mg/kg benzo(b+j)fluoranthenes = 34 mg/kg indeno(1,2,3-cd)pyrene = 16 mg/kg
BH20-05	0.15-0.45	< stds	< stds	< stds
	0.6-1.1	arsenic = 10.6 mg/kg cobalt = 31.2 mg/kg	< stds	< stds
BH20-06	0.2-0.5	arsenic = 14.4 mg/kg	< stds	< stds
	0.6-1.1	arsenic = 10.2 mg/kg chromium = 67.4 mg/kg	< stds	< stds
BH20-07	0.1-0.3	arsenic = 11.4 mg/kg chromium = 81.6 mg/kg cobalt = 39.3 mg/kg	< stds	< stds
	0.6-1	< stds	< stds	< stds
BH20-09	0.5-0.9	< stds	< stds	< stds

Notes:
(1) Table indicates parameters with concentrations greater than the CSR IL most stringent standards. The remaining parameters in the group not included in the table had concentrations less then or equal to the CSR IL standards
CSR - British Columbia Contaminated Sites Regulation
IL - industrial land
mbg - metres below grade
mg/kg - milligram per kilogram
PAH - polycyclic aromatic hydrocarbons
PHC - petroleum hydrocarbons
PCB - polychlorinated biphenyls
stds - standards
VOC - volatile organic compounds

Parameter	CSR IL standard (mg/kg)
arsenic	10
chromium	65 (1)
chloride	100
cobalt	25
lead	120-150
benz(a)anthracene	10
benzo(b+j)fluoranthenes	10
indeno(1,2,3-cd)pyrene	10

Notes:
(1) Standard is the CSR Protocol 4 background concentration for Vancouver Island

Soil Quality	Approximate Volume (m^3)
IL+ Metals and PAH	230 m^3
IL+ Metals	620 m^3
IL-	635 m^3

Notes:
IL+ (metals and PAH): One or more metal and PAH parameter(s) with concentrations greater than the British Columbia Contaminated Sites Regulation (CSR) Industrial Land (IL) standards
IL+ (metals): One or more metal parameter(s) with concentrations greater than the British Columbia Contaminated Sites Regulation (CSR) Industrial Land (IL) standards
IL-: Parameters with concentrations less than or equal the British Columbia Contaminated Sites Regulation (CSR) Industrial Land (IL) standards
m^2: square metres
m^3: cubic metres

NOTES:
Imagery provided by DND.

LEGEND:

- SITE BOUNDARY
- IL+ (METALS): ONE OR MORE METAL(S) PARAMETER CONCENTRATION(S) GREATER THAN THE CSR IL MOST STRINGENT STANDARDS
- IL+ (METALS AND PAH): ONE OR MORE METAL(S) AND PAH PARAMETER CONCENTRATION(S) GREATER THAN THE CSR IL MOST STRINGENT STANDARDS
- SOIL SAMPLE
- (1.2) APPROXIMATE DEPTH TO REFUSAL AT INFERRED BEDROCK/BOULDERS (mbg)
- **SOIL LABORATORY ANALYSIS RESULTS**
  - CONCENTRATIONS LESS THAN OR EQUAL TO APPLICABLE CSR IL STANDARDS
  - CONCENTRATION(S) GREATER THAN APPLICABLE CSR IL STANDARD(S)
- NO COLOUR — SAMPLE NOT ANALYZED AT THIS DEPTH

0 2.5 5 10 15 m

SCALE 1:300
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM Zone 10 U

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

PUBLIC SERVICES AND PROCUREMENT CANADA
ESQUIMALT GRAVING DOCK
VICTORIA, BC

EAST END DOCK EXTENSION SOIL CHARACTERIZATION

SLICE DIAGRAM: 0 - 1 m

Date: July 2, 2020
Project No. 205.04024.00000
Drawing No. 1

SLR

Cadfile name: N:\Vancouver\CAD\Project Drawings\205\205.04024\205.04024.00000\S_205-04024-00000-A1.dwg

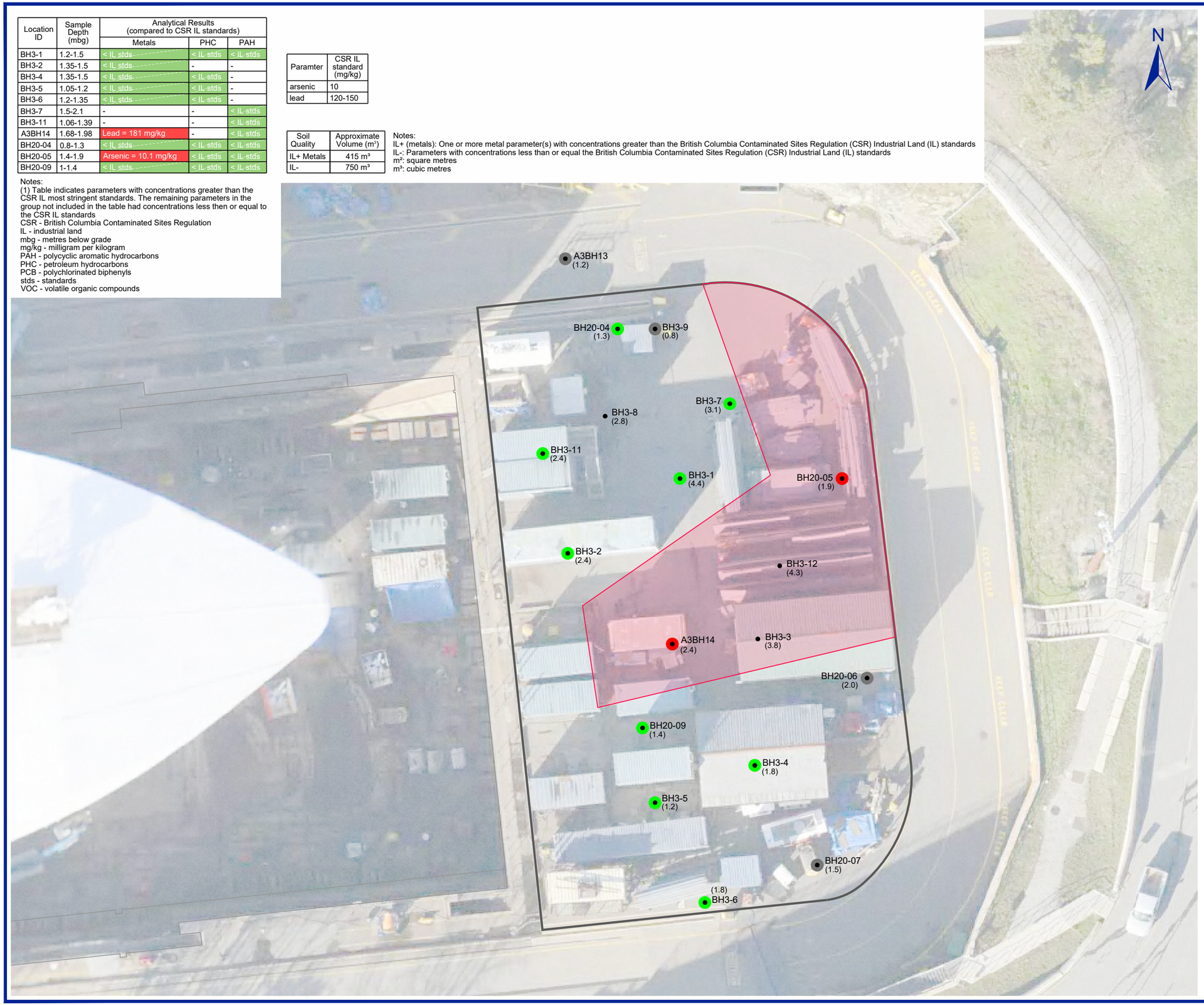
Location ID	Sample Depth (mbg)	Analytical Results (compared to CSR IL standards)		
		Metals	PHC	PAH
BH3-1	1.2-1.5	< IL stds	< IL stds	< IL stds
BH3-2	1.35-1.5	< IL stds	-	-
BH3-4	1.35-1.5	< IL stds	< IL stds	-
BH3-5	1.05-1.2	< IL stds	< IL stds	-
BH3-6	1.2-1.35	< IL stds	< IL stds	-
BH3-7	1.5-2.1	-	-	< IL stds
BH3-11	1.06-1.39	-	-	< IL stds
A3BH14	1.68-1.98	Lead = 181 mg/kg	-	< IL stds
BH20-04	0.8-1.3	< IL stds	< IL stds	< IL stds
BH20-05	1.4-1.9	Arsenic = 10.1 mg/kg	< IL stds	< IL stds
BH20-09	1-1.4	< IL stds	< IL stds	< IL stds

Notes:
(1) Table indicates parameters with concentrations greater than the CSR IL most stringent standards. The remaining parameters in the group not included in the table had concentrations less then or equal to the CSR IL standards
CSR - British Columbia Contaminated Sites Regulation
IL - industrial land
mbg - metres below grade
mg/kg - milligram per kilogram
PAH - polycyclic aromatic hydrocarbons
PHC - petroleum hydrocarbons
PCB - polychlorinated biphenyls
stds - standards
VOC - volatile organic compounds

Paramter	CSR IL standard (mg/kg)
arsenic	10
lead	120-150

Soil Quality	Approximate Volume (m^3)
IL+ Metals	415 m^3
IL-	750 m^3

Notes:
IL+ (metals): One or more metal parameter(s) with concentrations greater than the British Columbia Contaminated Sites Regulation (CSR) Industrial Land (IL) standards
IL-: Parameters with concentrations less than or equal the British Columbia Contaminated Sites Regulation (CSR) Industrial Land (IL) standards
m^2: square metres
m^3: cubic metres



NOTES:
Imagery provided by DND.

LEGEND:

- SITE BOUNDARY
- IL+ (METALS): ONE OR MORE METAL(S) PARAMETER CONCENTRATION(S) GREATER THAN THE CSR IL MOST STRINGENT STANDARDS
- SOIL SAMPLE
- BEDROCK/BOULDERS
- (1.2) APPROXIMATE DEPTH TO REFUSAL AT INFERRED BEDROCK/BOULDERS (mbg)
- **SOIL LABORATORY ANALYSIS RESULTS**
  - CONCENTRATIONS LESS THAN OR EQUAL TO APPLICABLE CSR IL STANDARDS
  - CONCENTRATION(S) GREATER THAN APPLICABLE CSR IL STANDARD(S)
- NO COLOUR — SAMPLE NOT ANALYZED AT THIS DEPTH

0 2.5 5 10 15 m

SCALE 1:300
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM Zone 10 U

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

PUBLIC SERVICES AND PROCUREMENT CANADA
ESQUIMALT GRAVING DOCK
VICTORIA, BC

EAST END DOCK EXTENSION SOIL CHARACTERIZATION

SLICE DIAGRAM: 1 - 2 m

Date: July 2, 2020
Project No. 205.04024.00000
Drawing No. 2

SLR

Cadfile name: N:\Vancouver\CAD\Project Drawings\205\205.04024\205.04024.00000\S_205-04024-00000-A1.dwg

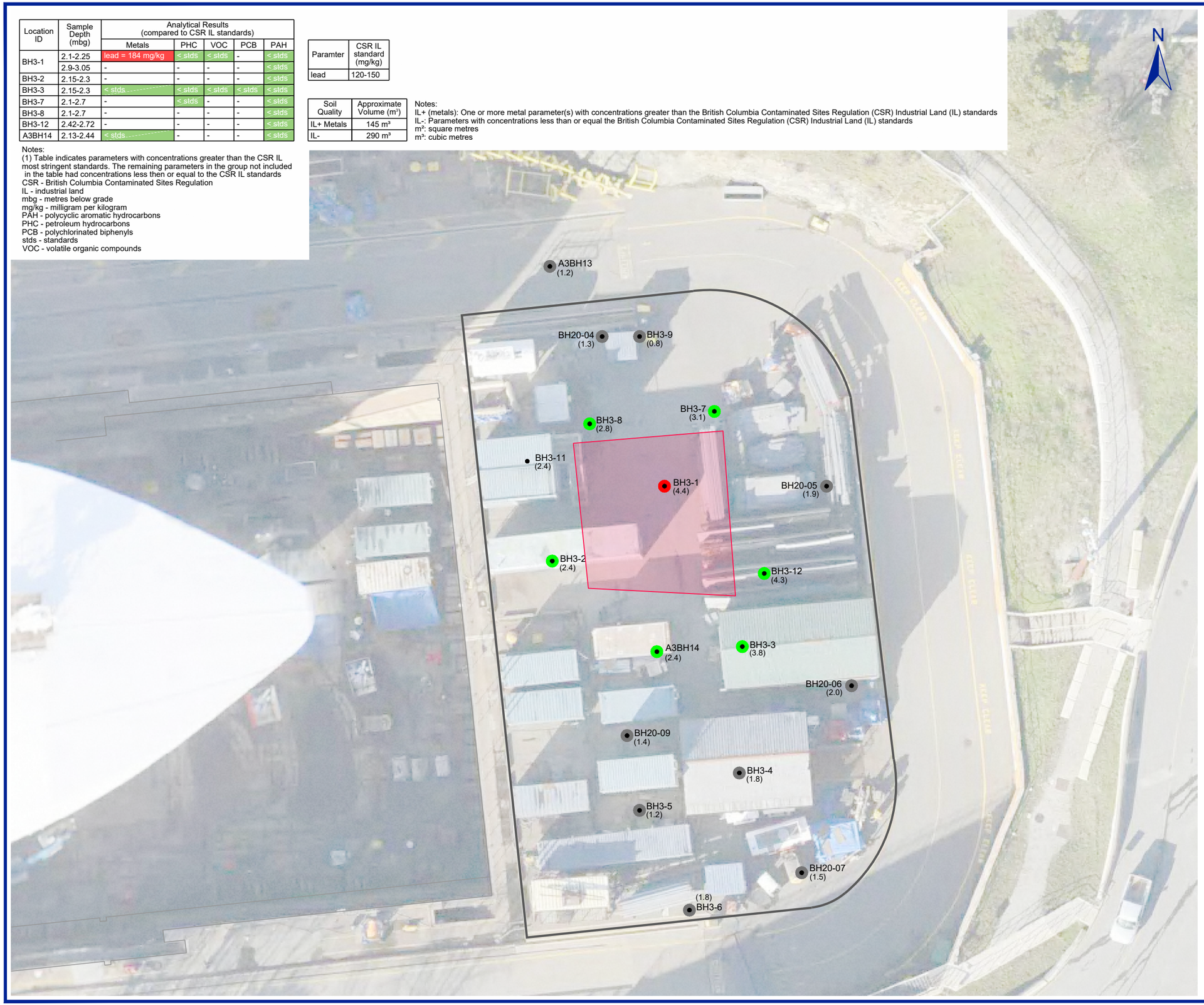
Location ID	Sample Depth (mbg)	Analytical Results (compared to CSR IL standards)				
		Metals	PHC	VOC	PCB	PAH
BH3-1	2.1-2.25	lead = 184 mg/kg	< stds	< stds	-	< stds
	2.9-3.05	-	-	-	-	< stds
BH3-2	2.15-2.3	-	-	-	-	< stds
BH3-3	2.15-2.3	< stds	< stds	< stds	< stds	< stds
BH3-7	2.1-2.7	-	< stds	-	-	< stds
BH3-8	2.1-2.7	-	-	-	-	< stds
BH3-12	2.42-2.72	-	-	-	-	< stds
A3BH14	2.13-2.44	< stds	-	-	-	< stds

Notes:
(1) Table indicates parameters with concentrations greater than the CSR IL most stringent standards. The remaining parameters in the group not included in the table had concentrations less then or equal to the CSR IL standards
CSR - British Columbia Contaminated Sites Regulation
IL - industrial land
mbg - metres below grade
mg/kg - milligram per kilogram
PAH - polycyclic aromatic hydrocarbons
PHC - petroleum hydrocarbons
PCB - polychlorinated biphenyls
stds - standards
VOC - volatile organic compounds

Paramter	CSR IL standard (mg/kg)
lead	120-150

Soil Quality	Approximate Volume (m^3)
IL+ Metals	145 m^3
IL-	290 m^3

Notes:
IL+ (metals): One or more metal parameter(s) with concentrations greater than the British Columbia Contaminated Sites Regulation (CSR) Industrial Land (IL) standards
IL-: Parameters with concentrations less than or equal the British Columbia Contaminated Sites Regulation (CSR) Industrial Land (IL) standards
m^2: square metres
m^3: cubic metres



NOTES:
Imagery provided by DND.

LEGEND:

- SITE BOUNDARY
- IL+ (METALS): ONE OR MORE METAL(S) PARAMETER CONCENTRATION(S) GREATER THAN THE CSR IL MOST STRINGENT STANDARDS
- SOIL SAMPLE
- BEDROCK/BOULDERS
- (1.2) APPROXIMATE DEPTH TO REFUSAL AT INFERRED BEDROCK/BOULDERS (mbg)
- **SOIL LABORATORY ANALYSIS RESULTS**
  - CONCENTRATIONS LESS THAN OR EQUAL TO APPLICABLE CSR IL STANDARDS
  - CONCENTRATION(S) GREATER THAN APPLICABLE CSR IL STANDARD(S)
- NO COLOUR — SAMPLE NOT ANALYZED AT THIS DEPTH

0 2.5 5 10 15 m

SCALE 1:300
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM Zone 10 U

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

PUBLIC SERVICES AND PROCUREMENT CANADA
ESQUIMALT GRAVING DOCK
VICTORIA, BC

EAST END DOCK EXTENSION SOIL CHARACTERIZATION

SLICE DIAGRAM: 2 - 3 m

Date: July 2, 2020
Project No. 205.04024.00000
Drawing No. 3

SLR

Cadfile name: N:\Vancouver\CAD\Project Drawings\205\205.04024205.04024.00000S_205-04024-00000-A1.dwg

Location ID	Sample Depth (mbg)	Analytical Results (compared to CSR IL standards)
		Metals
BH3-1	4.25-4.44	< stds
BH3-3	3.65-3.8	< stds

Notes:
CSR - British Columbia Contaminated Sites Regulation
IL - industrial land
mbg - metres below grade
mg/kg - milligram per kilogram
PAH - polycyclic aromatic hydrocarbons
PHC - petroleum hydrocarbons
PCB - polychlorinated biphenyls
stds - standards
VOC - volatile organic compounds

Soil Quality	Approximate Volume (m^3)
IL-	280 m^3

Notes:
IL-: Parameters with concentrations less than or equal the British Columbia Contaminated Sites Regulation (CSR) Industrial Land (IL) standards
m^2: square metres
m^3: cubic metres

NOTES:
Imagery provided by DND.

LEGEND:

- SITE BOUNDARY
- SOIL SAMPLE
- BEDROCK/BOULDERS
- (1.2) APPROXIMATE DEPTH TO REFUSAL AT INFERRED BEDROCK/BOULDERS (mbg)
- **SOIL LABORATORY ANALYSIS RESULTS** CONCENTRATIONS LESS THAN OR EQUAL TO APPLICABLE CSR IL STANDARDS
- NO COLOUR — SAMPLE NOT ANALYZED AT THIS DEPTH

0 2.5 5 10 15 m

SCALE 1:300
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM Zone 10 U

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

PUBLIC SERVICES AND PROCUREMENT CANADA
ESQUIMALT GRAVING DOCK
VICTORIA, BC

EAST END DOCK EXTENSION SOIL CHARACTERIZATION

SLICE DIAGRAM: 3 - 4+ m

Date: July 2, 2020
Project No. 205.04024.00000
Drawing No. 4

SLR

Cadfile name: N:\Vancouver\CAD\Project Drawings\205\205.04024\205.04024.00000\S_205-04024-00000-A1.dwg

ANALYTICAL DATA

Soil Excavation Quality for the EEDE Construction Project
Esquimalt Graving Dock
SLR Project No.: 205.04024.00000

Your P.O. #: VIC3255
Your Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your C.O.C. #: 601728-01-01, 601728-02-01

Attention: Roberto Prieto

SLR CONSULTING (CANADA) LTD
#303-3960 Quadra Street
VICTORIA, BC
CANADA V8X 4A3

Report Date: 2020/03/19
Report #: R2860088
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C017076
Received: 2020/03/06, 08:45

Sample Matrix: Soil
Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
BTEX/MTBE LH VH F1 in Soil - Field Pres. (1)	6	N/A	2020/03/08	BBY8SOP-00010 / BBY8SOP-00011 / BBY8SOP-00012	BCMOE BCLM Jul 2017
Chloride (soluble)	1	2020/03/08	2020/03/09	BBY6SOP-00011	SM 23 4500-Cl- E m
Chloride (soluble)	11	2020/03/09	2020/03/09	BBY6SOP-00011	SM 23 4500-Cl- E m
Soluble Chloride Ion Calc. (mg/kg)	12	N/A	2020/03/09	BBY WI-00033	Auto Calc
Elements by ICPMS (total)	11	2020/03/10	2020/03/10	BBY7SOP-00004 / BBY7SOP-00001	EPA 6020b R2 m
Elements by ICPMS (total)	1	2020/03/10	2020/03/11	BBY7SOP-00004 / BBY7SOP-00001	EPA 6020b R2 m
Metals - TCLP	1	2020/03/17	2020/03/18	BBY7SOP-00005 / BBY7SOP-00001	EPA 1311, 6020bR2 m
Moisture	12	2020/03/09	2020/03/10	BBY8SOP-00017	BCMOE BCLM Dec2000 m
Soluble Sodium Ion Calc. (mg/kg)	12	N/A	2020/03/10	BBY WI-00033	Auto Calc
PAH in TCLP Leachate by GC/MS (SIM)	1	2020/03/18	2020/03/18	BBY7SOP-00005 / BBY8SOP-00021	BCMOE BCLM Jul2017m
PAH in Soil by GC/MS (SIM)	9	2020/03/09	2020/03/09	BBY8SOP-00022	BCMOE BCLM Jul2017m
PAH in Soil by GC/MS (SIM)	3	2020/03/09	2020/03/10	BBY8SOP-00022	BCMOE BCLM Jul2017m
Total LMW, HMW, Total PAH Calc (2)	1	N/A	2020/03/19	BBY WI-00033	Auto Calc
Total PAH and B(a)P Calculation (3)	11	N/A	2020/03/10	BBY WI-00033	Auto Calc
Total PAH and B(a)P Calculation (3)	1	N/A	2020/03/11	BBY WI-00033	Auto Calc
pH (2:1 DI Water Extract)	12	2020/03/09	2020/03/09	BBY6SOP-00028	BCMOE BCLM Mar2005 m
TCLP pH Measurements	1	N/A	2020/03/18	BBY7SOP-00005	EPA 1311
Saturated Paste	1	2020/03/08	2020/03/09	BBY6SOP-00030	BC Lab Manual 2015 m
Saturated Paste	11	2020/03/09	2020/03/09	BBY6SOP-00030	BC Lab Manual 2015 m
Soluble Cations (Ca,K,Mg,Na,S)	12	N/A	2020/03/10	BBY7SOP-00018 / BBY7SOP-00030 / BCLM Nov 2015	EPA 6010d m
EPH less PAH in Soil By GC/FID (4)	11	N/A	2020/03/10	BBY WI-00033	Auto Calc
EPH less PAH in Soil By GC/FID (4)	1	N/A	2020/03/11	BBY WI-00033	Auto Calc
EPH in Soil by GC/FID	10	2020/03/09	2020/03/09	BBY8SOP-00029	BCMOE BCLM Dec2016 m
EPH in Soil by GC/FID	2	2020/03/09	2020/03/10	BBY8SOP-00029	BCMOE BCLM Dec2016 m
Volatile HC-BTEX for Soil (5)	6	N/A	2020/03/10	BBY WI-00033	Auto Calc

Your P.O. #: VIC3255
Your Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your C.O.C. #: 601728-01-01, 601728-02-01

Attention: Roberto Prieto

SLR CONSULTING (CANADA) LTD
#303-3960 Quadra Street
VICTORIA, BC
CANADA V8X 4A3

Report Date: 2020/03/19
Report #: R2860088
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C017076
Received: 2020/03/06, 08:45

Remarks:

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) The extraction date for VOC, BTEX, VH, or F1 samples that are field preserved with methanol equals the date sampled, unless otherwise stated.
(2) Total PAHs include: Quinoline, Naphthalene, 1-Methylnaphthalene, 2-Methylnaphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Acridine, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b&j)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, and Benzo (g,h,i)perylene.
(3) Total PAHs in Soil include: Quinoline, Naphthalene, 1-Methylnaphthalene, 2-Methylnaphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Acridine, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b&j)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, and Benzo(g,h,i)perylene.

Total PAHs in Sediment include (B.C. Reg. 116/2018, Schedule 3.4): Naphthalene, 2-Methylnaphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(a)pyrene, and Dibenz(a,h)anthracene.
(4) LEPH = EPH (C10 to C19) - (Naphthalene + Phenanthrene)
HEPH = EPH (C19 to C32) - (Benzo(a)anthracene + Benzo(a)pyrene + Benzo(b)fluoranthene + Benzo(k)fluoranthene + Dibenz(a,h)anthracene + Indeno(1,2,3-cd)pyrene + Pyrene)
(5) VPH = VH - (Benzene + Toluene + Ethylbenzene + m & p-Xylene + o-Xylene + Styrene)

Your P.O. #: VIC3255
Your Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your C.O.C. #: 601728-01-01, 601728-02-01

Attention: Roberto Prieto

SLR CONSULTING (CANADA) LTD
#303-3960 Quadra Street
VICTORIA, BC
CANADA V8X 4A3

Report Date: 2020/03/19
Report #: R2860088
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C017076
Received: 2020/03/06, 08:45

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Safiann Maiter, Key Account Specialist
Email: Safiann.Maiter@bvlabs.com
Phone# (604)639-2616

==========

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

RESULTS OF CHEMICAL ANALYSES OF SOIL

BV Labs ID		XM8995		
Sampling Date		2020/03/04 11:20		
COC Number		601728-01-01		
	UNITS	**BH20-04_0.2-0.6**	**RDL**	**QC Batch**
Calculated Parameters				
Leachate Low Molecular Weight PAH`s	ug/L	<0.50	0.50	9797887
Leachate High Molecular Weight PAH`s	ug/L	<0.20	0.20	9797887
Leachate Total PAH	ug/L	<0.50	0.50	9797887
RDL = Reportable Detection Limit				

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

PHYSICAL TESTING (SOIL)

BV Labs ID		XM8992		XM8993		XM8994	XM8995		
Sampling Date		2020/03/04 09:45		2020/03/04 09:50		2020/03/04 09:55	2020/03/04 11:20		
COC Number		601728-01-01		601728-01-01		601728-01-01	601728-01-01		
	UNITS	**BH20-05_0.15-0.45**	**QC Batch**	**BH20-05_0.6-1.1**	**QC Batch**	**BH20-04_1.4-1.9**	**BH20-04_0.2-0.6**	**RDL**	**QC Batch**
Physical Properties									
Moisture	%	5.1	9790847	7.5	9790995	8.3	10	0.30	9790847
RDL = Reportable Detection Limit									

BV Labs ID		XM8996	XM8997	XM8998	XM8999		
Sampling Date		2020/03/04 11:25	2020/03/04 12:30	2020/03/04 12:35	2020/03/04 14:55		
COC Number		601728-01-01	601728-01-01	601728-01-01	601728-01-01		
	UNITS	**BH20-04_0.8-1.3**	**BH20-09_0.5-0.9**	**BH20-09_1.0-1.4**	**BH20-06_0.2-0.5**	**RDL**	**QC Batch**
Physical Properties							
Moisture	%	15	20	12	5.3	0.30	9790847
RDL = Reportable Detection Limit							

BV Labs ID		XM9000	XM9001	XM9012	XM9013		
Sampling Date		2020/03/04 15:00	2020/03/04 15:00	2020/03/04 15:50	2020/03/04 15:55		
COC Number		601728-01-01	601728-01-01	601728-02-01	601728-02-01		
	UNITS	**BH20-06_0.6-1.1**	**DUP-A**	**BH20-07_0.1-0.3**	**BH20-07_0.6-1.0**	**RDL**	**QC Batch**
Physical Properties							
Moisture	%	8.6	6.9	5.9	8.6	0.30	9790995
RDL = Reportable Detection Limit							

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

SEMIVOLATILE ORGANICS BY GC-MS (SOIL)

BV Labs ID		XM8995		
Sampling Date		2020/03/04 11:20		
COC Number		601728-01-01		
	UNITS	**BH20-04_0.2-0.6**	**RDL**	**QC Batch**
Polycyclic Aromatics				
Leachate Naphthalene	ug/L	0.13	0.10	9801670
Leachate 2-Methylnaphthalene	ug/L	<0.10	0.10	9801670
Leachate Quinoline	ug/L	<0.50	0.50	9801670
Leachate Acenaphthylene	ug/L	0.11	0.10	9801670
Leachate Acenaphthene	ug/L	<0.10	0.10	9801670
Leachate Fluorene	ug/L	<0.10	0.10	9801670
Leachate Phenanthrene	ug/L	<0.10	0.10	9801670
Leachate Anthracene	ug/L	<0.10	0.10	9801670
Leachate Acridine	ug/L	<0.50	0.50	9801670
Leachate Fluoranthene	ug/L	<0.10	0.10	9801670
Leachate Pyrene	ug/L	<0.10	0.10	9801670
Leachate Benzo(a)anthracene	ug/L	<0.10	0.10	9801670
Leachate Chrysene	ug/L	<0.10	0.10	9801670
Leachate Benzo(b&j)fluoranthene	ug/L	<0.10	0.10	9801670
Leachate Benzo(k)fluoranthene	ug/L	<0.10	0.10	9801670
Leachate Benzo(a)pyrene	ug/L	<0.10	0.10	9801670
Leachate Indeno(1,2,3-cd)pyrene	ug/L	<0.20	0.20	9801670
Leachate Dibenz(a,h)anthracene	ug/L	<0.20	0.20	9801670
Leachate Benzo(g,h,i)perylene	ug/L	<0.20	0.20	9801670
Surrogate Recovery (%)				
Leachate D10-ANTHRACENE (sur.)	%	106		9801670
Leachate D8-ACENAPHTHYLENE (sur.)	%	92		9801670
Leachate D8-NAPHTHALENE (sur.)	%	95		9801670
Leachate TERPHENYL-D14 (sur.)	%	96		9801670
RDL = Reportable Detection Limit				

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

BV Labs ID		XM8995		
Sampling Date		2020/03/04 11:20		
COC Number		601728-01-01		
	UNITS	**BH20-04_0.2-0.6**	**RDL**	**QC Batch**
TCLP Extraction Procedure				
Leachate Antimony (Sb)	mg/L	<0.10	0.10	9801623
Leachate Arsenic (As)	mg/L	<0.10	0.10	9801623
Leachate Barium (Ba)	mg/L	0.48	0.10	9801623
Leachate Beryllium (Be)	mg/L	<0.10	0.10	9801623
Leachate Boron (B)	mg/L	0.16	0.10	9801623
Leachate Cadmium (Cd)	mg/L	<0.10	0.10	9801623
Leachate Chromium (Cr)	mg/L	<0.10	0.10	9801623
Leachate Cobalt (Co)	mg/L	<0.10	0.10	9801623
Leachate Copper (Cu)	mg/L	0.12	0.10	9801623
Leachate Iron (Fe)	mg/L	<0.50	0.50	9801623
Leachate Lead (Pb)	mg/L	<0.10	0.10	9801623
Leachate Mercury (Hg)	mg/L	<0.0020	0.0020	9801623
Leachate Molybdenum (Mo)	mg/L	<0.10	0.10	9801623
Leachate Nickel (Ni)	mg/L	<0.10	0.10	9801623
Leachate Selenium (Se)	mg/L	<0.10	0.10	9801623
Leachate Silver (Ag)	mg/L	<0.010	0.010	9801623
Leachate Thallium (Tl)	mg/L	<0.10	0.10	9801623
Leachate Uranium (U)	mg/L	<0.10	0.10	9801623
Leachate Vanadium (V)	mg/L	<0.10	0.10	9801623
Leachate Zinc (Zn)	mg/L	0.25	0.10	9801623
Leachate Zirconium (Zr)	mg/L	<0.10	0.10	9801623
Initial pH of Sample	pH	9.80	N/A	9800410
pH after HCl	pH	1.49	N/A	9800410
Final pH of Leachate	pH	5.55	N/A	9800410
pH of Leaching Fluid	pH	4.91	N/A	9800410

RDL = Reportable Detection Limit
N/A = Not Applicable

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

CSR BTEX/VPH IN SOIL - FIELD PRESERVED (SOIL)

BV Labs ID		XM8993	XM8995	XM8997	XM9000	XM9001		
Sampling Date		2020/03/04 09:50	2020/03/04 11:20	2020/03/04 12:30	2020/03/04 15:00	2020/03/04 15:00		
COC Number		601728-01-01	601728-01-01	601728-01-01	601728-01-01	601728-01-01		
	UNITS	**BH20-05_0.6-1.1**	**BH20-04_0.2-0.6**	**BH20-09_0.5-0.9**	**BH20-06_0.6-1.1**	**DUP-A**	**RDL**	**QC Batch**
Calculated Parameters								
VPH (VHW6 to 10 - BTEX)	mg/kg	<10	<10	<10	<10	<10	10	9789350
Volatiles								
Methyl-tert-butylether (MTBE)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	9790497
Benzene	mg/kg	<0.0050	0.012	<0.0050	<0.0050	<0.0050	0.0050	9790497
Toluene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	0.050	9790497
Ethylbenzene	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	9790497
m & p-Xylene	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	9790497
o-Xylene	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	9790497
Styrene	mg/kg	<0.030	<0.030	<0.030	<0.030	<0.030	0.030	9790497
Xylenes (Total)	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	9790497
VH C6-C10	mg/kg	<10	<10	<10	<10	<10	10	9790497
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	99	102	112	101	105		9790497
4-Bromofluorobenzene (sur.)	%	102	100	100	101	101		9790497
D10-ETHYLBENZENE (sur.)	%	98	99	98	103	102		9790497
D4-1,2-Dichloroethane (sur.)	%	114	109	112	105	113		9790497

RDL = Reportable Detection Limit

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

CSR BTEX/VPH IN SOIL - FIELD PRESERVED (SOIL)

BV Labs ID		XM9012		
Sampling Date		2020/03/04 15:50		
COC Number		601728-02-01		
	UNITS	**BH20-07_0.1-0.3**	**RDL**	**QC Batch**
Calculated Parameters				
VPH (VHW6 to 10 - BTEX)	mg/kg	<10	10	9789350
Volatiles				
Methyl-tert-butylether (MTBE)	mg/kg	<0.10	0.10	9790497
Benzene	mg/kg	<0.0050	0.0050	9790497
Toluene	mg/kg	<0.050	0.050	9790497
Ethylbenzene	mg/kg	<0.010	0.010	9790497
m & p-Xylene	mg/kg	<0.040	0.040	9790497
o-Xylene	mg/kg	<0.040	0.040	9790497
Styrene	mg/kg	<0.030	0.030	9790497
Xylenes (Total)	mg/kg	<0.040	0.040	9790497
VH C6-C10	mg/kg	<10	10	9790497
Surrogate Recovery (%)				
1,4-Difluorobenzene (sur.)	%	114		9790497
4-Bromofluorobenzene (sur.)	%	102		9790497
D10-ETHYLBENZENE (sur.)	%	101		9790497
D4-1,2-Dichloroethane (sur.)	%	114		9790497
RDL = Reportable Detection Limit				

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

LEPH & HEPH WITH PAH FOR CSR IN SOIL (SOIL)

BV Labs ID		XM8992		XM8993		XM8994		
Sampling Date		2020/03/04 09:45		2020/03/04 09:50		2020/03/04 09:55		
COC Number		601728-01-01		601728-01-01		601728-01-01		
	UNITS	**BH20-05_0.15-0.45**	**QC Batch**	**BH20-05_0.6-1.1**	**QC Batch**	**BH20-04_1.4-1.9**	**RDL**	**QC Batch**
Calculated Parameters								
Low Molecular Weight PAH`s	mg/kg	<0.050	9789313	0.056	9789313	<0.050	0.050	9789313
High Molecular Weight PAH`s	mg/kg	<0.050	9789313	0.43	9789313	0.26	0.050	9789313
Total PAH	mg/kg	<0.050	9789313	0.49	9789313	0.29	0.050	9789313
Polycyclic Aromatics								
Quinoline	mg/kg	<0.050	9791007	<0.050	9791343	<0.050	0.050	9791007
Naphthalene	mg/kg	<0.010	9791007	<0.010	9791343	<0.010	0.010	9791007
1-Methylnaphthalene	mg/kg	<0.050	9791007	<0.050	9791343	<0.050	0.050	9791007
2-Methylnaphthalene	mg/kg	<0.020	9791007	<0.020	9791343	<0.020	0.020	9791007
Acenaphthylene	mg/kg	<0.0050	9791007	0.012	9791343	0.0077	0.0050	9791007
Acenaphthene	mg/kg	<0.0050	9791007	<0.0050	9791343	<0.0050	0.0050	9791007
Fluorene	mg/kg	<0.020	9791007	<0.020	9791343	<0.020	0.020	9791007
Phenanthrene	mg/kg	<0.010	9791007	0.032	9791343	0.021	0.010	9791007
Anthracene	mg/kg	<0.0040	9791007	0.012	9791343	0.0061	0.0040	9791007
Fluoranthene	mg/kg	<0.020	9791007	0.081	9791343	0.055	0.020	9791007
Pyrene	mg/kg	<0.020	9791007	0.083	9791343	0.058	0.020	9791007
Benzo(a)anthracene	mg/kg	<0.020	9791007	0.046	9791343	0.029	0.020	9791007
Chrysene	mg/kg	<0.020	9791007	0.050	9791343	0.033	0.020	9791007
Benzo(b&j)fluoranthene	mg/kg	<0.020	9791007	0.065	9791343	0.028	0.020	9791007
Benzo(b)fluoranthene	mg/kg	<0.020	9791007	0.039	9791343	0.028	0.020	9791007
Benzo(k)fluoranthene	mg/kg	<0.020	9791007	0.023	9791343	<0.020	0.020	9791007
Benzo(a)pyrene	mg/kg	<0.020	9791007	0.051	9791343	0.034	0.020	9791007
Indeno(1,2,3-cd)pyrene	mg/kg	<0.020	9791007	0.034	9791343	0.020	0.020	9791007
Dibenz(a,h)anthracene	mg/kg	<0.020	9791007	<0.020	9791343	<0.020	0.020	9791007
Benzo(g,h,i)perylene	mg/kg	<0.050	9791007	<0.050	9791343	<0.050	0.050	9791007
Calculated Parameters								
LEPH (C10-C19 less PAH)	mg/kg	<100	9789348	<100	9789348	<100	100	9789348
HEPH (C19-C32 less PAH)	mg/kg	<100	9789348	<100	9789348	<100	100	9789348
Hydrocarbons								
EPH (C10-C19)	mg/kg	<100	9790999	<100	9791350	<100	100	9790999
EPH (C19-C32)	mg/kg	<100	9790999	<100	9791350	<100	100	9790999
RDL = Reportable Detection Limit								

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

LEPH & HEPH WITH PAH FOR CSR IN SOIL (SOIL)

BV Labs ID		XM8992		XM8993		XM8994		
Sampling Date		2020/03/04 09:45		2020/03/04 09:50		2020/03/04 09:55		
COC Number		601728-01-01		601728-01-01		601728-01-01		
	UNITS	**BH20-05_0.15-0.45**	**QC Batch**	**BH20-05_0.6-1.1**	**QC Batch**	**BH20-04_1.4-1.9**	**RDL**	**QC Batch**
Surrogate Recovery (%)								
D10-ANTHRACENE (sur.)	%	70	9791007	73	9791343	73		9791007
D8-ACENAPHTHYLENE (sur.)	%	72	9791007	71	9791343	72		9791007
D8-NAPHTHALENE (sur.)	%	71	9791007	68	9791343	73		9791007
TERPHENYL-D14 (sur.)	%	72	9791007	70	9791343	73		9791007
O-TERPHENYL (sur.)	%	91	9790999	93	9791350	92		9790999
RDL = Reportable Detection Limit								

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

LEPH & HEPH WITH PAH FOR CSR IN SOIL (SOIL)

BV Labs ID		XM8995		XM8996	XM8997	XM8998		
Sampling Date		2020/03/04 11:20		2020/03/04 11:25	2020/03/04 12:30	2020/03/04 12:35		
COC Number		601728-01-01		601728-01-01	601728-01-01	601728-01-01		
	UNITS	**BH20-04_0.2-0.6**	**RDL**	**BH20-04_0.8-1.3**	**BH20-09_0.5-0.9**	**BH20-09_1.0-1.4**	**RDL**	**QC Batch**
Calculated Parameters								
Low Molecular Weight PAH`s	mg/kg	18	0.050	<0.050	<0.050	<0.050	0.050	9789313
High Molecular Weight PAH`s	mg/kg	260	0.50	0.22	<0.050	<0.050	0.050	9789313
Total PAH	mg/kg	280	0.50	0.24	<0.050	<0.050	0.050	9789313
Polycyclic Aromatics								
Quinoline	mg/kg	<0.050	0.050	<0.050	<0.050	<0.050	0.050	9791007
Naphthalene	mg/kg	0.094	0.010	<0.010	<0.010	<0.010	0.010	9791007
1-Methylnaphthalene	mg/kg	0.061	0.050	<0.050	<0.050	<0.050	0.050	9791007
2-Methylnaphthalene	mg/kg	0.053	0.020	<0.020	<0.020	<0.020	0.020	9791007
Acenaphthylene	mg/kg	3.8	0.0050	0.0069	<0.0050	<0.0050	0.0050	9791007
Acenaphthene	mg/kg	0.27	0.0050	<0.0050	<0.0050	<0.0050	0.0050	9791007
Fluorene	mg/kg	0.61	0.020	<0.020	<0.020	<0.020	0.020	9791007
Phenanthrene	mg/kg	9.4	0.010	0.010	<0.010	<0.010	0.010	9791007
Anthracene	mg/kg	3.8	0.0040	0.0050	<0.0040	<0.0040	0.0040	9791007
Fluoranthene	mg/kg	48 (1)	0.20	0.051	<0.020	0.022	0.020	9791007
Pyrene	mg/kg	52 (1)	0.20	0.055	<0.020	0.024	0.020	9791007
Benzo(a)anthracene	mg/kg	26 (1)	0.20	0.028	<0.020	<0.020	0.020	9791007
Chrysene	mg/kg	26 (1)	0.20	0.030	<0.020	<0.020	0.020	9791007
Benzo(b&j)fluoranthene	mg/kg	34 (1)	0.20	0.024	<0.020	<0.020	0.020	9791007
Benzo(b)fluoranthene	mg/kg	20 (1)	0.20	0.024	<0.020	<0.020	0.020	9791007
Benzo(k)fluoranthene	mg/kg	8.6	0.020	<0.020	<0.020	<0.020	0.020	9791007
Benzo(a)pyrene	mg/kg	30 (1)	0.20	0.032	<0.020	<0.020	0.020	9791007
Indeno(1,2,3-cd)pyrene	mg/kg	16 (1)	0.20	<0.020	<0.020	<0.020	0.020	9791007
Dibenz(a,h)anthracene	mg/kg	3.9	0.020	<0.020	<0.020	<0.020	0.020	9791007
Benzo(g,h,i)perylene	mg/kg	16 (1)	0.50	<0.050	<0.050	<0.050	0.050	9791007
Calculated Parameters								
LEPH (C10-C19 less PAH)	mg/kg	<100	100	<100	<100	<100	100	9789348
HEPH (C19-C32 less PAH)	mg/kg	1000	100	<100	<100	<100	100	9789348
Hydrocarbons								
EPH (C10-C19)	mg/kg	100	100	<100	<100	<100	100	9790999
EPH (C19-C32)	mg/kg	1200	100	<100	<100	<100	100	9790999

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

LEPH & HEPH WITH PAH FOR CSR IN SOIL (SOIL)

BV Labs ID		XM8995		XM8996	XM8997	XM8998		
Sampling Date		2020/03/04 11:20		2020/03/04 11:25	2020/03/04 12:30	2020/03/04 12:35		
COC Number		601728-01-01		601728-01-01	601728-01-01	601728-01-01		
	UNITS	**BH20-04_0.2-0.6**	**RDL**	**BH20-04_0.8-1.3**	**BH20-09_0.5-0.9**	**BH20-09_1.0-1.4**	**RDL**	**QC Batch**
Surrogate Recovery (%)								
D10-ANTHRACENE (sur.)	%	75		72	75	73		9791007
D8-ACENAPHTHYLENE (sur.)	%	69		72	75	72		9791007
D8-NAPHTHALENE (sur.)	%	72		71	75	70		9791007
TERPHENYL-D14 (sur.)	%	79		74	76	74		9791007
O-TERPHENYL (sur.)	%	98		88	91	89		9790999
RDL = Reportable Detection Limit								

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

LEPH & HEPH WITH PAH FOR CSR IN SOIL (SOIL)

BV Labs ID		XM8999		XM9000		XM9001	XM9012		
Sampling Date		2020/03/04 14:55		2020/03/04 15:00		2020/03/04 15:00	2020/03/04 15:50		
COC Number		601728-01-01		601728-01-01		601728-01-01	601728-02-01		
	UNITS	**BH20-06_0.2-0.5**	**QC Batch**	**BH20-06_0.6-1.1**	**QC Batch**	**DUP-A**	**BH20-07_0.1-0.3**	**RDL**	**QC Batch**
Calculated Parameters									
Low Molecular Weight PAH`s	mg/kg	<0.050	9789313	<0.050	9789313	<0.050	<0.050	0.050	9789313
High Molecular Weight PAH`s	mg/kg	<0.050	9789313	0.12	9789313	0.27	<0.050	0.050	9789313
Total PAH	mg/kg	<0.050	9789313	0.14	9789313	0.30	<0.050	0.050	9789313
Polycyclic Aromatics									
Quinoline	mg/kg	<0.050	9791007	<0.050	9791343	<0.050	<0.050	0.050	9791007
Naphthalene	mg/kg	<0.010	9791007	<0.010	9791343	<0.010	<0.010	0.010	9791007
1-Methylnaphthalene	mg/kg	<0.050	9791007	<0.050	9791343	<0.050	<0.050	0.050	9791007
2-Methylnaphthalene	mg/kg	<0.020	9791007	<0.020	9791343	<0.020	<0.020	0.020	9791007
Acenaphthylene	mg/kg	<0.0050	9791007	<0.0050	9791343	0.0078	<0.0050	0.0050	9791007
Acenaphthene	mg/kg	<0.0050	9791007	<0.0050	9791343	<0.0050	<0.0050	0.0050	9791007
Fluorene	mg/kg	<0.020	9791007	<0.020	9791343	<0.020	<0.020	0.020	9791007
Phenanthrene	mg/kg	<0.010	9791007	0.016	9791343	0.019	<0.010	0.010	9791007
Anthracene	mg/kg	<0.0040	9791007	0.0057	9791343	0.0057	<0.0040	0.0040	9791007
Fluoranthene	mg/kg	<0.020	9791007	0.035	9791343	0.058	<0.020	0.020	9791007
Pyrene	mg/kg	<0.020	9791007	0.037	9791343	0.062	<0.020	0.020	9791007
Benzo(a)anthracene	mg/kg	<0.020	9791007	<0.020	9791343	0.030	<0.020	0.020	9791007
Chrysene	mg/kg	<0.020	9791007	0.022	9791343	0.034	<0.020	0.020	9791007
Benzo(b&j)fluoranthene	mg/kg	<0.020	9791007	<0.020	9791343	0.029	<0.020	0.020	9791007
Benzo(b)fluoranthene	mg/kg	<0.020	9791007	<0.020	9791343	0.029	<0.020	0.020	9791007
Benzo(k)fluoranthene	mg/kg	<0.020	9791007	<0.020	9791343	<0.020	<0.020	0.020	9791007
Benzo(a)pyrene	mg/kg	<0.020	9791007	0.022	9791343	0.036	<0.020	0.020	9791007
Indeno(1,2,3-cd)pyrene	mg/kg	<0.020	9791007	<0.020	9791343	0.022	<0.020	0.020	9791007
Dibenz(a,h)anthracene	mg/kg	<0.020	9791007	<0.020	9791343	<0.020	<0.020	0.020	9791007
Benzo(g,h,i)perylene	mg/kg	<0.050	9791007	<0.050	9791343	<0.050	<0.050	0.050	9791007
Calculated Parameters									
LEPH (C10-C19 less PAH)	mg/kg	<100	9789348	<100	9789348	<100	<100	100	9789348
HEPH (C19-C32 less PAH)	mg/kg	<100	9789348	<100	9789348	<100	<100	100	9789348
Hydrocarbons									
EPH (C10-C19)	mg/kg	<100	9790999	<100	9791350	<100	<100	100	9790999
EPH (C19-C32)	mg/kg	<100	9790999	<100	9791350	<100	<100	100	9790999
RDL = Reportable Detection Limit									

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

LEPH & HEPH WITH PAH FOR CSR IN SOIL (SOIL)

BV Labs ID		XM8999		XM9000		XM9001	XM9012		
Sampling Date		2020/03/04 14:55		2020/03/04 15:00		2020/03/04 15:00	2020/03/04 15:50		
COC Number		601728-01-01		601728-01-01		601728-01-01	601728-02-01		
	UNITS	**BH20-06_0.2-0.5**	**QC Batch**	**BH20-06_0.6-1.1**	**QC Batch**	**DUP-A**	**BH20-07_0.1-0.3**	**RDL**	**QC Batch**
Surrogate Recovery (%)									
D10-ANTHRACENE (sur.)	%	67	9791007	73	9791343	72	73		9791007
D8-ACENAPHTHYLENE (sur.)	%	68	9791007	70	9791343	71	73		9791007
D8-NAPHTHALENE (sur.)	%	69	9791007	68	9791343	71	73		9791007
TERPHENYL-D14 (sur.)	%	68	9791007	68	9791343	73	74		9791007
O-TERPHENYL (sur.)	%	88	9790999	92	9791350	90	88		9790999
RDL = Reportable Detection Limit									

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

LEPH & HEPH WITH PAH FOR CSR IN SOIL (SOIL)

BV Labs ID		XM9013		
Sampling Date		2020/03/04 15:55		
COC Number		601728-02-01		
	UNITS	**BH20-07_0.6-1.0**	**RDL**	**QC Batch**
Calculated Parameters				
Low Molecular Weight PAH`s	mg/kg	0.25	0.050	9789313
High Molecular Weight PAH`s	mg/kg	2.7	0.050	9789313
Total PAH	mg/kg	3.0	0.050	9789313
Polycyclic Aromatics				
Quinoline	mg/kg	<0.050	0.050	9791007
Naphthalene	mg/kg	<0.010	0.010	9791007
1-Methylnaphthalene	mg/kg	<0.050	0.050	9791007
2-Methylnaphthalene	mg/kg	<0.020	0.020	9791007
Acenaphthylene	mg/kg	0.061	0.0050	9791007
Acenaphthene	mg/kg	0.0055	0.0050	9791007
Fluorene	mg/kg	<0.020	0.020	9791007
Phenanthrene	mg/kg	0.13	0.010	9791007
Anthracene	mg/kg	0.059	0.0040	9791007
Fluoranthene	mg/kg	0.46	0.020	9791007
Pyrene	mg/kg	0.50	0.020	9791007
Benzo(a)anthracene	mg/kg	0.25	0.020	9791007
Chrysene	mg/kg	0.26	0.020	9791007
Benzo(b&j)fluoranthene	mg/kg	0.36	0.020	9791007
Benzo(b)fluoranthene	mg/kg	0.22	0.020	9791007
Benzo(k)fluoranthene	mg/kg	0.14	0.020	9791007
Benzo(a)pyrene	mg/kg	0.31	0.020	9791007
Indeno(1,2,3-cd)pyrene	mg/kg	0.18	0.020	9791007
Dibenz(a,h)anthracene	mg/kg	0.053	0.020	9791007
Benzo(g,h,i)perylene	mg/kg	0.21	0.050	9791007
Calculated Parameters				
LEPH (C10-C19 less PAH)	mg/kg	<100	100	9789348
HEPH (C19-C32 less PAH)	mg/kg	<100	100	9789348
Hydrocarbons				
EPH (C10-C19)	mg/kg	<100	100	9790999
EPH (C19-C32)	mg/kg	<100	100	9790999
RDL = Reportable Detection Limit				

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

LEPH & HEPH WITH PAH FOR CSR IN SOIL (SOIL)

BV Labs ID		XM9013		
Sampling Date		2020/03/04 15:55		
COC Number		601728-02-01		
	UNITS	**BH20-07_0.6-1.0**	**RDL**	**QC Batch**
Surrogate Recovery (%)				
D10-ANTHRACENE (sur.)	%	72		9791007
D8-ACENAPHTHYLENE (sur.)	%	70		9791007
D8-NAPHTHALENE (sur.)	%	71		9791007
TERPHENYL-D14 (sur.)	%	73		9791007
O-TERPHENYL (sur.)	%	89		9790999
RDL = Reportable Detection Limit				

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

CSR/CCME METALS IN SOIL WITH HG (SOIL)

BV Labs ID		XM8992	XM8993	XM8994	XM8995	XM8996		
Sampling Date		2020/03/04 09:45	2020/03/04 09:50	2020/03/04 09:55	2020/03/04 11:20	2020/03/04 11:25		
COC Number		601728-01-01	601728-01-01	601728-01-01	601728-01-01	601728-01-01		
	UNITS	**BH20-05_0.15-0.45**	**BH20-05_0.6-1.1**	**BH20-04_1.4-1.9**	**BH20-04_0.2-0.6**	**BH20-04_0.8-1.3**	**RDL**	**QC Batch**
Physical Properties								
Soluble (2:1) pH	pH	7.82	8.14	7.95	9.28	8.13	N/A	9791100
Total Metals by ICPMS								
Total Aluminum (Al)	mg/kg	19900	25500	25400	19700	26700	100	9792274
Total Antimony (Sb)	mg/kg	0.16	0.91	0.94	19.8	0.30	0.10	9792274
Total Arsenic (As)	mg/kg	10.0	10.6	10.1	37.6	4.90	0.20	9792274
Total Barium (Ba)	mg/kg	23.1	47.5	49.0	63.3	81.5	0.10	9792274
Total Beryllium (Be)	mg/kg	0.31	0.34	0.36	0.30	0.40	0.20	9792274
Total Bismuth (Bi)	mg/kg	<0.10	<0.10	<0.10	0.10	<0.10	0.10	9792274
Total Boron (B)	mg/kg	1.9	4.5	4.4	8.2	5.2	1.0	9792274
Total Cadmium (Cd)	mg/kg	0.122	0.177	0.182	0.230	0.136	0.050	9792274
Total Calcium (Ca)	mg/kg	11100	16400	15300	22000	11900	100	9792274
Total Chromium (Cr)	mg/kg	24.2	64.4	63.0	50.4	54.9	0.50	9792274
Total Cobalt (Co)	mg/kg	19.9	31.2	29.6	19.5	21.5	0.10	9792274
Total Copper (Cu)	mg/kg	42.9	118	136	212	70.9	0.50	9792274
Total Iron (Fe)	mg/kg	37400	46000	47000	35700	39400	100	9792274
Total Lead (Pb)	mg/kg	5.59	9.90	12.7	84.8	6.09	0.10	9792274
Total Lithium (Li)	mg/kg	27.0	21.4	19.6	8.82	15.6	0.50	9792274
Total Magnesium (Mg)	mg/kg	13600	16400	16900	12000	11900	100	9792274
Total Manganese (Mn)	mg/kg	712	954	985	586	709	0.20	9792274
Total Mercury (Hg)	mg/kg	<0.050	0.089	0.100	0.568	0.266	0.050	9792274
Total Molybdenum (Mo)	mg/kg	1.21	1.67	1.66	3.66	0.40	0.10	9792274
Total Nickel (Ni)	mg/kg	21.5	59.4	53.3	35.1	43.8	0.50	9792274
Total Phosphorus (P)	mg/kg	736	695	715	524	550	10	9792274
Total Potassium (K)	mg/kg	666	621	564	540	937	100	9792274
Total Selenium (Se)	mg/kg	<0.50	0.53	0.50	<0.50	<0.50	0.50	9792274
Total Silver (Ag)	mg/kg	0.091	0.111	0.124	0.118	0.069	0.050	9792274
Total Sodium (Na)	mg/kg	<100	167	156	402	355	100	9792274
Total Strontium (Sr)	mg/kg	26.7	44.4	43.2	79.3	63.7	0.10	9792274
Total Thallium (Tl)	mg/kg	<0.050	<0.050	<0.050	0.051	0.061	0.050	9792274
Total Tin (Sn)	mg/kg	0.18	0.95	1.03	5.22	0.71	0.10	9792274

RDL = Reportable Detection Limit
N/A = Not Applicable

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

CSR/CCME METALS IN SOIL WITH HG (SOIL)

BV Labs ID		XM8992	XM8993	XM8994	XM8995	XM8996		
Sampling Date		2020/03/04 09:45	2020/03/04 09:50	2020/03/04 09:55	2020/03/04 11:20	2020/03/04 11:25		
COC Number		601728-01-01	601728-01-01	601728-01-01	601728-01-01	601728-01-01		
	UNITS	**BH20-05_0.15-0.45**	**BH20-05_0.6-1.1**	**BH20-04_1.4-1.9**	**BH20-04_0.2-0.6**	**BH20-04_0.8-1.3**	**RDL**	**QC Batch**
Total Titanium (Ti)	mg/kg	1580	2240	1890	1200	1430	1.0	9792274
Total Tungsten (W)	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	9792274
Total Uranium (U)	mg/kg	0.239	0.245	0.246	0.307	0.311	0.050	9792274
Total Vanadium (V)	mg/kg	37.6	87.3	90.5	88.1	102	1.0	9792274
Total Zinc (Zn)	mg/kg	81.5	96.7	101	195	64.7	1.0	9792274
Total Zirconium (Zr)	mg/kg	3.38	4.46	3.99	4.94	2.76	0.50	9792274
RDL = Reportable Detection Limit								

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

CSR/CCME METALS IN SOIL WITH HG (SOIL)

BV Labs ID		XM8997	XM8998	XM8999	XM9000	XM9001		
Sampling Date		2020/03/04 12:30	2020/03/04 12:35	2020/03/04 14:55	2020/03/04 15:00	2020/03/04 15:00		
COC Number		601728-01-01	601728-01-01	601728-01-01	601728-01-01	601728-01-01		
	UNITS	**BH20-09_0.5-0.9**	**BH20-09_1.0-1.4**	**BH20-06_0.2-0.5**	**BH20-06_0.6-1.1**	**DUP-A**	**RDL**	**QC Batch**
Physical Properties								
Soluble (2:1) pH	pH	8.29	8.46	7.81	7.75	7.72	N/A	9791100
Total Metals by ICPMS								
Total Aluminum (Al)	mg/kg	18300	11800	20900	24500	24700	100	9792274
Total Antimony (Sb)	mg/kg	0.26	0.13	0.17	0.58	0.63	0.10	9792274
Total Arsenic (As)	mg/kg	6.15	3.65	14.4	8.75	10.2	0.20	9792274
Total Barium (Ba)	mg/kg	73.7	36.6	26.6	35.3	42.5	0.10	9792274
Total Beryllium (Be)	mg/kg	0.36	<0.20	0.35	0.31	0.34	0.20	9792274
Total Bismuth (Bi)	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	9792274
Total Boron (B)	mg/kg	5.6	3.3	1.7	3.3	3.6	1.0	9792274
Total Cadmium (Cd)	mg/kg	0.080	<0.050	0.119	0.138	0.153	0.050	9792274
Total Calcium (Ca)	mg/kg	11000	7140	11000	12000	12300	100	9792274
Total Chromium (Cr)	mg/kg	39.5	20.2	30.6	67.4	60.8	0.50	9792274
Total Cobalt (Co)	mg/kg	13.0	8.36	22.9	28.7	29.3	0.10	9792274
Total Copper (Cu)	mg/kg	39.5	34.5	58.0	94.9	98.9	0.50	9792274
Total Iron (Fe)	mg/kg	29900	21000	40300	46800	46000	100	9792274
Total Lead (Pb)	mg/kg	4.79	2.14	6.82	9.21	10.4	0.10	9792274
Total Lithium (Li)	mg/kg	15.7	8.06	28.1	21.3	22.9	0.50	9792274
Total Magnesium (Mg)	mg/kg	7810	5760	13700	16900	16000	100	9792274
Total Manganese (Mn)	mg/kg	613	369	782	938	950	0.20	9792274
Total Mercury (Hg)	mg/kg	0.052	<0.050	<0.050	<0.050	0.056	0.050	9792274
Total Molybdenum (Mo)	mg/kg	0.36	0.21	1.14	1.46	1.63	0.10	9792274
Total Nickel (Ni)	mg/kg	36.4	18.6	28.6	55.3	53.3	0.50	9792274
Total Phosphorus (P)	mg/kg	775	439	848	739	709	10	9792274
Total Potassium (K)	mg/kg	1540	530	708	566	631	100	9792274
Total Selenium (Se)	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	9792274
Total Silver (Ag)	mg/kg	0.058	<0.050	0.094	0.098	0.087	0.050	9792274
Total Sodium (Na)	mg/kg	526	348	<100	126	152	100	9792274
Total Strontium (Sr)	mg/kg	68.5	24.2	28.0	34.2	35.4	0.10	9792274
Total Thallium (Tl)	mg/kg	0.067	<0.050	<0.050	<0.050	<0.050	0.050	9792274
Total Tin (Sn)	mg/kg	0.41	0.24	0.20	0.61	0.69	0.10	9792274

RDL = Reportable Detection Limit
N/A = Not Applicable

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

CSR/CCME METALS IN SOIL WITH HG (SOIL)

BV Labs ID		XM8997	XM8998	XM8999	XM9000	XM9001		
Sampling Date		2020/03/04 12:30	2020/03/04 12:35	2020/03/04 14:55	2020/03/04 15:00	2020/03/04 15:00		
COC Number		601728-01-01	601728-01-01	601728-01-01	601728-01-01	601728-01-01		
	UNITS	**BH20-09_0.5-0.9**	**BH20-09_1.0-1.4**	**BH20-06_0.2-0.5**	**BH20-06_0.6-1.1**	**DUP-A**	**RDL**	**QC Batch**
Total Titanium (Ti)	mg/kg	1110	1030	1760	1930	2180	1.0	9792274
Total Tungsten (W)	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	9792274
Total Uranium (U)	mg/kg	0.297	0.197	0.219	0.214	0.227	0.050	9792274
Total Vanadium (V)	mg/kg	74.2	55.8	44.8	81.6	79.6	1.0	9792274
Total Zinc (Zn)	mg/kg	56.3	32.8	85.6	89.3	93.9	1.0	9792274
Total Zirconium (Zr)	mg/kg	7.16	5.01	3.61	3.54	4.02	0.50	9792274
RDL = Reportable Detection Limit								

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

CSR/CCME METALS IN SOIL WITH HG (SOIL)

BV Labs ID		XM9012	XM9013		
Sampling Date		2020/03/04 15:50	2020/03/04 15:55		
COC Number		601728-02-01	601728-02-01		
	UNITS	**BH20-07_0.1-0.3**	**BH20-07_0.6-1.0**	**RDL**	**QC Batch**
Physical Properties					
Soluble (2:1) pH	pH	7.58	7.98	N/A	9791100
Total Metals by ICPMS					
Total Aluminum (Al)	mg/kg	26300	22000	100	9792320
Total Antimony (Sb)	mg/kg	0.21	1.41	0.10	9792320
Total Arsenic (As)	mg/kg	11.4	8.29	0.20	9792320
Total Barium (Ba)	mg/kg	37.4	46.8	0.10	9792320
Total Beryllium (Be)	mg/kg	0.28	0.34	0.20	9792320
Total Bismuth (Bi)	mg/kg	<0.10	<0.10	0.10	9792320
Total Boron (B)	mg/kg	2.8	4.2	1.0	9792320
Total Cadmium (Cd)	mg/kg	0.162	0.139	0.050	9792320
Total Calcium (Ca)	mg/kg	9470	15100	100	9792320
Total Chromium (Cr)	mg/kg	81.6	56.0	0.50	9792320
Total Cobalt (Co)	mg/kg	39.3	24.3	0.10	9792320
Total Copper (Cu)	mg/kg	93.0	112	0.50	9792320
Total Iron (Fe)	mg/kg	55200	39300	100	9792320
Total Lead (Pb)	mg/kg	4.18	11.0	0.10	9792320
Total Lithium (Li)	mg/kg	32.4	16.4	0.50	9792320
Total Magnesium (Mg)	mg/kg	18200	14200	100	9792320
Total Manganese (Mn)	mg/kg	1520	753	0.20	9792320
Total Mercury (Hg)	mg/kg	<0.050	0.110	0.050	9792320
Total Molybdenum (Mo)	mg/kg	1.20	1.14	0.10	9792320
Total Nickel (Ni)	mg/kg	68.3	45.4	0.50	9792320
Total Phosphorus (P)	mg/kg	764	631	10	9792320
Total Potassium (K)	mg/kg	471	622	100	9792320
Total Selenium (Se)	mg/kg	<0.50	<0.50	0.50	9792320
Total Silver (Ag)	mg/kg	0.076	0.095	0.050	9792320
Total Sodium (Na)	mg/kg	<100	213	100	9792320
Total Strontium (Sr)	mg/kg	22.0	42.5	0.10	9792320
Total Thallium (Tl)	mg/kg	0.051	<0.050	0.050	9792320
Total Tin (Sn)	mg/kg	0.24	0.98	0.10	9792320

RDL = Reportable Detection Limit
N/A = Not Applicable

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

CSR/CCME METALS IN SOIL WITH HG (SOIL)

BV Labs ID		XM9012	XM9013		
Sampling Date		2020/03/04 15:50	2020/03/04 15:55		
COC Number		601728-02-01	601728-02-01		
	UNITS	**BH20-07_0.1-0.3**	**BH20-07_0.6-1.0**	**RDL**	**QC Batch**
Total Titanium (Ti)	mg/kg	2220	1790	1.0	9792320
Total Tungsten (W)	mg/kg	<0.50	<0.50	0.50	9792320
Total Uranium (U)	mg/kg	0.151	0.251	0.050	9792320
Total Vanadium (V)	mg/kg	88.2	79.6	1.0	9792320
Total Zinc (Zn)	mg/kg	82.6	90.3	1.0	9792320
Total Zirconium (Zr)	mg/kg	3.61	4.14	0.50	9792320
RDL = Reportable Detection Limit					

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

SOLUBLE SODIUM AND CHLORIDE IN SOIL (SOIL)

BV Labs ID		XM8992		XM8993		XM8994		XM8995		
Sampling Date		2020/03/04 09:45		2020/03/04 09:50		2020/03/04 09:55		2020/03/04 11:20		
COC Number		601728-01-01		601728-01-01		601728-01-01		601728-01-01		
	UNITS	**BH20-05_0.15-0.45**	**RDL**	**BH20-05_0.6-1.1**	**RDL**	**BH20-04_1.4-1.9**	**RDL**	**BH20-04_0.2-0.6**	**RDL**	**QC Batch**
ANIONS										
Soluble Chloride (Cl)	mg/L	<10	10	<10	10	24	10	403	10	9791572
Calculated Parameters										
Soluble Chloride (Cl)	mg/kg	<3.3	3.3	<3.8	3.8	7.4	3.1	142	3.5	9789853
Soluble Sodium (Na)	mg/kg	7.9	1.6	28.6	1.9	19.8	1.5	68.4	1.8	9789854
Soluble Parameters										
Saturation %	%	32.9	N/A	38.4	N/A	30.6	N/A	35.3	N/A	9790728
Soluble Sodium (Na)	mg/L	23.9	5.0	74.7	5.0	64.7	5.0	194	5.0	9791633

RDL = Reportable Detection Limit
N/A = Not Applicable

BV Labs ID		XM8996	XM8997		XM8998		XM8999		
Sampling Date		2020/03/04 11:25	2020/03/04 12:30		2020/03/04 12:35		2020/03/04 14:55		
COC Number		601728-01-01	601728-01-01		601728-01-01		601728-01-01		
	UNITS	**BH20-04_0.8-1.3**	**BH20-09_0.5-0.9**	**RDL**	**BH20-09_1.0-1.4**	**RDL**	**BH20-06_0.2-0.5**	**RDL**	**QC Batch**
ANIONS									
Soluble Chloride (Cl)	mg/L	14	29	10	16	10	11	10	9791572
Calculated Parameters									
Soluble Chloride (Cl)	mg/kg	5.4	11.4	3.9	5.8	3.6	3.6	3.2	9789853
Soluble Sodium (Na)	mg/kg	32.7	11.2	1.9	9.0	1.8	15.6	1.6	9789854
Soluble Parameters									
Saturation %	%	38.9	38.5	N/A	36.1	N/A	32.3	N/A	9790728
Soluble Sodium (Na)	mg/L	84.1	29.1	5.0	24.8	5.0	48.3	5.0	9791633

RDL = Reportable Detection Limit
N/A = Not Applicable

BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

SOLUBLE SODIUM AND CHLORIDE IN SOIL (SOIL)

BV Labs ID		XM9000		XM9001		XM9012		XM9013		
Sampling Date		2020/03/04 15:00		2020/03/04 15:00		2020/03/04 15:50		2020/03/04 15:55		
COC Number		601728-01-01		601728-01-01		601728-02-01		601728-02-01		
	UNITS	**BH20-06_0.6-1.1**	**RDL**	**DUP-A**	**RDL**	**BH20-07_0.1-0.3**	**RDL**	**BH20-07_0.6-1.0**	**RDL**	**QC Batch**
ANIONS										
Soluble Chloride (Cl)	mg/L	18	10	13	10	12	10	11	10	9791572
Calculated Parameters										
Soluble Chloride (Cl)	mg/kg	6.3	3.5	4.2	3.3	4.7	3.8	3.8	3.6	9789853
Soluble Sodium (Na)	mg/kg	19.4	1.8	16.7	1.7	13.9	1.9	18.4	1.8	9789854
Soluble Parameters										
Saturation %	%	35.1	N/A	33.1	N/A	38.4	N/A	36.3	N/A	9790728
Soluble Sodium (Na)	mg/L	55.2	5.0	50.5	5.0	36.2	5.0	50.6	5.0	9791633

RDL = Reportable Detection Limit
N/A = Not Applicable

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	1.0°C

Version 2: Report reissued to include results for TCLP PAH and Metals on sample BH20-04_0.2-0.6 as per client request received 2020/03/13.

Results relate only to the items tested.

BV Labs Job #: C017076
Report Date: 2020/03/19

QUALITY ASSURANCE REPORT

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9790497	1,4-Difluorobenzene (sur.)	2020/03/08	110	70 - 130	110	70 - 130	92	%				
9790497	4-Bromofluorobenzene (sur.)	2020/03/08	103	70 - 130	104	70 - 130	99	%				
9790497	D10-ETHYLBENZENE (sur.)	2020/03/08	103	60 - 130	85	60 - 130	81	%				
9790497	D4-1,2-Dichloroethane (sur.)	2020/03/08	116	70 - 130	103	70 - 130	100	%				
9790999	O-TERPHENYL (sur.)	2020/03/09	89	60 - 140	85	60 - 140	92	%				
9791007	D10-ANTHRACENE (sur.)	2020/03/09	75	50 - 140	75	50 - 140	74	%				
9791007	D8-ACENAPHTHYLENE (sur.)	2020/03/09	75	50 - 140	75	50 - 140	73	%				
9791007	D8-NAPHTHALENE (sur.)	2020/03/09	76	50 - 140	77	50 - 140	74	%				
9791007	TERPHENYL-D14 (sur.)	2020/03/09	76	50 - 140	76	50 - 140	75	%				
9791343	D10-ANTHRACENE (sur.)	2020/03/09	69	50 - 140	71	50 - 140	79	%				
9791343	D8-ACENAPHTHYLENE (sur.)	2020/03/09	68	50 - 140	70	50 - 140	75	%				
9791343	D8-NAPHTHALENE (sur.)	2020/03/09	68	50 - 140	70	50 - 140	73	%				
9791343	TERPHENYL-D14 (sur.)	2020/03/09	68	50 - 140	70	50 - 140	76	%				
9791350	O-TERPHENYL (sur.)	2020/03/09	87	60 - 140	87	60 - 140	91	%				
9801670	Leachate D10-ANTHRACENE (sur.)	2020/03/18			105	50 - 140	101	%				
9801670	Leachate D8-ACENAPHTHYLENE (sur.)	2020/03/18			93	50 - 140	91	%				
9801670	Leachate D8-NAPHTHALENE (sur.)	2020/03/18			96	50 - 140	92	%				
9801670	Leachate TERPHENYL-D14 (sur.)	2020/03/18			96	50 - 140	93	%				
9790497	Benzene	2020/03/08	136	60 - 140	102	70 - 130	<0.0050	mg/kg	NC	40		
9790497	Ethylbenzene	2020/03/08	127	60 - 140	99	70 - 130	<0.010	mg/kg	NC	40		
9790497	m & p-Xylene	2020/03/08	123	60 - 140	96	70 - 130	<0.040	mg/kg	NC	40		
9790497	Methyl-tert-butylether (MTBE)	2020/03/08	129	60 - 140	98	70 - 130	<0.10	mg/kg	NC	40		
9790497	o-Xylene	2020/03/08	123	60 - 140	95	70 - 130	<0.040	mg/kg	NC	40		
9790497	Styrene	2020/03/08	133	60 - 140	111	70 - 130	<0.030	mg/kg	NC	40		
9790497	Toluene	2020/03/08	121	60 - 140	92	70 - 130	<0.050	mg/kg	NC	40		
9790497	VH C6-C10	2020/03/08			91	70 - 130	<10	mg/kg	NC	40		
9790497	Xylenes (Total)	2020/03/08					<0.040	mg/kg	NC	40		
9790728	Saturation %	2020/03/09					0	%	0	30	103	75 - 125
9790847	Moisture	2020/03/10					<0.30	%	9.9	20		
9790995	Moisture	2020/03/10					<0.30	%	3.2	20		
9790999	EPH (C10-C19)	2020/03/09	82	60 - 140	79	70 - 130	<100	mg/kg	NC	40		

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9790999	EPH (C19-C32)	2020/03/09	94	60 - 140	90	70 - 130	<100	mg/kg	NC	40		
9791007	1-Methylnaphthalene	2020/03/09	78	50 - 140	78	50 - 140	<0.050	mg/kg	NC	50		
9791007	2-Methylnaphthalene	2020/03/09	80	50 - 140	79	50 - 140	<0.020	mg/kg	NC	50		
9791007	Acenaphthene	2020/03/09	81	50 - 140	79	50 - 140	<0.0050	mg/kg	NC	50		
9791007	Acenaphthylene	2020/03/09	82	50 - 140	82	50 - 140	<0.0050	mg/kg	NC	50		
9791007	Anthracene	2020/03/09	80	50 - 140	78	50 - 140	<0.0040	mg/kg	NC	50		
9791007	Benzo(a)anthracene	2020/03/09	76	50 - 140	76	50 - 140	<0.020	mg/kg	NC	50		
9791007	Benzo(a)pyrene	2020/03/09	76	50 - 140	75	50 - 140	<0.020	mg/kg	NC	50		
9791007	Benzo(b&j)fluoranthene	2020/03/09	78	50 - 140	79	50 - 140	<0.020	mg/kg	NC	50		
9791007	Benzo(b)fluoranthene	2020/03/09	79	50 - 140	80	50 - 140	<0.020	mg/kg	NC	50		
9791007	Benzo(g,h,i)perylene	2020/03/09	74	50 - 140	73	50 - 140	<0.050	mg/kg	NC	50		
9791007	Benzo(k)fluoranthene	2020/03/09	76	50 - 140	74	50 - 140	<0.020	mg/kg	NC	50		
9791007	Chrysene	2020/03/09	77	50 - 140	76	50 - 140	<0.020	mg/kg	NC	50		
9791007	Dibenz(a,h)anthracene	2020/03/09	69	50 - 140	69	50 - 140	<0.020	mg/kg	NC	50		
9791007	Fluoranthene	2020/03/09	79	50 - 140	79	50 - 140	<0.020	mg/kg	NC	50		
9791007	Fluorene	2020/03/09	77	50 - 140	76	50 - 140	<0.020	mg/kg	NC	50		
9791007	Indeno(1,2,3-cd)pyrene	2020/03/09	73	50 - 140	72	50 - 140	<0.020	mg/kg	NC	50		
9791007	Naphthalene	2020/03/09	80	50 - 140	80	50 - 140	<0.010	mg/kg	NC	50		
9791007	Phenanthrene	2020/03/09	77	50 - 140	78	50 - 140	<0.010	mg/kg	NC	50		
9791007	Pyrene	2020/03/09	81	50 - 140	80	50 - 140	<0.020	mg/kg	NC	50		
9791007	Quinoline	2020/03/09	112	50 - 140	115	50 - 140	<0.050	mg/kg	NC	50		
9791100	Soluble (2:1) pH	2020/03/09			101	97 - 103			0.11	20		
9791343	1-Methylnaphthalene	2020/03/09	76	50 - 140	71	50 - 140	<0.050	mg/kg	NC	50		
9791343	2-Methylnaphthalene	2020/03/09	80	50 - 140	73	50 - 140	<0.020	mg/kg	NC	50		
9791343	Acenaphthene	2020/03/09	80	50 - 140	74	50 - 140	<0.0050	mg/kg	NC	50		
9791343	Acenaphthylene	2020/03/09	84	50 - 140	77	50 - 140	<0.0050	mg/kg	16	50		
9791343	Anthracene	2020/03/09	82	50 - 140	74	50 - 140	<0.0040	mg/kg	2.4	50		
9791343	Benzo(a)anthracene	2020/03/09	76	50 - 140	71	50 - 140	<0.020	mg/kg	NC	50		
9791343	Benzo(a)pyrene	2020/03/09	76	50 - 140	72	50 - 140	<0.020	mg/kg	NC	50		
9791343	Benzo(b&j)fluoranthene	2020/03/09	77	50 - 140	73	50 - 140	<0.020	mg/kg	NC	50		
9791343	Benzo(b)fluoranthene	2020/03/09	80	50 - 140	75	50 - 140	<0.020	mg/kg	NC	50		

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9791343	Benzo(g,h,i)perylene	2020/03/09	76	50 - 140	73	50 - 140	<0.050	mg/kg	NC	50		
9791343	Benzo(k)fluoranthene	2020/03/09	75	50 - 140	71	50 - 140	<0.020	mg/kg	NC	50		
9791343	Chrysene	2020/03/09	76	50 - 140	72	50 - 140	<0.020	mg/kg	11	50		
9791343	Dibenz(a,h)anthracene	2020/03/09	76	50 - 140	71	50 - 140	<0.020	mg/kg	NC	50		
9791343	Fluoranthene	2020/03/09	77	50 - 140	71	50 - 140	<0.020	mg/kg	14	50		
9791343	Fluorene	2020/03/09	78	50 - 140	71	50 - 140	<0.020	mg/kg	NC	50		
9791343	Indeno(1,2,3-cd)pyrene	2020/03/09	74	50 - 140	73	50 - 140	<0.020	mg/kg	NC	50		
9791343	Naphthalene	2020/03/09	77	50 - 140	71	50 - 140	<0.010	mg/kg	NC	50		
9791343	Phenanthrene	2020/03/09	77	50 - 140	71	50 - 140	<0.010	mg/kg	14	50		
9791343	Pyrene	2020/03/09	79	50 - 140	73	50 - 140	<0.020	mg/kg	12	50		
9791343	Quinoline	2020/03/09	133	50 - 140	116	50 - 140	<0.050	mg/kg	NC	50		
9791350	EPH (C10-C19)	2020/03/10	84	60 - 140	78	70 - 130	<100	mg/kg	NC	40		
9791350	EPH (C19-C32)	2020/03/10	97	60 - 140	97	70 - 130	<100	mg/kg	NC	40		
9791572	Soluble Chloride (Cl)	2020/03/09	103	75 - 125	105	80 - 120	<10	mg/L	0.50	30	83	75 - 125
9791633	Soluble Sodium (Na)	2020/03/10	98	80 - 120	99	80 - 120	<5.0	mg/L	2.1	40	94	75 - 125
9792274	Total Aluminum (Al)	2020/03/11	NC	75 - 125	98	75 - 125	<100	mg/kg	4.7	40	94	70 - 130
9792274	Total Antimony (Sb)	2020/03/11	105	75 - 125	99	75 - 125	<0.10	mg/kg	17	30	106	70 - 130
9792274	Total Arsenic (As)	2020/03/11	97	75 - 125	97	75 - 125	<0.20	mg/kg	13	30	83	70 - 130
9792274	Total Barium (Ba)	2020/03/11	96	75 - 125	97	75 - 125	<0.10	mg/kg	0.28	40	96	70 - 130
9792274	Total Beryllium (Be)	2020/03/11	98	75 - 125	96	75 - 125	<0.20	mg/kg	3.9	30	99	70 - 130
9792274	Total Bismuth (Bi)	2020/03/11	92	75 - 125	94	75 - 125	<0.10	mg/kg	3.6	30		
9792274	Total Boron (B)	2020/03/11	93	75 - 125	97	75 - 125	<1.0	mg/kg	14	30		
9792274	Total Cadmium (Cd)	2020/03/11	94	75 - 125	99	75 - 125	<0.050	mg/kg	1.0	30	98	70 - 130
9792274	Total Calcium (Ca)	2020/03/11	NC	75 - 125	100	75 - 125	<100	mg/kg	20	30	93	70 - 130
9792274	Total Chromium (Cr)	2020/03/11	96	75 - 125	104	75 - 125	<0.50	mg/kg	14	30	101	70 - 130
9792274	Total Cobalt (Co)	2020/03/11	87	75 - 125	99	75 - 125	<0.10	mg/kg	1.2	30	95	70 - 130
9792274	Total Copper (Cu)	2020/03/11	89	75 - 125	101	75 - 125	<0.50	mg/kg	2.8	30	102	70 - 130
9792274	Total Iron (Fe)	2020/03/11	NC	75 - 125	101	75 - 125	<100	mg/kg	8.3	30	97	70 - 130
9792274	Total Lead (Pb)	2020/03/11	98	75 - 125	99	75 - 125	<0.10	mg/kg	11	40	106	70 - 130
9792274	Total Lithium (Li)	2020/03/11	94	75 - 125	90	75 - 125	<0.50	mg/kg	4.9	30	92	70 - 130
9792274	Total Magnesium (Mg)	2020/03/11	NC	75 - 125	100	75 - 125	<100	mg/kg	1.2	30	99	70 - 130

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9792274	Total Manganese (Mn)	2020/03/11	NC	75 - 125	100	75 - 125	<0.20	mg/kg	4.5	30	101	70 - 130
9792274	Total Mercury (Hg)	2020/03/11	97	75 - 125	102	75 - 125	<0.050	mg/kg	0.23	40	101	70 - 130
9792274	Total Molybdenum (Mo)	2020/03/11	103	75 - 125	96	75 - 125	<0.10	mg/kg	11	40	100	70 - 130
9792274	Total Nickel (Ni)	2020/03/11	88	75 - 125	100	75 - 125	<0.50	mg/kg	0.46	30	101	70 - 130
9792274	Total Phosphorus (P)	2020/03/11	83	75 - 125	98	75 - 125	<10	mg/kg	2.1	30	87	70 - 130
9792274	Total Potassium (K)	2020/03/11	100	75 - 125	99	75 - 125	<100	mg/kg	0.80	40	86	70 - 130
9792274	Total Selenium (Se)	2020/03/11	93	75 - 125	100	75 - 125	<0.50	mg/kg	NC	30		
9792274	Total Silver (Ag)	2020/03/11	92	75 - 125	97	75 - 125	<0.050	mg/kg	23	40	92	70 - 130
9792274	Total Sodium (Na)	2020/03/11	106	75 - 125	104	75 - 125	<100	mg/kg	7.2	40	92	70 - 130
9792274	Total Strontium (Sr)	2020/03/11	105	75 - 125	96	75 - 125	<0.10	mg/kg	4.5	40	98	70 - 130
9792274	Total Thallium (Tl)	2020/03/11	92	75 - 125	97	75 - 125	<0.050	mg/kg	1.3	30	89	70 - 130
9792274	Total Tin (Sn)	2020/03/11	99	75 - 125	99	75 - 125	<0.10	mg/kg	6.7	40	93	70 - 130
9792274	Total Titanium (Ti)	2020/03/11	NC	75 - 125	95	75 - 125	<1.0	mg/kg	19	40		
9792274	Total Tungsten (W)	2020/03/11	80	75 - 125	101	75 - 125	<0.50	mg/kg	NC	40		
9792274	Total Uranium (U)	2020/03/11	96	75 - 125	96	75 - 125	<0.050	mg/kg	22	30	96	70 - 130
9792274	Total Vanadium (V)	2020/03/11	99	75 - 125	100	75 - 125	<1.0	mg/kg	8.5	30	100	70 - 130
9792274	Total Zinc (Zn)	2020/03/11	104	75 - 125	101	75 - 125	<1.0	mg/kg	1.6	30	99	70 - 130
9792274	Total Zirconium (Zr)	2020/03/11	106	75 - 125	94	75 - 125	<0.50	mg/kg	19	40		
9792320	Total Aluminum (Al)	2020/03/10	NC	75 - 125	99	75 - 125	<100	mg/kg	4.9	40	99	70 - 130
9792320	Total Antimony (Sb)	2020/03/10	99	75 - 125	101	75 - 125	<0.10	mg/kg	13	30	110	70 - 130
9792320	Total Arsenic (As)	2020/03/10	100	75 - 125	99	75 - 125	<0.20	mg/kg	1.1	30	87	70 - 130
9792320	Total Barium (Ba)	2020/03/10	100	75 - 125	98	75 - 125	<0.10	mg/kg	7.2	40	99	70 - 130
9792320	Total Beryllium (Be)	2020/03/10	106	75 - 125	100	75 - 125	<0.20	mg/kg	NC	30	110	70 - 130
9792320	Total Bismuth (Bi)	2020/03/10	96	75 - 125	94	75 - 125	<0.10	mg/kg	NC	30		
9792320	Total Boron (B)	2020/03/10	103	75 - 125	101	75 - 125	<1.0	mg/kg				
9792320	Total Cadmium (Cd)	2020/03/10	101	75 - 125	102	75 - 125	<0.050	mg/kg	6.0	30	105	70 - 130
9792320	Total Calcium (Ca)	2020/03/10	NC	75 - 125	103	75 - 125	<100	mg/kg	1.4	30	95	70 - 130
9792320	Total Chromium (Cr)	2020/03/10	104	75 - 125	109	75 - 125	<0.50	mg/kg	6.6	30	105	70 - 130
9792320	Total Cobalt (Co)	2020/03/10	99	75 - 125	103	75 - 125	<0.10	mg/kg	5.6	30	98	70 - 130
9792320	Total Copper (Cu)	2020/03/10	98	75 - 125	104	75 - 125	<0.50	mg/kg	3.0	30	104	70 - 130
9792320	Total Iron (Fe)	2020/03/10	NC	75 - 125	103	75 - 125	<100	mg/kg	6.9	30	100	70 - 130

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9792320	Total Lead (Pb)	2020/03/10	98	75 - 125	99	75 - 125	<0.10	mg/kg	3.0	40	105	70 - 130
9792320	Total Lithium (Li)	2020/03/10	98	75 - 125	96	75 - 125	<0.50	mg/kg	6.3	30	105	70 - 130
9792320	Total Magnesium (Mg)	2020/03/10	NC	75 - 125	101	75 - 125	<100	mg/kg	8.8	30	103	70 - 130
9792320	Total Manganese (Mn)	2020/03/10	NC	75 - 125	103	75 - 125	<0.20	mg/kg	5.9	30	105	70 - 130
9792320	Total Mercury (Hg)	2020/03/10	103	75 - 125	103	75 - 125	<0.050	mg/kg	NC	40	100	70 - 130
9792320	Total Molybdenum (Mo)	2020/03/10	99	75 - 125	99	75 - 125	<0.10	mg/kg	5.8	40	99	70 - 130
9792320	Total Nickel (Ni)	2020/03/10	99	75 - 125	104	75 - 125	<0.50	mg/kg	5.7	30	105	70 - 130
9792320	Total Phosphorus (P)	2020/03/10	92	75 - 125	96	75 - 125	<10	mg/kg	7.7	30	90	70 - 130
9792320	Total Potassium (K)	2020/03/10	111	75 - 125	100	75 - 125	<100	mg/kg	6.5	40	89	70 - 130
9792320	Total Selenium (Se)	2020/03/10	101	75 - 125	101	75 - 125	<0.50	mg/kg	NC	30		
9792320	Total Silver (Ag)	2020/03/10	98	75 - 125	99	75 - 125	<0.050	mg/kg	NC	40	114	70 - 130
9792320	Total Sodium (Na)	2020/03/10	120	75 - 125	105	75 - 125	<100	mg/kg	0.30	40	94	70 - 130
9792320	Total Strontium (Sr)	2020/03/10	105	75 - 125	97	75 - 125	<0.10	mg/kg	0.94	40	100	70 - 130
9792320	Total Thallium (Tl)	2020/03/10	96	75 - 125	98	75 - 125	<0.050	mg/kg	NC	30	84	70 - 130
9792320	Total Tin (Sn)	2020/03/10	100	75 - 125	99	75 - 125	<0.10	mg/kg	11	40	98	70 - 130
9792320	Total Titanium (Ti)	2020/03/10	NC	75 - 125	101	75 - 125	<1.0	mg/kg	9.8	40		
9792320	Total Tungsten (W)	2020/03/10	94	75 - 125	104	75 - 125	<0.50	mg/kg				
9792320	Total Uranium (U)	2020/03/10	101	75 - 125	98	75 - 125	<0.050	mg/kg	15	30	98	70 - 130
9792320	Total Vanadium (V)	2020/03/10	101	75 - 125	103	75 - 125	<1.0	mg/kg	7.3	30	104	70 - 130
9792320	Total Zinc (Zn)	2020/03/10	98	75 - 125	104	75 - 125	<1.0	mg/kg	1.8	30	102	70 - 130
9792320	Total Zirconium (Zr)	2020/03/10	105	75 - 125	97	75 - 125	<0.50	mg/kg	4.9	40		
9800410	Final pH of Leachate	2020/03/18					4.92	pH	0	N/A		
9800410	Initial pH of Sample	2020/03/18					4.91	pH	1.9	N/A		
9800410	pH after HCl	2020/03/18							2.1	N/A		
9800410	pH of Leaching Fluid	2020/03/18					4.91	pH	0	N/A		
9801623	Leachate Antimony (Sb)	2020/03/18	95	75 - 125	99	75 - 125	<0.10	mg/L				
9801623	Leachate Arsenic (As)	2020/03/18	112	75 - 125	112	75 - 125	<0.10	mg/L				
9801623	Leachate Barium (Ba)	2020/03/18	103	75 - 125	105	75 - 125	<0.10	mg/L				
9801623	Leachate Beryllium (Be)	2020/03/18	100	75 - 125	102	75 - 125	<0.10	mg/L				
9801623	Leachate Boron (B)	2020/03/18	103	75 - 125	103	75 - 125	<0.10	mg/L				
9801623	Leachate Cadmium (Cd)	2020/03/18	104	75 - 125	105	75 - 125	<0.10	mg/L				

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9801623	Leachate Chromium (Cr)	2020/03/18	105	75 - 125	105	75 - 125	<0.10	mg/L	NC	35		
9801623	Leachate Cobalt (Co)	2020/03/18	97	75 - 125	101	75 - 125	<0.10	mg/L				
9801623	Leachate Copper (Cu)	2020/03/18	101	75 - 125	104	75 - 125	<0.10	mg/L				
9801623	Leachate Iron (Fe)	2020/03/18	101	75 - 125	103	75 - 125	<0.50	mg/L				
9801623	Leachate Lead (Pb)	2020/03/18	105	75 - 125	103	75 - 125	<0.10	mg/L	2.7	35		
9801623	Leachate Mercury (Hg)	2020/03/18	105	75 - 125	104	75 - 125	<0.0020	mg/L				
9801623	Leachate Molybdenum (Mo)	2020/03/18	106	75 - 125	105	75 - 125	<0.10	mg/L				
9801623	Leachate Nickel (Ni)	2020/03/18	98	75 - 125	100	75 - 125	<0.10	mg/L				
9801623	Leachate Selenium (Se)	2020/03/18	108	75 - 125	109	75 - 125	<0.10	mg/L				
9801623	Leachate Silver (Ag)	2020/03/18	99	75 - 125	98	75 - 125	<0.010	mg/L				
9801623	Leachate Thallium (Tl)	2020/03/18	103	75 - 125	100	75 - 125	<0.10	mg/L				
9801623	Leachate Uranium (U)	2020/03/18	106	75 - 125	107	75 - 125	<0.10	mg/L				
9801623	Leachate Vanadium (V)	2020/03/18	103	75 - 125	105	75 - 125	<0.10	mg/L				
9801623	Leachate Zinc (Zn)	2020/03/18	100	75 - 125	102	75 - 125	<0.10	mg/L				
9801623	Leachate Zirconium (Zr)	2020/03/18	109	75 - 125	108	75 - 125	<0.10	mg/L				
9801670	Leachate 2-Methylnaphthalene	2020/03/18			96	50 - 140	<0.10	ug/L				
9801670	Leachate Acenaphthene	2020/03/18			97	50 - 140	<0.10	ug/L				
9801670	Leachate Acenaphthylene	2020/03/18			102	50 - 140	<0.10	ug/L				
9801670	Leachate Acridine	2020/03/18			101	50 - 140	<0.50	ug/L				
9801670	Leachate Anthracene	2020/03/18			101	50 - 140	<0.10	ug/L				
9801670	Leachate Benzo(a)anthracene	2020/03/18			97	50 - 140	<0.10	ug/L				
9801670	Leachate Benzo(a)pyrene	2020/03/18			96	50 - 140	<0.10	ug/L				
9801670	Leachate Benzo(b&j)fluoranthene	2020/03/18			100	50 - 140	<0.10	ug/L				
9801670	Leachate Benzo(g,h,i)perylene	2020/03/18			97	50 - 140	<0.20	ug/L				
9801670	Leachate Benzo(k)fluoranthene	2020/03/18			98	50 - 140	<0.10	ug/L				
9801670	Leachate Chrysene	2020/03/18			96	50 - 140	<0.10	ug/L				
9801670	Leachate Dibenz(a,h)anthracene	2020/03/18			96	50 - 140	<0.20	ug/L				
9801670	Leachate Fluoranthene	2020/03/18			97	50 - 140	<0.10	ug/L				
9801670	Leachate Fluorene	2020/03/18			94	50 - 140	<0.10	ug/L				
9801670	Leachate Indeno(1,2,3-cd)pyrene	2020/03/18			98	50 - 140	<0.20	ug/L				
9801670	Leachate Naphthalene	2020/03/18			99	50 - 140	<0.10	ug/L				

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
9801670	Leachate Phenanthrene	2020/03/18			100	50 - 140	<0.10	ug/L				
9801670	Leachate Pyrene	2020/03/18			100	50 - 140	<0.10	ug/L				
9801670	Leachate Quinoline	2020/03/18			118	50 - 140	<0.50	ug/L				

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

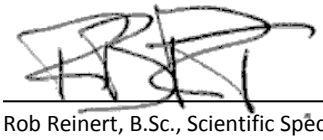
BV Labs Job #: C017076
Report Date: 2020/03/19

SLR CONSULTING (CANADA) LTD
Client Project #: 205.04011.00000
Site Location: EEDE Soil Characterization
Your P.O. #: VIC3255
Sampler Initials: FP

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Richard Cheng, Scientific Service Specialist



Rob Reinert, B.Sc., Scientific Specialist

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.
For Service Group specific validation please refer to the Validation Signature Page.

Bureau Veritas Laboratories Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Bureau Veritas Laboratories
Unit 1 - 460 Tennyson Place, Victoria, British Columbia Canada V8Z 6S8 Tel:(250) 385 6112 Toll-free:800-563-6266 Fax:(250) 382 6364 www.bvlabs.com

C

C017076_COC

INVOICE TO:		Report Information		Project Information	
Company Name	#11223 SLR CONSULTING (CANADA) LTD	Company Name		Quotation #	B90035
Contact Name	Roberto Prieto	Contact Name	Roberto Prieto	P.O. #	VIC3255
Address	#303-3960 Quadra Street	Address		Project #	205.04011.00000
	VICTORIA BC V8X 4A3			Project Name	EGD EEDE
Phone	(250) 475-9595 Fax (250) 475-9596	Phone	Fax	Site #	
Email	rprieto@slrconsulting.com	Email	rprieto@slrconsulting.com; analytical@slrconsulting.co	Sampled By	EP

Chain Of Custody Record: C#601728-01-01

Project Manager: Safiarin Maiter

Regulatory Criteria

Special Instructions

Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form

Samples must be kept cool (< 10°C) from time of sampling until delivery to BV Labs

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Regulated Drinking Water ? (Y / N)	Metals Field Filtered ? (Y / N)	CSR BTEX/VPH in Soil - Field Preserved	LEPH & HEPH with PAH for CSR in Soil	CSR/CCME Metals in Soil with Hg	Soluble Sodium and Chloride in Soil by Saturated Paste	# of Bottles	Comments
1		BH20-05_0.15-0.45	2020/03/04	09:45	Soil	N	-		X	X	X	5	
2		BH20-05_0.6-1.1	2020/03/04	09:50	Soil	N	-	X	X	X	X	5	
3		BH20-05_1.4-1.9	2020/03/04	09:55	Soil	N	-		X	X	X	3	
4		BH20-04_0.2-0.6	2020/03/04	11:20	Soil	N	-	X	X	X	X	4	
5		BH20-04_0.8-1.3	2020/03/04	11:25	Soil	N	-		X	X	X	2	
6		BH20-09_0.5-0.9	2020/03/04	12:30	Soil	N	-	X	X	X	X	5	
7		BH20-09_1.0-1.4	2020/03/04	12:35	Soil	N	-		X	X	X	3	
8		BH20-06_0.2-0.5	2020/03/04	14:55	Soil	N	-		X	X	X	5	
9		BH20-06_0.6-1.1	2020/03/04	15:00	Soil	N	-	X	X	X	X	5	
10		DUP-A	2020/03/04	15:00	Soil	N	-	X	X	X	X	5	

Analysis Requested

Turnaround Time (TAT) Required

Please provide advance notice for rush projects

Regular (Standard) TAT
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: Time Required:
Rush Confirmation Number: (call lab for #)

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
FOREST PIMM	20/03/05	15:00	[illegible]	20/03/06	[illegible]	N/A

Lab Use Only

Time Sensitive	Temperature (°C) on Receipt	Custody Seal Intact on Cooler?
☐	1.1.1	☐ Yes ☒ No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS.
* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

White: BV Labs Yellow: Client

Bureau Veritas Laboratories
Unit 1 - 460 Tennyson Place, Victoria, British Columbia Canada V8Z 6S8 Tel (250) 385 6112 Toll-free 800-563-6266 Fax:(250) 382 6364 www.bvlabs.com

C017076_COC

C#601728-02-01

INVOICE TO:		Report Information		Project Information		s Order #:
Company Name	#11223 SLR CONSULTING (CANADA) LTD	Company Name		Quotation #	B90035	01728
Contact Name	Roberto Prieto	Contact Name	Roberto Prieto	P.O. #	VIC3255	
Address	#303-3960 Quadra Street	Address		Project #	205.04011.00000	Project Manager
	VICTORIA BC V8X 4A3			Project Name	EGDEDE	Safiann Maiter
Phone	(250) 475-9595 Fax: (250) 475-9596	Phone	Fax:	Site #		
Email	rprieto@slrconsulting.com	Email	rprieto@slrconsulting.com; analytical@slrconsulting.co	Sampled By	FP	

Regulatory Criteria

Special Instructions

Note: For regulated drinking water samples - please use the Drinking Water Chain of Custody Form

Samples must be kept cool (< 10°C) from time of sampling until delivery to BV Labs

Turnaround Time (TAT) Required

Please provide advance notice for rush projects

Regular (Standard) TAT (will be applied if Rush TAT is not specified) — X

Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: _____ Time Required: _____
Rush Confirmation Number: _____ (call lab for #)

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Regulated Drinking Water ? (Y / N)	Metals Field Filtered ? (Y / N)	CSR BTEX/VPH in Soil - Field Preserved	LEPH & HEPH with PAH for CSR in Soil	CSR/CCME Metals in Soil with Hg	Soluble Sodium and Chloride in Soil by Saturated Paste	# of Bottles	Comments
1		BH20-07_0.1-0.3	2020/03/04	15:50	Soil	N	-	X	X	X	X	5	
2		BH20-07_0.6-1.0	2020/03/04	15:55	Soil	N	-		X	X	X	5	
3													
4													
5													
6													
7													
8													
9													
10													

RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
FOREST PIMM	20/03/05	15:00	ALDEAN ALCANOJ	20/03/06	8:15	NIL

Lab Use Only

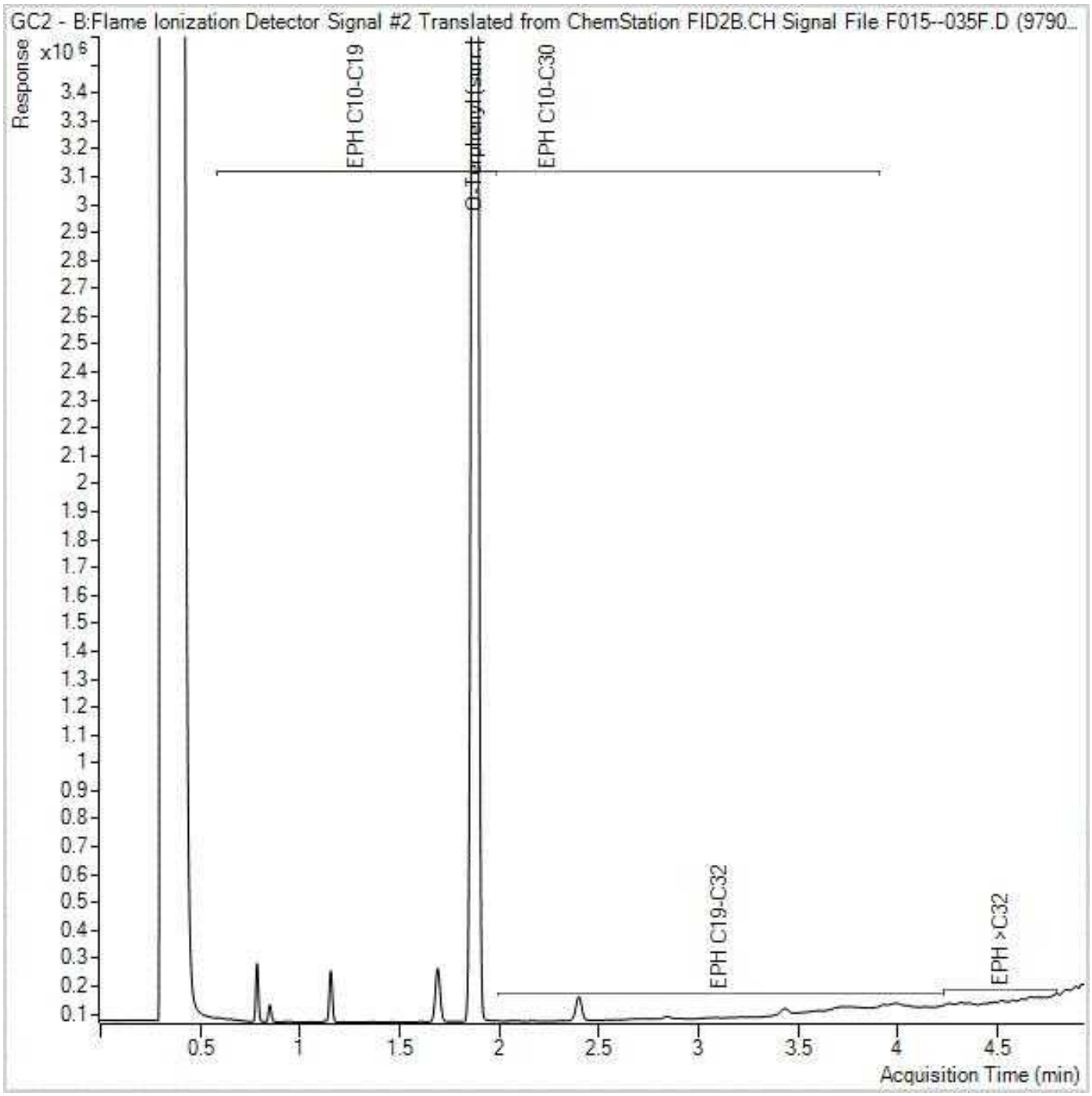
Time Sensitive	Temperature (°C) on Receipt	Custody Seal Intact on Cooler?
☐	1.1.1	☐ Yes ☒ No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVLABS.COM/TERMS-AND-CONDITIONS. BE-AS

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

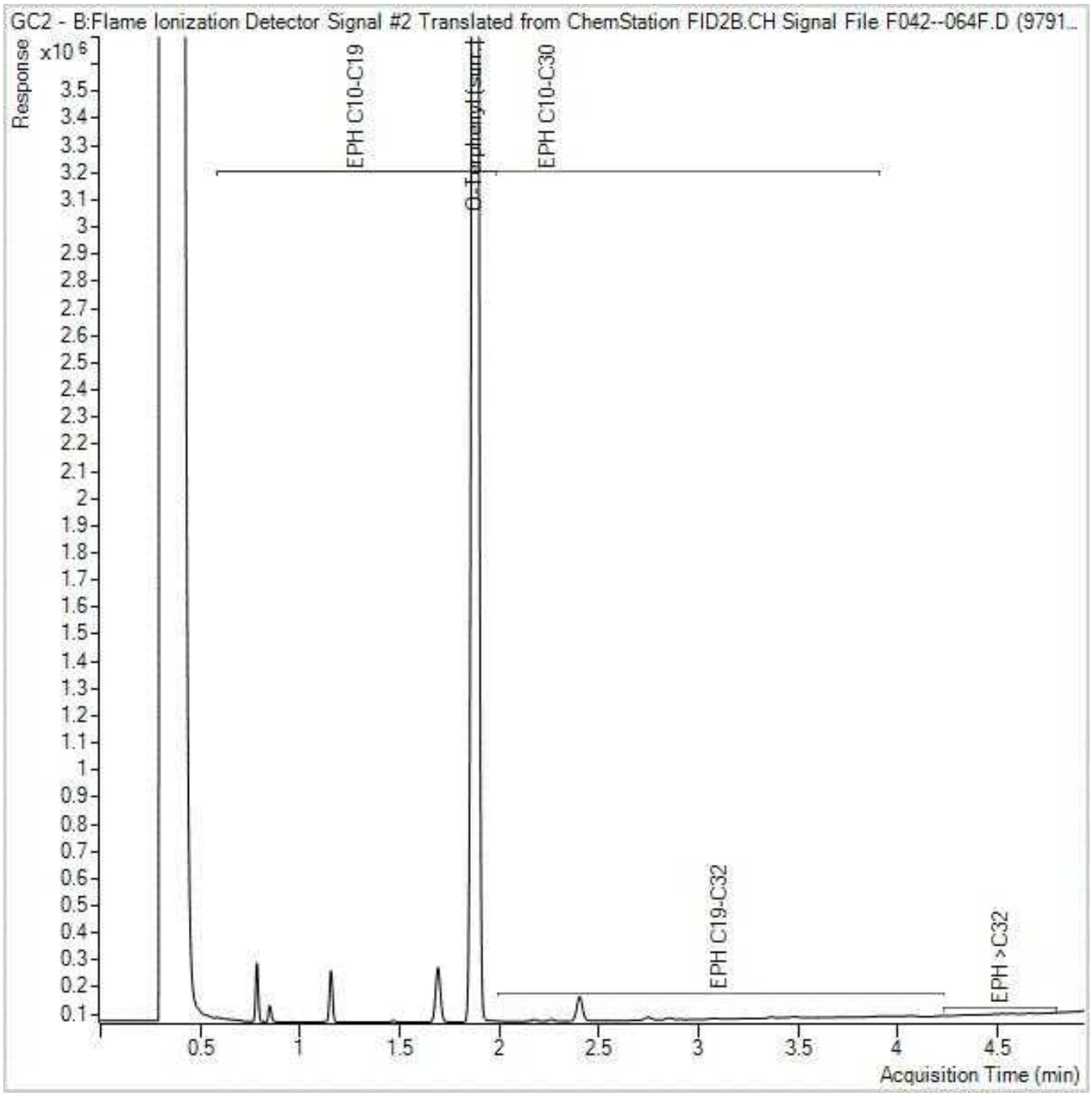
White: BV Labs Yellow: Client

EPH in Soil by GC/FID Chromatogram



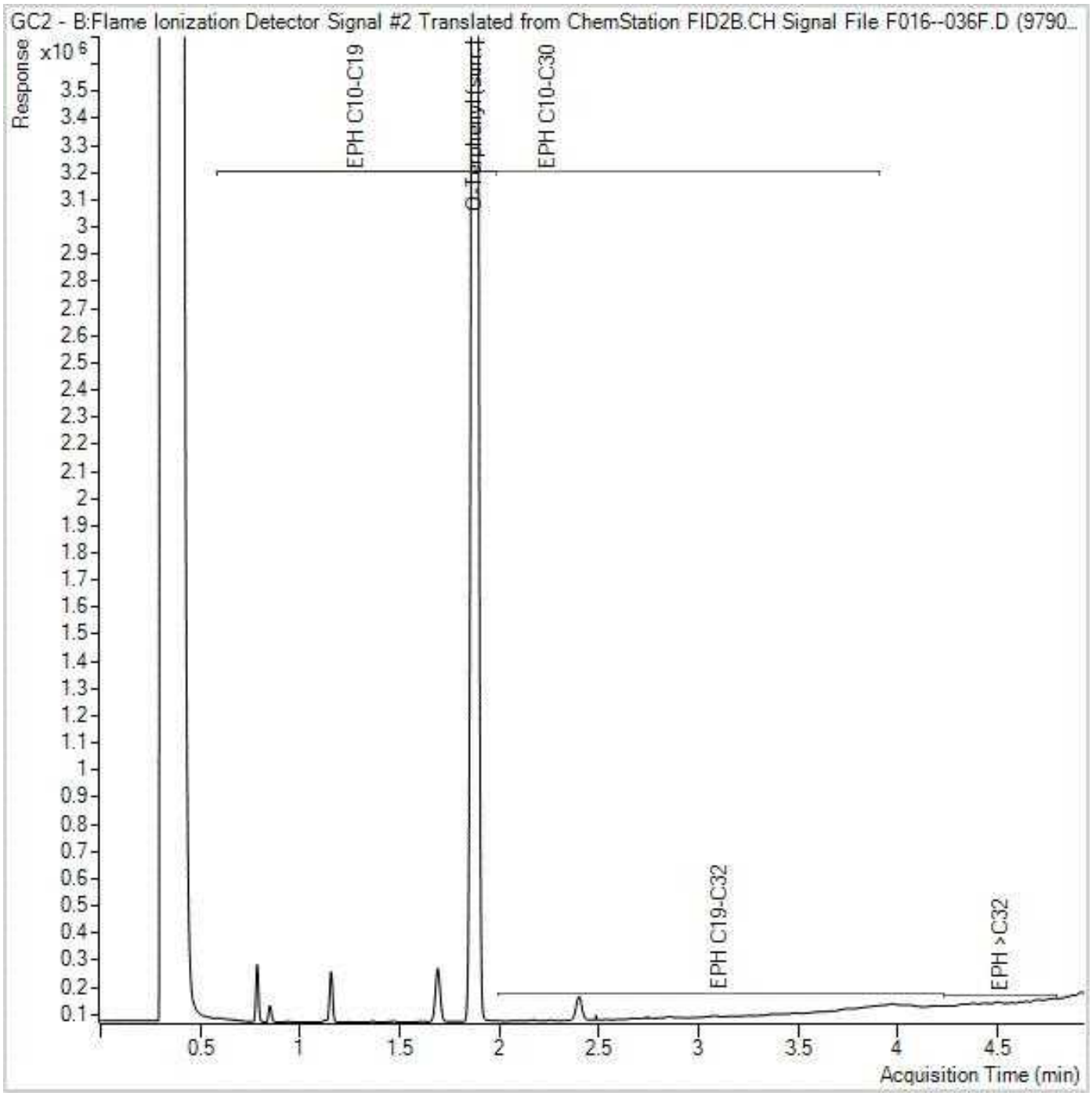
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

EPH in Soil by GC/FID Chromatogram



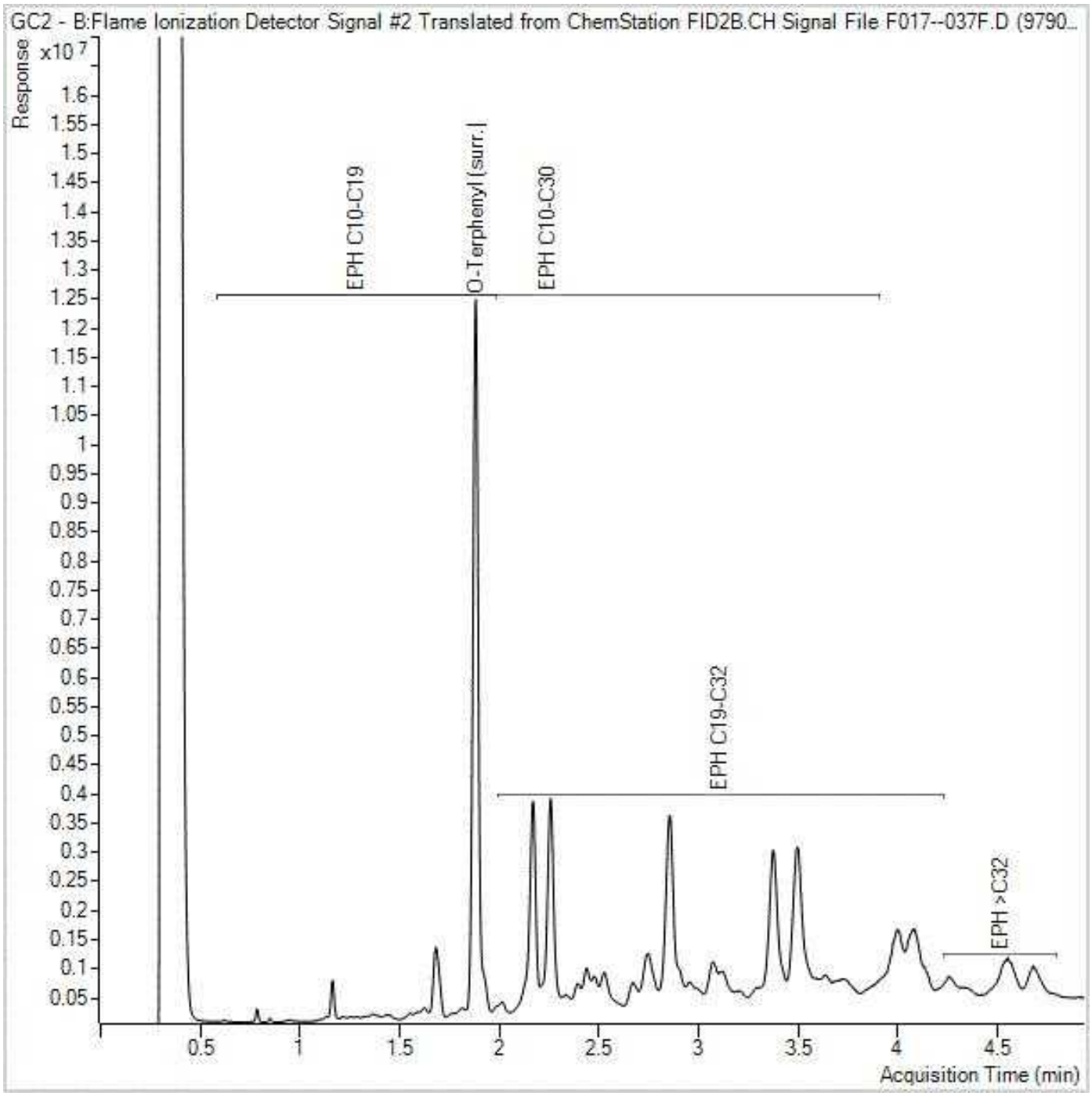
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

EPH in Soil by GC/FID Chromatogram



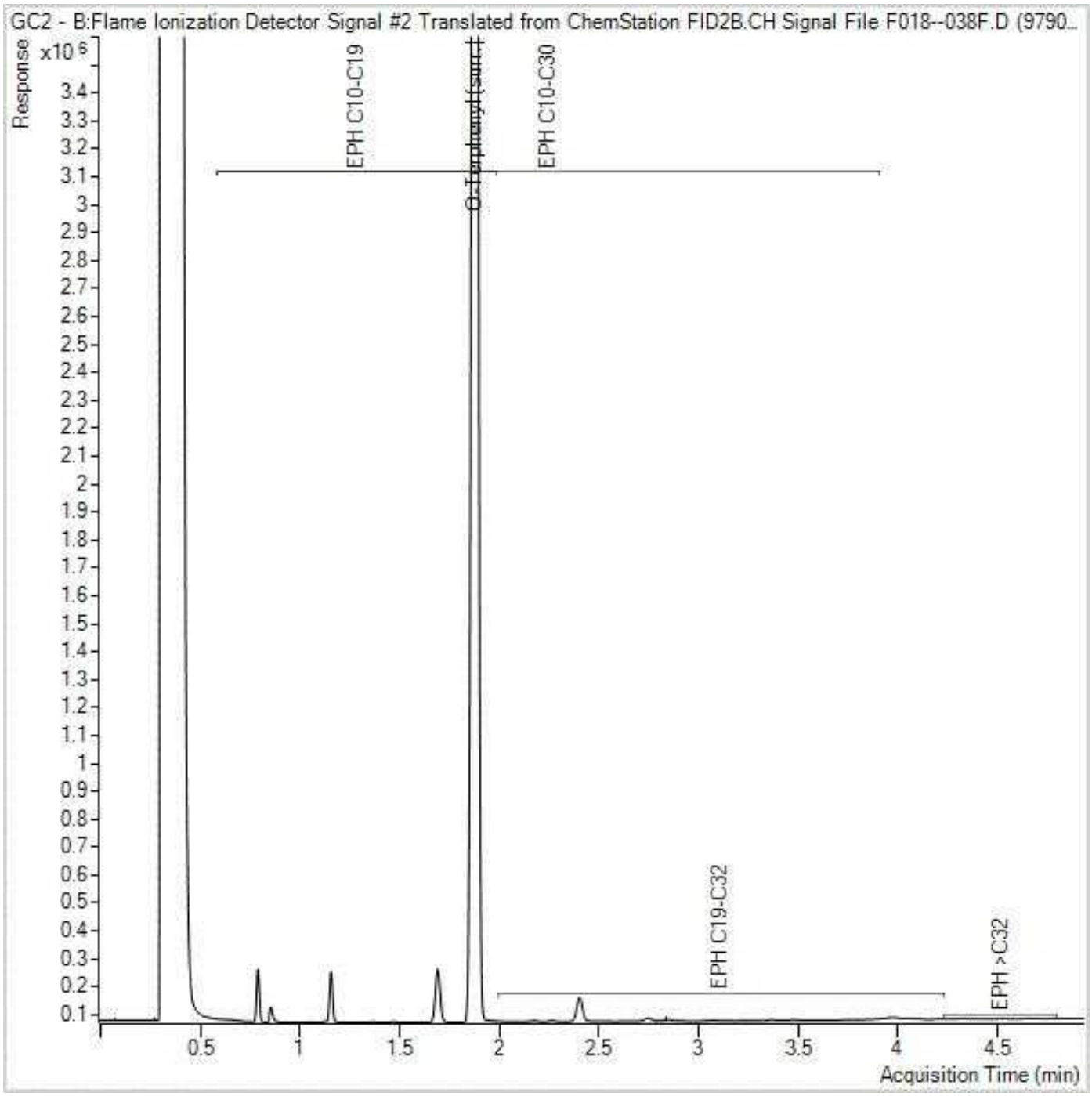
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

EPH in Soil by GC/FID Chromatogram



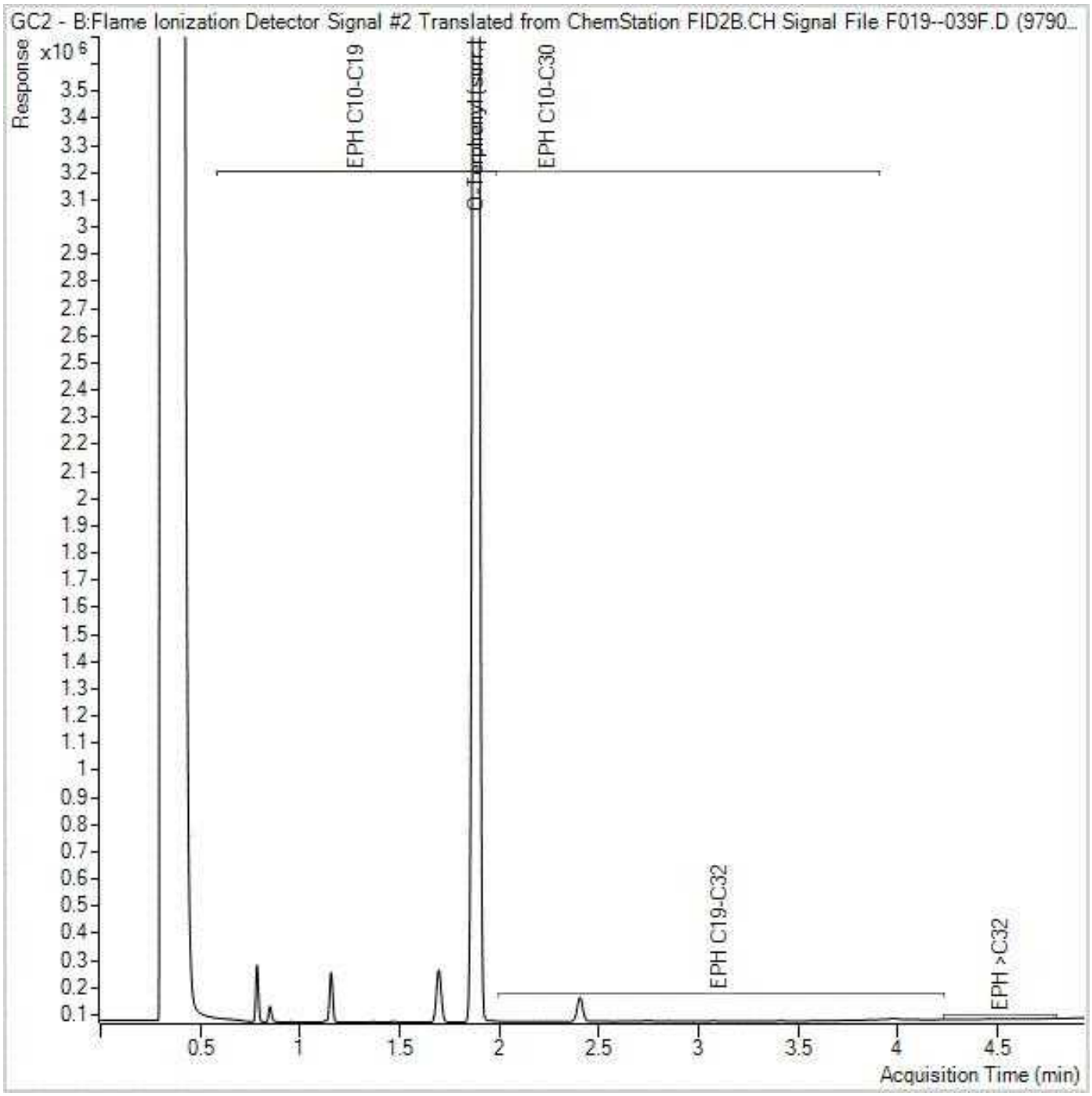
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

EPH in Soil by GC/FID Chromatogram



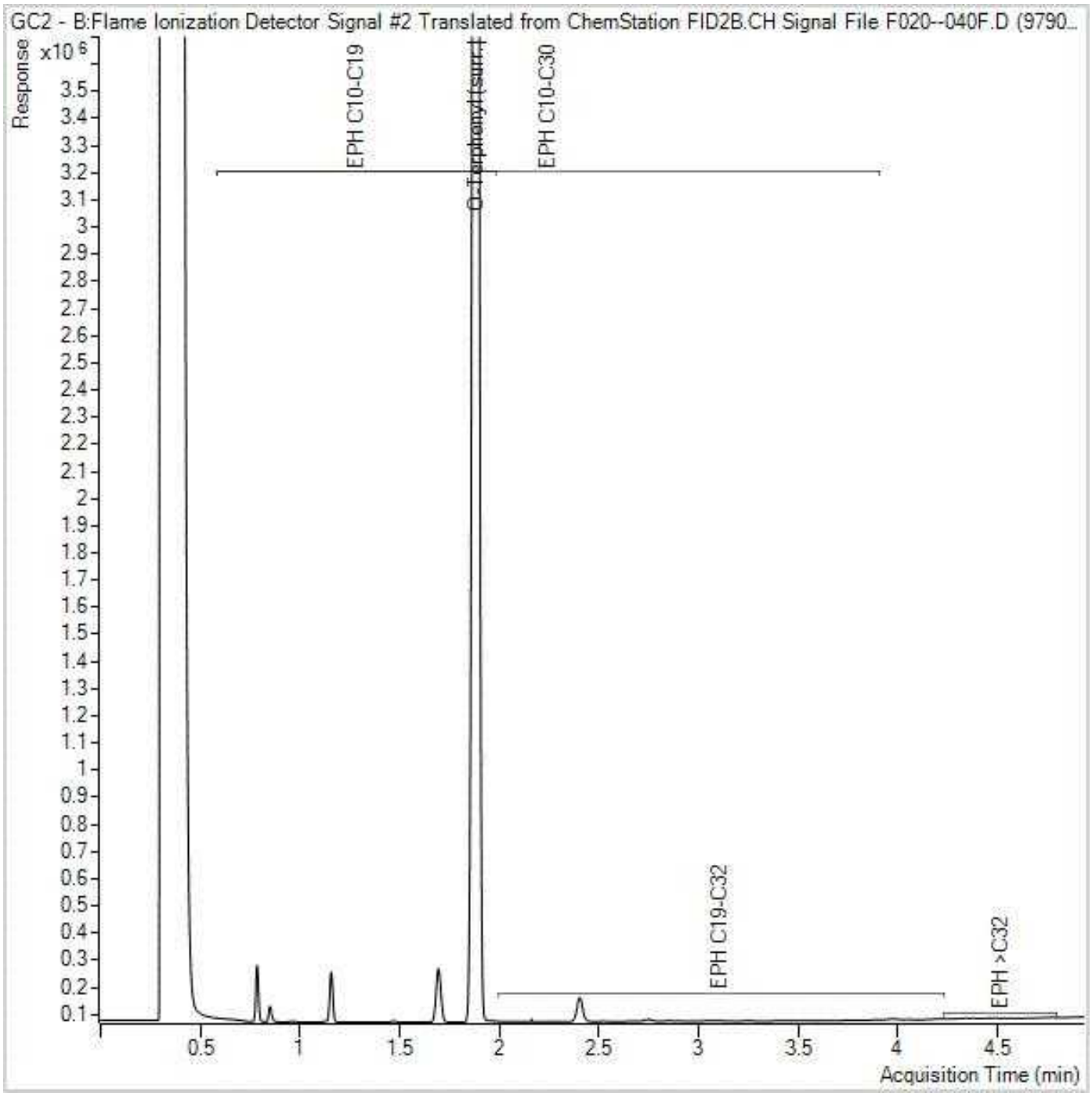
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

EPH in Soil by GC/FID Chromatogram



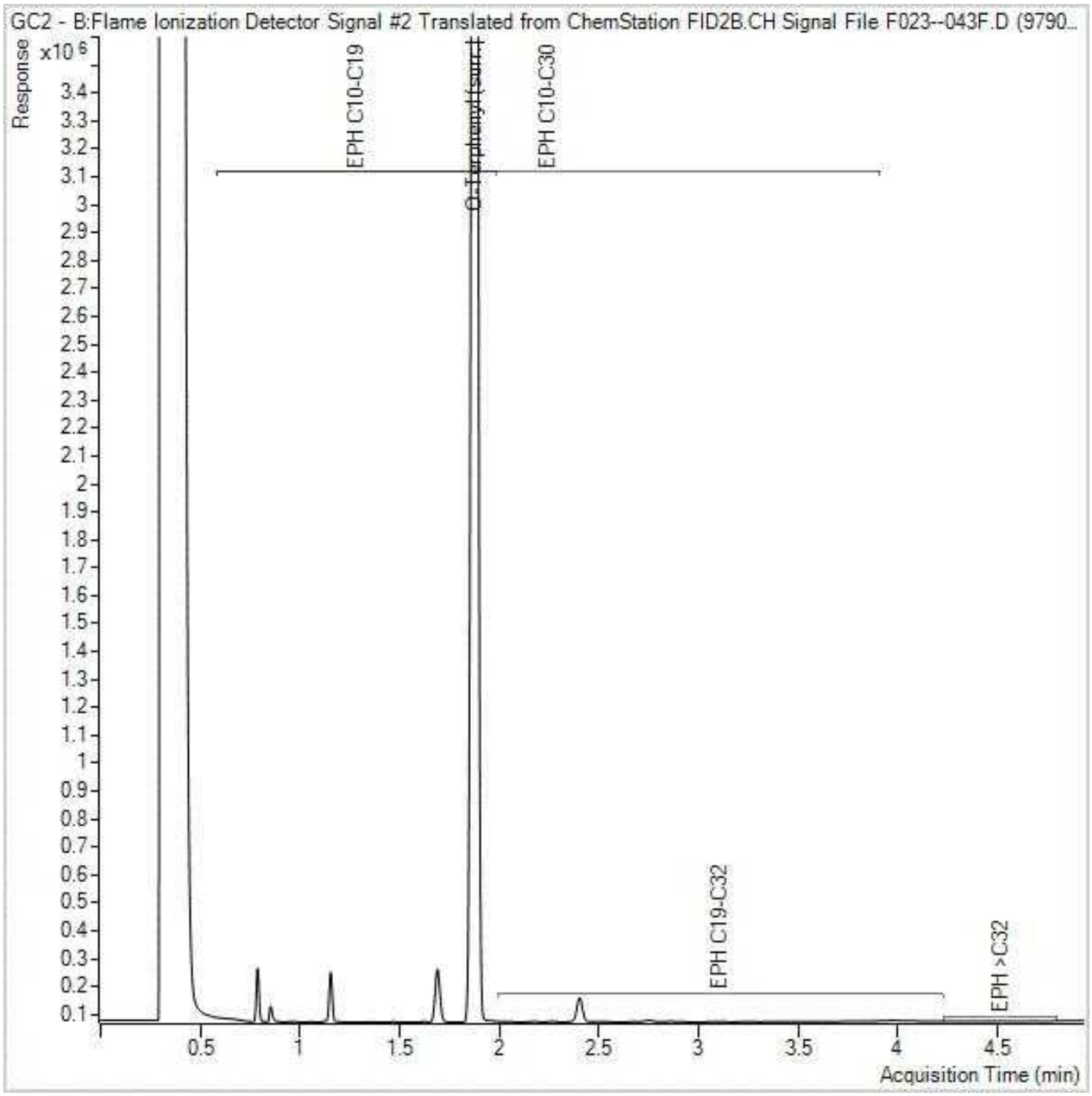
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

EPH in Soil by GC/FID Chromatogram



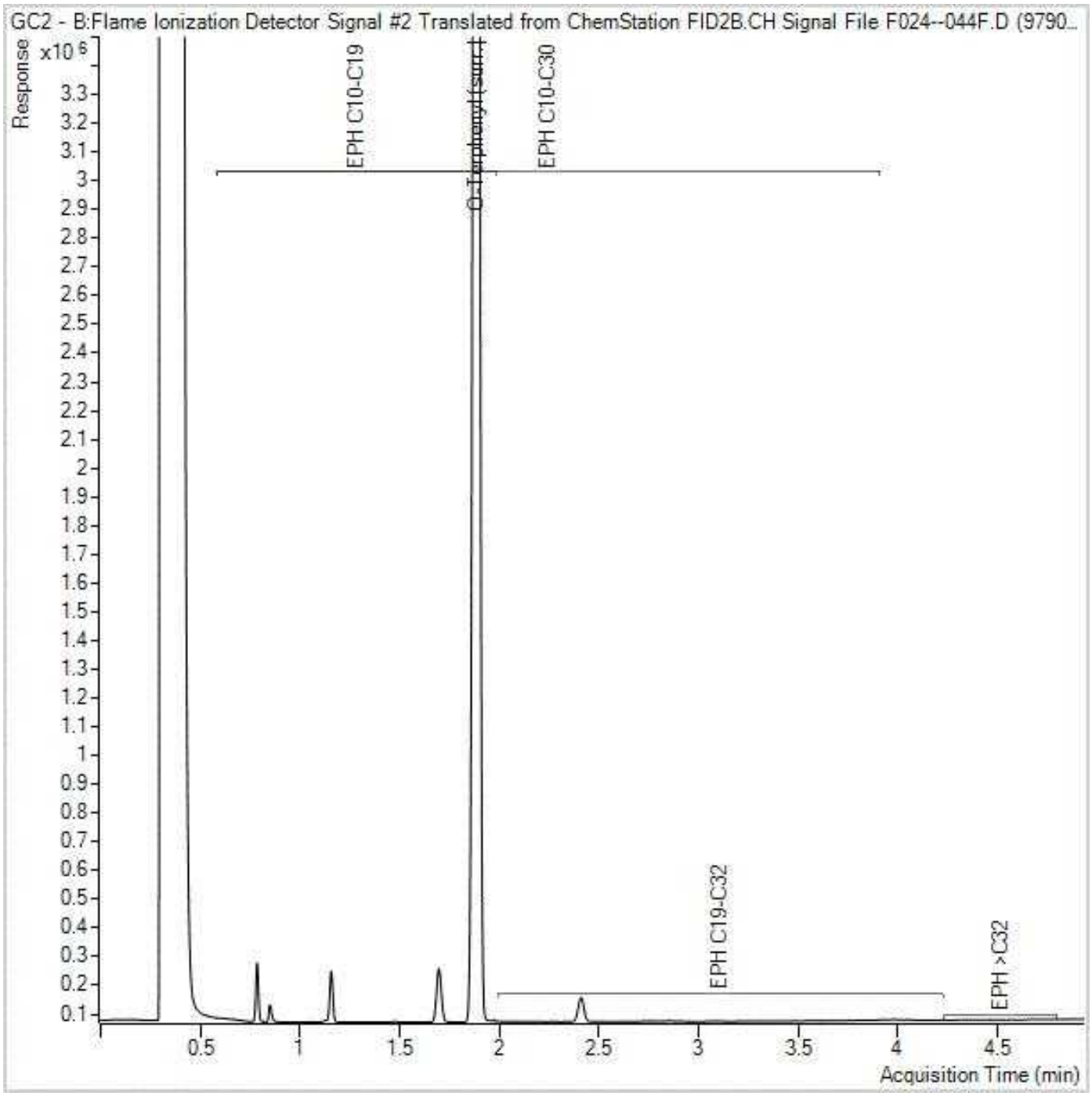
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

EPH in Soil by GC/FID Chromatogram



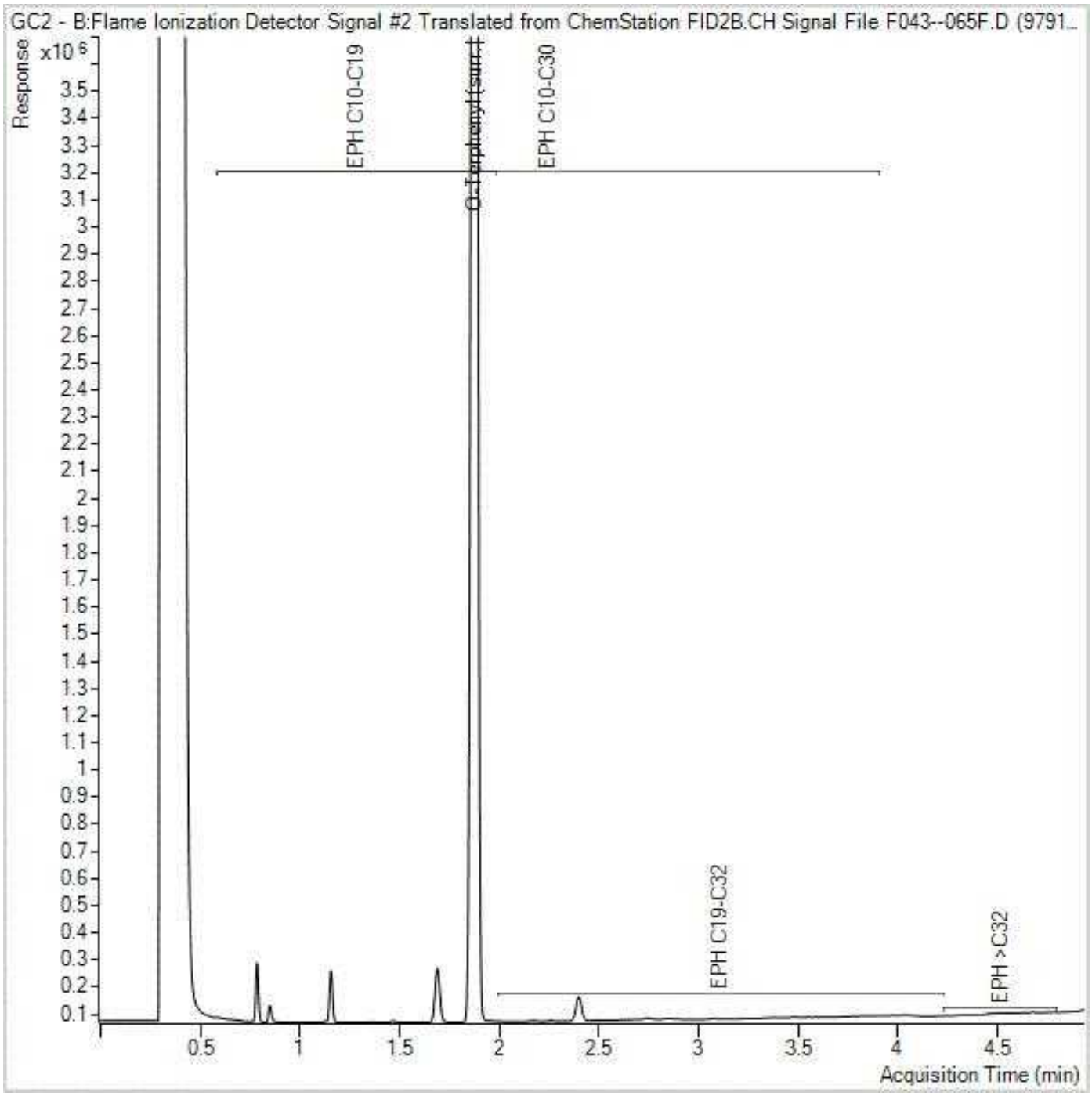
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

EPH in Soil by GC/FID Chromatogram



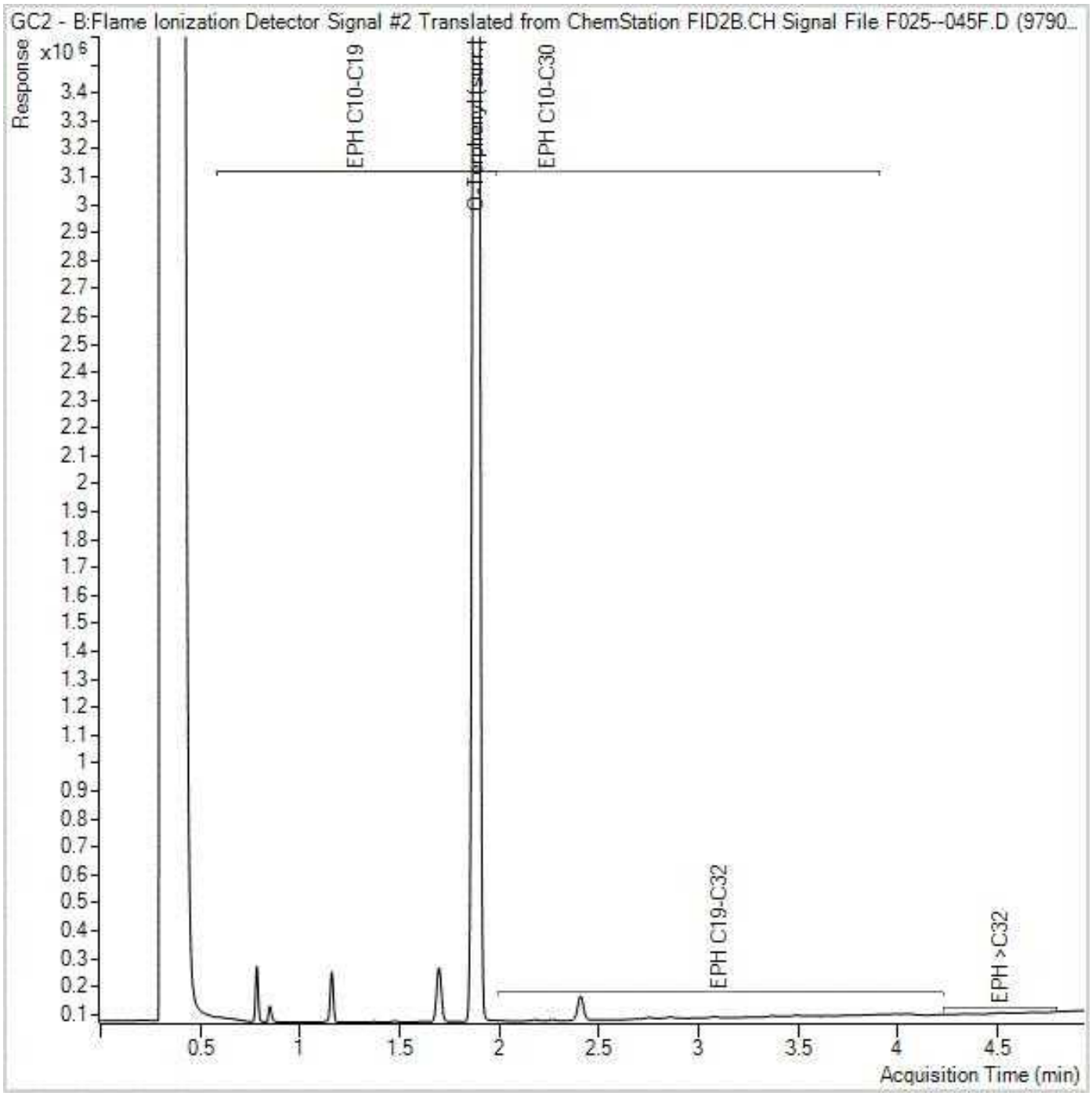
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

EPH in Soil by GC/FID Chromatogram



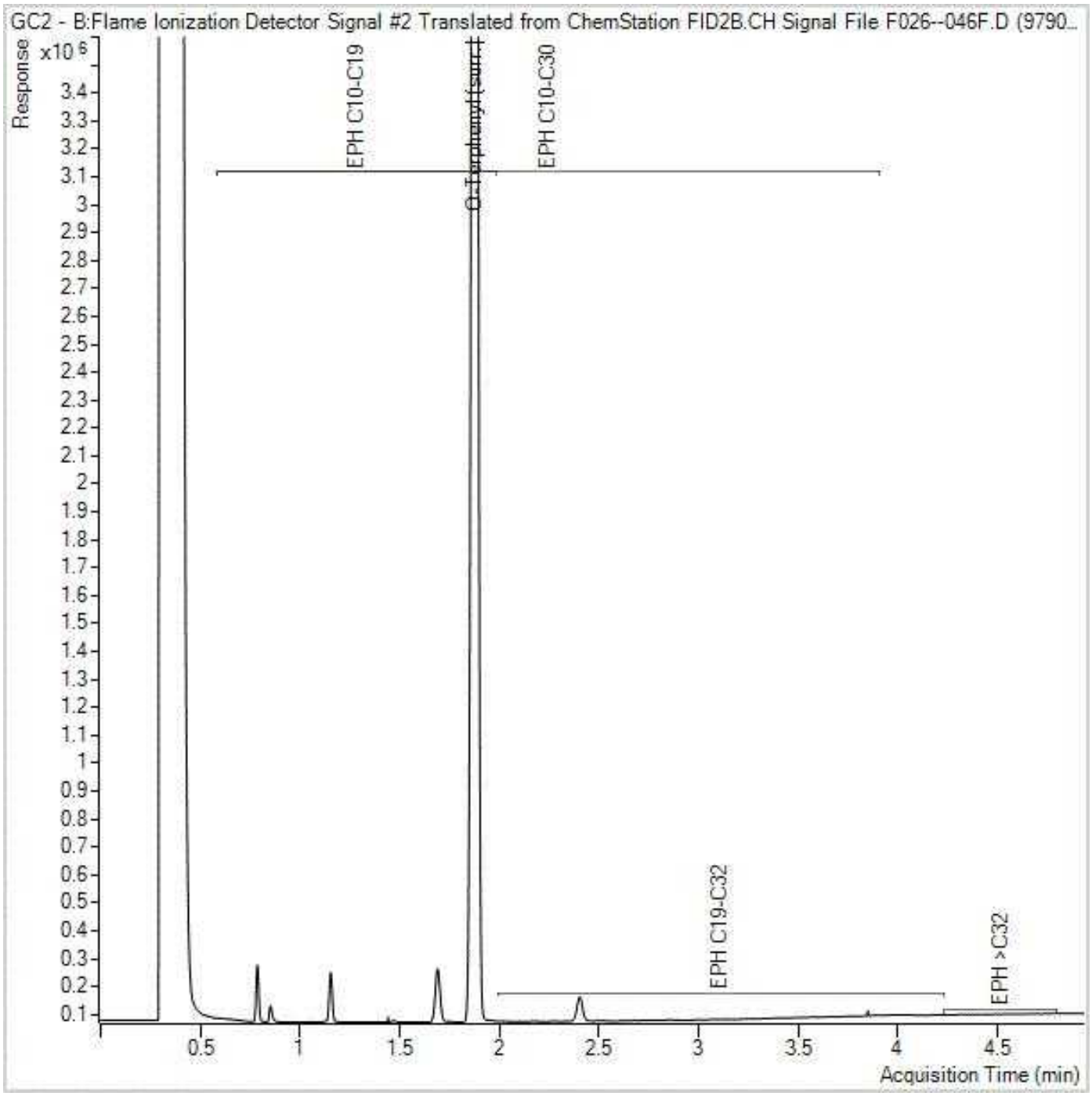
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

EPH in Soil by GC/FID Chromatogram



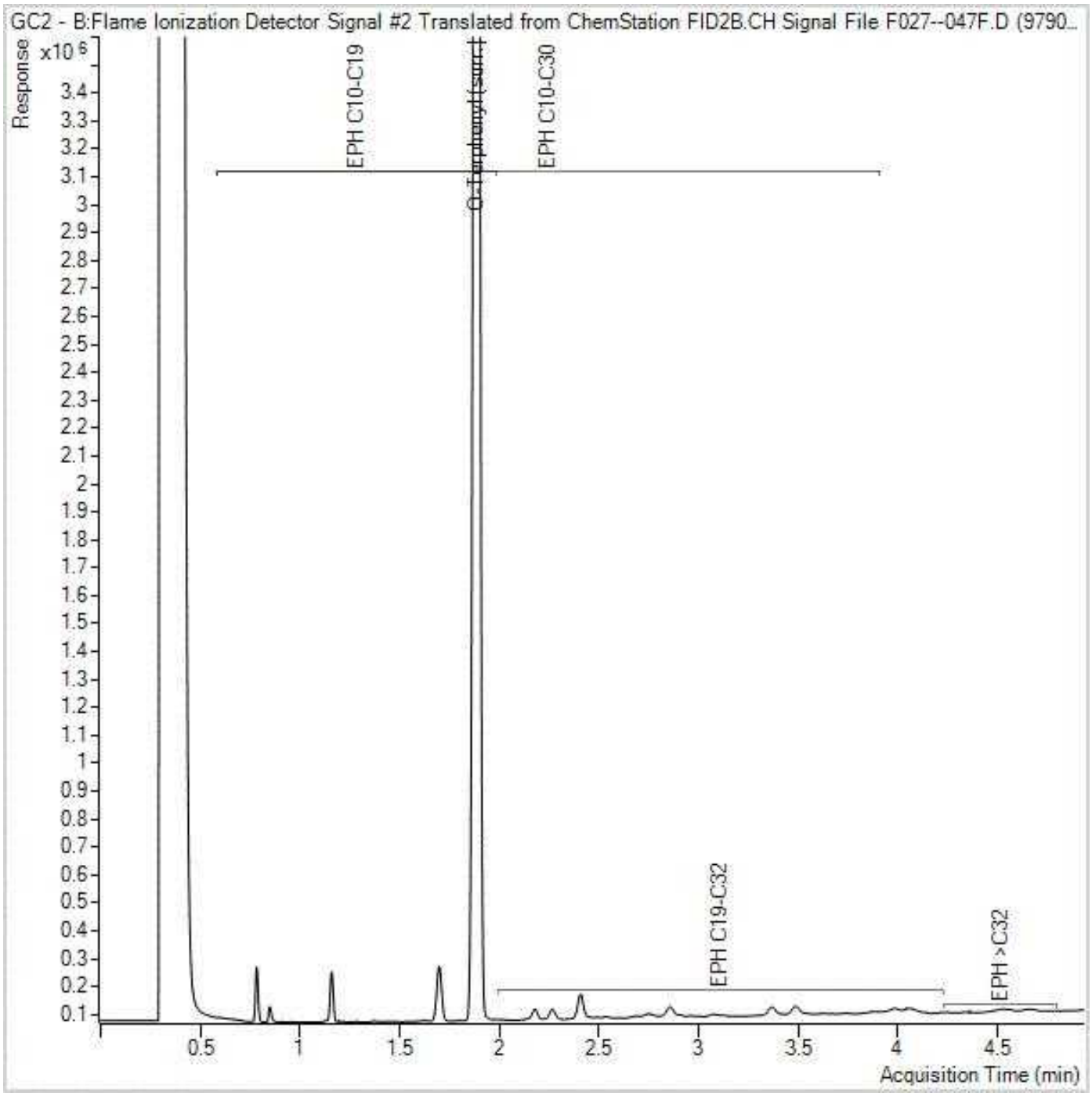
Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

EPH in Soil by GC/FID Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

EPH in Soil by GC/FID Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Your Project #: 201.88351.04 EGD SUP. INVSTGN
Site Location: AREA 3, ESQUIMALT GRAVING DOCK, ESQUIMALT, BC
Your C.O.C. #: 08304408

Attention: Jennifer Evans
SLR CONSULTING (CANADA) LTD
#200 - 1620 WEST 8TH AVENUE
VANCOUVER, BC
Canada V6J 1V4

Report Date: 2009/10/29
This report supersedes all previous reports with the same Maxxam job number

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: A949516
Received: 2009/09/10, 10:10

Sample Matrix: Soil
Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
BTEX/MTBE Soil LH, VH, F1 SIM/MS	1	2009/09/11	2009/09/14	BRN-SOP-0304 R10.0	EPA SW846 8260B
Chloride (soluble)	1	2009/09/14	2009/09/15	BRN SOP-00268 R5.0	Carter, SSMA 18.2.2
Volatile F1-BTEX	1	N/A	2009/09/14		
CCME Hydrocarbons (F2-F4 in soil)	1	2009/09/11	2009/09/15	BRN SOP-00342 R9.0	CCME Soil Tier 1
Elements by ICPMS (total)	5	2009/09/14	2009/09/14	BRN SOP-00203 R5.0	Based on EPA 200.8
Particulate Mesh 200	2	N/A	2009/09/15	NA	NA
Moisture	5	N/A	2009/09/12	BRN SOP-00321 R5.0	Ont MOE -E 3139
PAH in Soil by GC/MS (SIM)	5	2009/09/11	2009/09/16	BRN SOP-00332 R9.0	Based on EPA 8270D
Total LMW, HMW, Total PAH Calc	3	N/A	2009/09/16		
Total LMW, HMW, Total PAH Calc	2	N/A	2009/09/17		
pH (2:1 DI Water Extract)	5	2009/09/13	2009/09/13	BRN SOP-00266 R6.0	Carter, SSMA 16.2
Sodium Adsorption Ratio SP	1	N/A	2009/10/29		
Saturated Paste	1	2009/09/14	2009/09/14	BRN SOP-00268 R5.0	Carter SSMA 18.2.2
Soluble Ions Na, Cl	1	N/A	2009/09/16		
Soluble Cations (Ca,K,Mg,Na,S)	1	N/A	2009/09/15	BRN SOP-00268 R5.0	Carter, SM 18.2.2
EPH less PAH in Soil By GC/FID	1	N/A	2009/09/16		
BC Hydrocarbons in Soil by GC/FID	1	2009/09/11	2009/09/15	BRN SOP-00341 R14	Based BCCSR Method 3

* Results relate only to the items tested.

(1) SCC/CAEAL

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

KIMBERLEY WEBBER, BBY Customer Service
Email: kim.webber@maxxamanalytics.com
Phone# (604) 444-4808 Ext:259

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. SCC and CALA have approved this reporting process and electronic report format.

Total cover pages: 1

Maxxam Job #: A949516
Report Date: 2009/10/29

SLR CONSULTING (CANADA) LTD
Client Project #: 201.88351.04 EGD SUP. INVSTGN
Site Reference: AREA 3, ESQUIMALT GRAVING DOCK, ESQUIMALT, BC
Sampler Initials: JE

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		Q67460	Q67461	Q67462	Q67463	Q67464		
Sampling Date		2009/09/08	2009/09/08	2009/09/08	2009/09/08	2009/09/08		
	Units	**A3BH13-1**	**A3BH14-1**	**A3BH14-4**	**A3BH14-5**	**A3BH14-6**	**RDL**	**QC Batch**
Soluble Parameters								
Sodium Adsorption Ratio	N/A		2.1				0.1	3523206
Physical Properties								
<200 mesh (>.075 mm)	%	60.7			86.7		0.1	3416843
>200 mesh (<.075 mm)	%	39.3			13.4		0.1	3416843
Moisture	%	13	10	22	15	15	0.3	3410506

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		Q67461		
Sampling Date		2009/09/08		
	Units	**A3BH14-1**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon				
F2 (C10-C16 Hydrocarbons)	mg/kg	ND	10	3414623
F3 (C16-C34 Hydrocarbons)	mg/kg	15	10	3414623
F4 (C34-C50 Hydrocarbons)	mg/kg	21	10	3414623
Reached Baseline at C50	mg/kg	YES	N/A	3414623
Surrogate Recovery (%)				
O-TERPHENYL (sur.)	%	87		3414623

N/A = Not Applicable
ND = Not detected
RDL = Reportable Detection Limit

Maxxam Job #: A949516
Report Date: 2009/10/29

SLR CONSULTING (CANADA) LTD
Client Project #: 201.88351.04 EGD SUP. INVSTGN
Site Reference: AREA 3, ESQUIMALT GRAVING DOCK, ESQUIMALT, BC
Sampler Initials: JE

CCME BTEX/F1 BY HS - SOIL (SOIL)

Maxxam ID		Q67461		
Sampling Date		2009/09/08		
	Units	**A3BH14-1**	**RDL**	**QC Batch**
Calculated Parameters				
F1 (C6-C10) - BTEX	mg/kg	ND	10	3408608
Monocyclic Aromatics				
Benzene	mg/kg	ND	0.005	3413456
Ethylbenzene	mg/kg	ND	0.01	3413456
m & p-Xylene	mg/kg	ND	0.1	3413456
o-Xylene	mg/kg	ND	0.1	3413456
Styrene	mg/kg	ND	0.1	3413456
Toluene	mg/kg	ND	0.05	3413456
Xylenes (Total)	mg/kg	ND	0.1	3413456
Extractable Hydrocarbons				
(C6-C10)	mg/kg	ND	10	3413456
Volatiles				
Methyl-tert-butylether (MTBE)	mg/kg	ND	0.1	3413456
Surrogate Recovery (%)				
4-BROMOFLUOROBENZENE (sur.)	%	98		3413456
D10-ETHYLBENZENE (sur.)	%	99		3413456
D4-1,2-DICHLOROETHANE (sur.)	%	117		3413456
D8-TOLUENE (sur.)	%	91		3413456

ND = Not detected
RDL = Reportable Detection Limit

Maxxam Job #: A949516
Report Date: 2009/10/29

SLR CONSULTING (CANADA) LTD
Client Project #: 201.88351.04 EGD SUP. INVSTGN
Site Reference: AREA 3, ESQUIMALT GRAVING DOCK, ESQUIMALT, BC
Sampler Initials: JE

LEPH & HEPH FOR CSR IN SOIL (SOIL)

Maxxam ID		Q67461		
Sampling Date		2009/09/08		
	Units	**A3BH14-1**	**RDL**	**QC Batch**
Polycyclic Aromatics				
Low Molecular Weight PAH`s	mg/kg	0.12	0.01	3406520
High Molecular Weight PAH`s	mg/kg	0.29	0.02	3406520
Total PAH	mg/kg	0.40	0.02	3406520
Naphthalene	mg/kg	0.03	0.01	3417140
2-Methylnaphthalene	mg/kg	0.05	0.01	3417140
Acenaphthylene	mg/kg	0.01	0.01	3417140
Acenaphthene	mg/kg	ND	0.01	3417140
Fluorene	mg/kg	ND	0.01	3417140
Phenanthrene	mg/kg	0.03	0.01	3417140
Anthracene	mg/kg	ND	0.01	3417140
Fluoranthene	mg/kg	0.06	0.01	3417140
Pyrene	mg/kg	0.05	0.01	3417140
Benzo(a)anthracene	mg/kg	0.02	0.01	3417140
Chrysene	mg/kg	0.03	0.01	3417140
Benzo(b&j)fluoranthene	mg/kg	0.04	0.01	3417140
Benzo(k)fluoranthene	mg/kg	0.02	0.01	3417140
Benzo(a)pyrene	mg/kg	0.03	0.01	3417140
Indeno(1,2,3-cd)pyrene	mg/kg	0.02	0.02	3417140
Dibenz(a,h)anthracene	mg/kg	ND	0.02	3417140
Benzo(g,h,i)perylene	mg/kg	0.02	0.02	3417140
Surrogate Recovery (%)				
D10-ANTHRACENE (sur.)	%	100		3417140
D12-BENZO(A)PYRENE (sur.)	%	94		3417140
D8-ACENAPHTHYLENE (sur.)	%	91		3417140
TERPHENYL-D14 (sur.)	%	89		3417140
Calculated Parameters				
HEPH (C19-C32 less PAH)	mg/kg	ND	100	3406521
LEPH (C10-C19 less PAH)	mg/kg	ND	100	3406521
Hydrocarbons				
EPH (C10-C19)	mg/kg	ND	100	3417022
EPH (C19-C32)	mg/kg	ND	100	3417022
Surrogate Recovery (%)				
O-TERPHENYL (sur.)	%	107		3417022

ND = Not detected
RDL = Reportable Detection Limit

Maxxam Job #: A949516
Report Date: 2009/10/29

SLR CONSULTING (CANADA) LTD
Client Project #: 201.88351.04 EGD SUP. INVSTGN
Site Reference: AREA 3, ESQUIMALT GRAVING DOCK, ESQUIMALT, BC
Sampler Initials: JE

CSR/CCME METALS IN SOIL (SOIL)

Maxxam ID		Q67460	Q67461		Q67462	Q67463	Q67464		
Sampling Date		2009/09/08	2009/09/08		2009/09/08	2009/09/08	2009/09/08		
	Units	**A3BH13-1**	**A3BH14-1**	**QC Batch**	**A3BH14-4**	**A3BH14-5**	**A3BH14-6**	**RDL**	**QC Batch**
Misc. Inorganics									
Soluble (2:1) pH	pH Units	8.66	8.38	3413290	7.90	6.94	6.94	0.01	3413290
Total Metals by ICPMS									
Total Aluminum (Al)	mg/kg	19600	26800	3414382	13300	8460	7880	100	3414430
Total Antimony (Sb)	mg/kg	0.2	0.2	3414382	0.2	ND	ND	0.1	3414430
Total Arsenic (As)	mg/kg	4.0	5.0	3414382	3.9	6.1	4.7	0.2	3414430
Total Barium (Ba)	mg/kg	50.9	42.9	3414382	174	17.5	16.1	0.1	3414430
Total Beryllium (Be)	mg/kg	0.3	0.3	3414382	0.1	0.2	ND	0.1	3414430
Total Bismuth (Bi)	mg/kg	ND	ND	3414382	0.2	ND	ND	0.1	3414430
Total Cadmium (Cd)	mg/kg	0.06	0.10	3414382	0.23	ND	ND	0.05	3414430
Total Calcium (Ca)	mg/kg	8350	11100	3414382	5740	4790	4580	100	3414430
Total Chromium (Cr)	mg/kg	43	67	3414382	23	14	12	1	3414430
Total Cobalt (Co)	mg/kg	15.8	24.5	3414382	8.0	5.6	5.3	0.3	3414430
Total Copper (Cu)	mg/kg	56.6	87.1	3414382	29.5	19.0	16.9	0.5	3414430
Total Iron (Fe)	mg/kg	34000	43900	3414382	20100	15800	15000	100	3414430
Total Lead (Pb)	mg/kg	6.6	8.5	3414382	181	2.8	1.4	0.1	3414430
Total Lithium (Li)	mg/kg	10	12	3414382	10	6	ND	5	3414430
Total Magnesium (Mg)	mg/kg	10300	18600	3414382	5220	4370	3940	100	3414430
Total Manganese (Mn)	mg/kg	494	658	3414382	284	192	176	0.2	3414430
Total Mercury (Hg)	mg/kg	0.23	0.13	3414382	0.64	ND	ND	0.05	3414430
Total Molybdenum (Mo)	mg/kg	0.3	0.2	3414382	0.7	0.3	0.2	0.1	3414430
Total Nickel (Ni)	mg/kg	37.7	53.4	3414382	20.0	13.7	11.5	0.8	3414430
Total Phosphorus (P)	mg/kg	575	649	3414382	520	338	294	10	3414430
Total Potassium (K)	mg/kg	514	711	3414382	882	399	336	100	3414430
Total Selenium (Se)	mg/kg	ND	ND	3414382	ND	ND	ND	0.5	3414430
Total Silver (Ag)	mg/kg	0.07	0.11	3414382	0.25	ND	ND	0.05	3414430
Total Sodium (Na)	mg/kg	357	272	3414382	774	253	228	100	3414430
Total Strontium (Sr)	mg/kg	39.7	49.6	3414382	33.9	18.5	15.1	0.1	3414430
Total Thallium (Tl)	mg/kg	ND	ND	3414382	0.06	ND	ND	0.05	3414430
Total Tin (Sn)	mg/kg	0.6	1.0	3414382	2.8	0.2	0.2	0.1	3414430
Total Titanium (Ti)	mg/kg	681	764	3414382	814	701	694	1	3414430
Total Uranium (U)	mg/kg	0.21	0.21	3414382	0.50	0.21	0.17	0.05	3414430
Total Vanadium (V)	mg/kg	74	103	3414382	49	42	41	2	3414430
Total Zinc (Zn)	mg/kg	59	82	3414382	55	25	23	1	3414430
Total Zirconium (Zr)	mg/kg	1.7	2.0	3414382	1.9	1.7	1.6	0.5	3414430

ND = Not detected
RDL = Reportable Detection Limit

Maxxam Job #: A949516
Report Date: 2009/10/29

SLR CONSULTING (CANADA) LTD
Client Project #: 201.88351.04 EGD SUP. INVSTGN
Site Reference: AREA 3, ESQUIMALT GRAVING DOCK, ESQUIMALT, BC
Sampler Initials: JE

SOLUBLE SODIUM AND CHLORIDE -SOIL (SOIL)

Maxxam ID		Q67461		
Sampling Date		2009/09/08		
	Units	**A3BH14-1**	**RDL**	**QC Batch**
ANIONS				
Soluble Chloride (Cl)	mg/L	69	5	3419556
Calculated Parameters				
Soluble Chloride (Cl)	mg/kg	38	5	3408610
Soluble Sodium (Na)	mg/kg	25	5	3408610
Soluble Parameters				
Saturation %	%	55	1	3413819
Wet Soluble Sodium (Na)	mg/L	46	5	3415986

RDL = Reportable Detection Limit

Maxxam Job #: A949516
Report Date: 2009/10/29

SLR CONSULTING (CANADA) LTD
Client Project #: 201.88351.04 EGD SUP. INVSTGN
Site Reference: AREA 3, ESQUIMALT GRAVING DOCK, ESQUIMALT, BC
Sampler Initials: JE

PAH IN SOIL BY GC/MS (SOIL)

Maxxam ID		Q67460	Q67462		Q67463	Q67464		
Sampling Date		2009/09/08	2009/09/08		2009/09/08	2009/09/08		
	Units	**A3BH13-1**	**A3BH14-4**	**QC Batch**	**A3BH14-5**	**A3BH14-6**	**RDL**	**QC Batch**
Polycyclic Aromatics								
Low Molecular Weight PAH`s	mg/kg	0.05	0.20	3406520	0.02	0.01	0.01	3406520
High Molecular Weight PAH`s	mg/kg	0.28	0.75	3406520	ND	ND	0.02	3406520
Total PAH	mg/kg	0.33	0.95	3406520	ND	ND	0.02	3406520
Naphthalene	mg/kg	ND	0.04	3417140	ND	ND	0.01	3415013
2-Methylnaphthalene	mg/kg	ND	0.04	3417140	ND	ND	0.01	3415013
Acenaphthylene	mg/kg	0.01	0.02	3417140	ND	ND	0.01	3415013
Acenaphthene	mg/kg	ND	ND	3417140	ND	ND	0.01	3415013
Fluorene	mg/kg	ND	ND	3417140	ND	ND	0.01	3415013
Phenanthrene	mg/kg	0.02	0.08	3417140	0.02	0.01	0.01	3415013
Anthracene	mg/kg	0.02	0.03	3417140	ND	ND	0.01	3415013
Fluoranthene	mg/kg	0.05	0.14	3417140	ND	ND	0.01	3415013
Pyrene	mg/kg	0.05	0.12	3417140	ND	ND	0.01	3415013
Benzo(a)anthracene	mg/kg	0.02	0.06	3417140	ND	ND	0.01	3415013
Chrysene	mg/kg	0.02	0.07	3417140	ND	ND	0.01	3415013
Benzo(b&j)fluoranthene	mg/kg	0.04	0.11	3417140	ND	ND	0.01	3415013
Benzo(k)fluoranthene	mg/kg	0.01	0.04	3417140	ND	ND	0.01	3415013
Benzo(a)pyrene	mg/kg	0.03	0.08	3417140	ND	ND	0.01	3415013
Indeno(1,2,3-cd)pyrene	mg/kg	0.02	0.06	3417140	ND	ND	0.02	3415013
Dibenz(a,h)anthracene	mg/kg	ND	ND	3417140	ND	ND	0.02	3415013
Benzo(g,h,i)perylene	mg/kg	0.03	0.07	3417140	ND	ND	0.02	3415013
Surrogate Recovery (%)								
D10-ANTHRACENE (sur.)	%	101	101	3417140	104	111		3415013
D12-BENZO(A)PYRENE (sur.)	%	93	90	3417140	98	104		3415013
D8-ACENAPHTHYLENE (sur.)	%	93	94	3417140	92	99		3415013
TERPHENYL-D14 (sur.)	%	90	90	3417140	92	99		3415013

ND = Not detected
RDL = Reportable Detection Limit

Maxxam Job #: A949516
Report Date: 2009/10/29

SLR CONSULTING (CANADA) LTD
Client Project #: 201.88351.04 EGD SUP. INVSTGN
Site Reference: AREA 3, ESQUIMALT GRAVING DOCK, ESQUIMALT, BC
Sampler Initials: JE

Package 1	3.7°C

Each temperature is the average of up to three cooler temperatures taken at receipt

CCME BTEX/F1 BY HS - SOIL (SOIL) Comments

Sample Q67461-01 BTEX/MTBE Soil LH, VH, F1 SIM/MS: Samples submitted with excessive headspace for volatiles analysis (>2cm)

Maxxam Job #: A949516
Report Date: 2009/10/29

SLR CONSULTING (CANADA) LTD
Client Project #: 201.88351.04 EGD SUP. INVSTGN
Site Reference: AREA 3, ESQUIMALT GRAVING DOCK, ESQUIMALT, BC
Sampler Initials: JE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
3410506	Moisture	2009/09/12					ND, RDL=0.3	%	3.0	20		
3413290	Soluble (2:1) pH	2009/09/13			100	96 - 104			1.3	20		
3413456	Benzene	2009/09/14	95	60 - 140	95	80 - 120	ND, RDL=0.005	mg/kg	NC	40		
3413456	Ethylbenzene	2009/09/14	97	60 - 140	96	80 - 120	ND, RDL=0.01	mg/kg	NC	40		
3413456	m & p-Xylene	2009/09/14	100	60 - 140	99	80 - 120	ND, RDL=0.1	mg/kg	NC	40		
3413456	o-Xylene	2009/09/14	95	60 - 140	93	80 - 120	ND, RDL=0.1	mg/kg	NC	40		
3413456	Toluene	2009/09/14	90	60 - 140	90	80 - 120	ND, RDL=0.05	mg/kg	NC	40		
3413456	4-BROMOFLUOROBENZENE (sur.)	2009/09/14	100	70 - 130	103	70 - 130	98	%			102	70 - 130
3413456	D10-ETHYLBENZENE (sur.)	2009/09/14	100	50 - 130	92	50 - 130	98	%			95	50 - 130
3413456	D4-1,2-DICHLOROETHANE (sur.)	2009/09/14	117	70 - 130	116	70 - 130	111	%			114	70 - 130
3413456	D8-TOLUENE (sur.)	2009/09/14	93	70 - 130	96	70 - 130	95	%			96	70 - 130
3413456	(C6-C10)	2009/09/14					ND, RDL=10	mg/kg	NC	40	84	60 - 140
3413456	Styrene	2009/09/14					ND, RDL=0.1	mg/kg	NC	40		
3413456	Xylenes (Total)	2009/09/14					ND, RDL=0.1	mg/kg	NC	40		
3413456	Methyl-tert-butylether(MTBE)	2009/09/14					ND, RDL=0.1	mg/kg	NC	40		
3413819	Saturation %	2009/09/14					ND, RDL=1	%	0.5	25		
3414382	Total Arsenic (As)	2009/09/14	99	75 - 125	102	75 - 125	ND, RDL=0.2	mg/kg	24.8	30	88	70 - 130
3414382	Total Beryllium (Be)	2009/09/14	110	75 - 125	103	75 - 125	ND, RDL=0.1	mg/kg				
3414382	Total Cadmium (Cd)	2009/09/14	106	75 - 125	105	75 - 125	ND, RDL=0.05	mg/kg			83	70 - 130
3414382	Total Chromium (Cr)	2009/09/14	101	75 - 125	101	75 - 125	ND, RDL=1	mg/kg	2.6	30	93	70 - 130
3414382	Total Cobalt (Co)	2009/09/14	103	75 - 125	103	75 - 125	ND, RDL=0.3	mg/kg			87	70 - 130
3414382	Total Copper (Cu)	2009/09/14	104	75 - 125	104	75 - 125	ND, RDL=0.5	mg/kg	3.6	30	89	70 - 130
3414382	Total Lead (Pb)	2009/09/14	103	75 - 125	104	75 - 125	ND, RDL=0.1	mg/kg	1.5	35	94	70 - 130
3414382	Total Lithium (Li)	2009/09/14	106	75 - 125	104	75 - 125	ND, RDL=5	mg/kg				
3414382	Total Mercury (Hg)	2009/09/14	107	75 - 125	113	75 - 125	ND, RDL=0.05	mg/kg				
3414382	Total Nickel (Ni)	2009/09/14	101	75 - 125	101	75 - 125	ND, RDL=0.8	mg/kg			88	70 - 130
3414382	Total Selenium (Se)	2009/09/14	109	75 - 125	106	75 - 125	ND, RDL=0.5	mg/kg				
3414382	Total Uranium (U)	2009/09/14	109	75 - 125	108	75 - 125	ND, RDL=0.05	mg/kg			78	70 - 130
3414382	Total Vanadium (V)	2009/09/14	NC	75 - 125	106	75 - 125	ND, RDL=2	mg/kg			103	70 - 130
3414382	Total Zinc (Zn)	2009/09/14	NC	75 - 125	111	75 - 125	ND, RDL=1	mg/kg	0.6	30	89	70 - 130
3414382	Total Aluminum (Al)	2009/09/14					ND, RDL=100	mg/kg			101	70 - 130
3414382	Total Antimony (Sb)	2009/09/14					ND, RDL=0.1	mg/kg			87	70 - 130
3414382	Total Barium (Ba)	2009/09/14					ND, RDL=0.1	mg/kg	1.6	35	106	70 - 130
3414382	Total Calcium (Ca)	2009/09/14					ND, RDL=100	mg/kg			100	70 - 130
3414382	Total Iron (Fe)	2009/09/14					ND, RDL=100	mg/kg			94	70 - 130
3414382	Total Magnesium (Mg)	2009/09/14					ND, RDL=100	mg/kg			99	70 - 130
3414382	Total Manganese (Mn)	2009/09/14					ND, RDL=0.2	mg/kg			94	70 - 130
3414382	Total Molybdenum (Mo)	2009/09/14					ND, RDL=0.1	mg/kg			86	70 - 130
3414382	Total Phosphorus (P)	2009/09/14					ND, RDL=10	mg/kg			92	70 - 130
3414382	Total Silver (Ag)	2009/09/14					ND, RDL=0.05	mg/kg			84	70 - 130

Maxxam Job #: A949516
Report Date: 2009/10/29

SLR CONSULTING (CANADA) LTD
Client Project #: 201.88351.04 EGD SUP. INVSTGN
Site Reference: AREA 3, ESQUIMALT GRAVING DOCK, ESQUIMALT, BC
Sampler Initials: JE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
3414382	Total Strontium (Sr)	2009/09/14					ND, RDL=0.1	mg/kg			94	70 - 130
3414382	Total Thallium (Tl)	2009/09/14					ND, RDL=0.05	mg/kg			85	70 - 130
3414382	Total Titanium (Ti)	2009/09/14					ND, RDL=1	mg/kg			109	70 - 130
3414382	Total Bismuth (Bi)	2009/09/14					ND, RDL=0.1	mg/kg				
3414382	Total Potassium (K)	2009/09/14					ND, RDL=100	mg/kg				
3414382	Total Sodium (Na)	2009/09/14					ND, RDL=100	mg/kg				
3414382	Total Tin (Sn)	2009/09/14					ND, RDL=0.1	mg/kg				
3414382	Total Zirconium (Zr)	2009/09/14					ND, RDL=0.5	mg/kg				
3414430	Total Arsenic (As)	2009/09/14	95	75 - 125	104	75 - 125	ND, RDL=0.2	mg/kg	10.0	30	90	70 - 130
3414430	Total Beryllium (Be)	2009/09/14	101	75 - 125	103	75 - 125	ND, RDL=0.1	mg/kg	NC	30		
3414430	Total Cadmium (Cd)	2009/09/14	100	75 - 125	105	75 - 125	ND, RDL=0.05	mg/kg	NC	30	82	70 - 130
3414430	Total Chromium (Cr)	2009/09/14	96	75 - 125	100	75 - 125	ND, RDL=1	mg/kg	4.8	30	95	70 - 130
3414430	Total Cobalt (Co)	2009/09/14	98	75 - 125	102	75 - 125	ND, RDL=0.3	mg/kg	4.7	30	90	70 - 130
3414430	Total Copper (Cu)	2009/09/14	99	75 - 125	106	75 - 125	ND, RDL=0.5	mg/kg	4.0	30	89	70 - 130
3414430	Total Lead (Pb)	2009/09/14	95	75 - 125	104	75 - 125	ND, RDL=0.1	mg/kg	1.5	35	96	70 - 130
3414430	Total Lithium (Li)	2009/09/14	98	75 - 125	101	75 - 125	ND, RDL=5	mg/kg				
3414430	Total Mercury (Hg)	2009/09/14	101	75 - 125	112	75 - 125	ND, RDL=0.05	mg/kg	NC	35		
3414430	Total Nickel (Ni)	2009/09/14	84	75 - 125	105	75 - 125	ND, RDL=0.8	mg/kg	2.7	30	91	70 - 130
3414430	Total Selenium (Se)	2009/09/14	103	75 - 125	110	75 - 125	ND, RDL=0.5	mg/kg	NC	30		
3414430	Total Uranium (U)	2009/09/14	101	75 - 125	107	75 - 125	ND, RDL=0.05	mg/kg			81	70 - 130
3414430	Total Vanadium (V)	2009/09/14	NC	75 - 125	106	75 - 125	ND, RDL=2	mg/kg	4.4	30	106	70 - 130
3414430	Total Zinc (Zn)	2009/09/14	102	75 - 125	113	75 - 125	ND, RDL=1	mg/kg	5.1	30	93	70 - 130
3414430	Total Aluminum (Al)	2009/09/14					ND, RDL=100	mg/kg	1.6	35	110	70 - 130
3414430	Total Antimony (Sb)	2009/09/14					ND, RDL=0.1	mg/kg	NC	30	89	70 - 130
3414430	Total Barium (Ba)	2009/09/14					ND, RDL=0.1	mg/kg	6.0	35	109	70 - 130
3414430	Total Calcium (Ca)	2009/09/14					ND, RDL=100	mg/kg	7.2	30	106	70 - 130
3414430	Total Iron (Fe)	2009/09/14					ND, RDL=100	mg/kg	2.1	30	100	70 - 130
3414430	Total Magnesium (Mg)	2009/09/14					ND, RDL=100	mg/kg	2.5	30	101	70 - 130
3414430	Total Manganese (Mn)	2009/09/14					ND, RDL=0.2	mg/kg	3.1	30	98	70 - 130
3414430	Total Molybdenum (Mo)	2009/09/14					ND, RDL=0.1	mg/kg	NC	35	101	70 - 130
3414430	Total Phosphorus (P)	2009/09/14					ND, RDL=10	mg/kg	1.1	30	90	70 - 130
3414430	Total Silver (Ag)	2009/09/14					ND, RDL=0.05	mg/kg	NC	35	90	70 - 130
3414430	Total Strontium (Sr)	2009/09/14					ND, RDL=0.1	mg/kg	3.2	35	96	70 - 130
3414430	Total Thallium (Tl)	2009/09/14					ND, RDL=0.05	mg/kg	NC	30	79	70 - 130
3414430	Total Titanium (Ti)	2009/09/14					ND, RDL=1	mg/kg	5.8	35	113	70 - 130
3414430	Total Bismuth (Bi)	2009/09/14					ND, RDL=0.1	mg/kg	NC	30		
3414430	Total Potassium (K)	2009/09/14					ND, RDL=100	mg/kg	NC	35		
3414430	Total Sodium (Na)	2009/09/14					ND, RDL=100	mg/kg	NC	35		
3414430	Total Tin (Sn)	2009/09/14					ND, RDL=0.1	mg/kg	NC	35		
3414430	Total Zirconium (Zr)	2009/09/14					ND, RDL=0.5	mg/kg	NC	30		

Maxxam Job #: A949516
Report Date: 2009/10/29

SLR CONSULTING (CANADA) LTD
Client Project #: 201.88351.04 EGD SUP. INVSTGN
Site Reference: AREA 3, ESQUIMALT GRAVING DOCK, ESQUIMALT, BC
Sampler Initials: JE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
3414623	O-TERPHENYL (sur.)	2009/09/15	89	50 - 130	85	50 - 130	93	%				
3414623	F2 (C10-C16 Hydrocarbons)	2009/09/15	99	50 - 130	100	80 - 120	ND, RDL=10	mg/kg	NC	40		
3414623	F3 (C16-C34 Hydrocarbons)	2009/09/15	93	50 - 130	98	80 - 120	ND, RDL=10	mg/kg	12.7	40		
3414623	F4 (C34-C50 Hydrocarbons)	2009/09/15	106	50 - 130	104	80 - 120	ND, RDL=10	mg/kg	8.3	40		
3414623	Reached Baseline at C50	2009/09/15							NC	50		
3415013	D10-ANTHRACENE (sur.)	2009/09/15	88	30 - 130	98	30 - 130	115	%				
3415013	D12-BENZO(A)PYRENE (sur.)	2009/09/15	88	30 - 130	98	30 - 130	102	%				
3415013	D8-ACENAPHTHYLENE (sur.)	2009/09/15	93	30 - 130	95	30 - 130	104	%				
3415013	TERPHENYL-D14 (sur.)	2009/09/15	86	30 - 130	97	30 - 130	100	%				
3415013	Naphthalene	2009/09/15	87	50 - 130	114	50 - 130	ND, RDL=0.01	mg/kg	NC	50		
3415013	2-Methylnaphthalene	2009/09/15	86	50 - 130	112	50 - 130	ND, RDL=0.01	mg/kg	NC	50		
3415013	Acenaphthylene	2009/09/15	83	50 - 130	92	50 - 130	ND, RDL=0.01	mg/kg	NC	50		
3415013	Acenaphthene	2009/09/15	88	50 - 130	102	50 - 130	ND, RDL=0.01	mg/kg	NC	50		
3415013	Fluorene	2009/09/15	86	50 - 130	97	50 - 130	ND, RDL=0.01	mg/kg	NC	50		
3415013	Phenanthrene	2009/09/15	85	60 - 130	96	60 - 130	ND, RDL=0.01	mg/kg	47.5	50		
3415013	Anthracene	2009/09/15	88	60 - 130	98	60 - 130	ND, RDL=0.01	mg/kg	NC	50		
3415013	Fluoranthene	2009/09/15	85	60 - 130	95	60 - 130	ND, RDL=0.01	mg/kg	29.2	50		
3415013	Pyrene	2009/09/15	82	60 - 130	109	60 - 130	ND, RDL=0.01	mg/kg	25.4	50		
3415013	Benzo(a)anthracene	2009/09/15	83	60 - 130	110	60 - 130	ND, RDL=0.01	mg/kg	23.5	50		
3415013	Chrysene	2009/09/15	82	60 - 130	106	60 - 130	ND, RDL=0.01	mg/kg	21.7	50		
3415013	Benzo(b&j)fluoranthene	2009/09/15	84	60 - 130	104	60 - 130	ND, RDL=0.01	mg/kg	16.4	50		
3415013	Benzo(k)fluoranthene	2009/09/15	83	60 - 130	106	60 - 130	ND, RDL=0.01	mg/kg	NC	50		
3415013	Benzo(a)pyrene	2009/09/15	90	60 - 130	106	60 - 130	ND, RDL=0.01	mg/kg	13.3	50		
3415013	Indeno(1,2,3-cd)pyrene	2009/09/15	83	60 - 130	95	60 - 130	ND, RDL=0.02	mg/kg	NC	50		
3415013	Dibenz(a,h)anthracene	2009/09/15	82	60 - 130	95	60 - 130	ND, RDL=0.02	mg/kg	NC	50		
3415013	Benzo(g,h,i)perylene	2009/09/15	80	60 - 130	89	60 - 130	ND, RDL=0.02	mg/kg	NC	50		
3415986	Wet Soluble Sodium (Na)	2009/09/15					ND, RDL=5	mg/L	1.2	30		
3416843	<200 mesh (>.075 mm)	2009/09/15							1.0	30		
3416843	>200 mesh (<.075 mm)	2009/09/15							6.3	30		
3417022	O-TERPHENYL (sur.)	2009/09/15	110	50 - 130	103	50 - 130	106	%				
3417022	EPH (C10-C19)	2009/09/15	102	50 - 130	97	50 - 130	ND, RDL=100	mg/kg	NC	50		
3417022	EPH (C19-C32)	2009/09/15	109	50 - 130	92	50 - 130	ND, RDL=100	mg/kg	NC	50		
3417140	D10-ANTHRACENE (sur.)	2009/09/15	96	30 - 130	100	30 - 130	100	%				
3417140	D12-BENZO(A)PYRENE (sur.)	2009/09/15	90	30 - 130	94	30 - 130	92	%				
3417140	D8-ACENAPHTHYLENE (sur.)	2009/09/15	82	30 - 130	92	30 - 130	92	%				
3417140	TERPHENYL-D14 (sur.)	2009/09/15	87	30 - 130	92	30 - 130	90	%				
3417140	Naphthalene	2009/09/16	NC	50 - 130	96	50 - 130	ND, RDL=0.01	mg/kg	16.6(1)	50		
3417140	2-Methylnaphthalene	2009/09/16	NC	50 - 130	98	50 - 130	ND, RDL=0.01	mg/kg	15.9(2)	50		
3417140	Acenaphthylene	2009/09/16	70	50 - 130	88	50 - 130	ND, RDL=0.01	mg/kg	NC(3)	50		
3417140	Acenaphthene	2009/09/16	74	50 - 130	96	50 - 130	ND, RDL=0.01	mg/kg	13.8	50		

Maxxam Job #: A949516
Report Date: 2009/10/29

SLR CONSULTING (CANADA) LTD
Client Project #: 201.88351.04 EGD SUP. INVSTGN
Site Reference: AREA 3, ESQUIMALT GRAVING DOCK, ESQUIMALT, BC
Sampler Initials: JE

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
3417140	Fluorene	2009/09/16	69	50 - 130	96	50 - 130	ND, RDL=0.01	mg/kg	16.5	50		
3417140	Phenanthrene	2009/09/16	NC	60 - 130	98	60 - 130	ND, RDL=0.01	mg/kg	15.7(1)	50		
3417140	Anthracene	2009/09/16	89	60 - 130	96	60 - 130	ND, RDL=0.01	mg/kg	NC(3)	50		
3417140	Fluoranthene	2009/09/16	84	60 - 130	96	60 - 130	ND, RDL=0.01	mg/kg	15.3	50		
3417140	Pyrene	2009/09/16	77	60 - 130	90	60 - 130	ND, RDL=0.01	mg/kg	15.3	50		
3417140	Benzo(a)anthracene	2009/09/16	77	60 - 130	87	60 - 130	ND, RDL=0.01	mg/kg	NC(3)	50		
3417140	Chrysene	2009/09/16	79	60 - 130	89	60 - 130	ND, RDL=0.01	mg/kg	NC	50		
3417140	Benzo(b&j)fluoranthene	2009/09/16	82	60 - 130	93	60 - 130	ND, RDL=0.01	mg/kg	NC	50		
3417140	Benzo(k)fluoranthene	2009/09/16	79	60 - 130	91	60 - 130	ND, RDL=0.01	mg/kg	NC	50		
3417140	Benzo(a)pyrene	2009/09/16	85	60 - 130	96	60 - 130	ND, RDL=0.01	mg/kg	NC	50		
3417140	Indeno(1,2,3-cd)pyrene	2009/09/16	82	60 - 130	87	60 - 130	ND, RDL=0.02	mg/kg	NC	50		
3417140	Dibenz(a,h)anthracene	2009/09/16	87	60 - 130	88	60 - 130	ND, RDL=0.02	mg/kg	NC	50		
3417140	Benzo(g,h,i)perylene	2009/09/16	80	60 - 130	87	60 - 130	ND, RDL=0.02	mg/kg	NC	50		
3419556	Soluble Chloride (Cl)	2009/09/15					ND, RDL=5	mg/L	0.1	30		

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) - Matrix spike recovery outside control limit - High target compounds - No impact, spike Invalid
(2) - RDL raised due to sample dilution.
(3) - RDL raised due to sample matrix interference.

Maxxam Analytics Inc

Calgary: 2021-41st Ave. NE, T2E 6P2. Ph: (403) 291-3077, Fax: (403) 291-9468, Toll free: (800) 386-7247
Edmonton: 9619 - 42 Ave, T6E 5R2. Ph: (780) 465-1212, Fax: (780) 450-4187, Toll free: (877) 465-8889
Burnaby: 8577 Commerce Court, V5A 4N5 Ph: (604) 444-4808, Fax (604) 444-4511, Toll free: (800) 440-4808

A949516

ANALYTICAL REQUEST FORM

Page 1 of 1

Invoice To:	Require Report? Yes [X] No [ ]	**Report To:**
Company Name:	SLR Consulting (Canada) Ltd.	same as invoice
Contact Name:	Jen Evans	
Address:	#200 - 1620 West 8th Avenue	
	Vancouver, BC PC: V8Z 1T2	
Phone / Fax#:	Ph: 604-738-2500 Fax: 604-738-2508	

PO# / AFE#:	
Quotation #:	PWGSC pricing
Project # :	201.88351.04
Proj. Name:	EGD supplemental investigation, Area 3
Location:	Esquimalt Graving Dock, Esquimalt, BC
Sampler's Initials:	JE/DGP

REGULATORY REQUIREMENTS:

- [ ] AT1 - Soil Contamination
- [X] CCME
- [ ] CCME FWAL
- [ ] Regulatory Limits to appear on Final report
- [ ] PST
- [ ] CDWQG
- [ ] G50

REPORT DISTRIBUTION:

- [ ] Mail
- [ ] Fax
- [X] PDF
- [ ] Excel
- [ ] Other:
- [X] Email: jevans@slrconsulting.com

SERVICE REQUESTED:

- [ ] RUSH (Please ensure you contact the lab)
  Date Required:
- [X] REGULAR Turnaround

METALS: (WATERS)

- [ ] Total
- [ ] Extractable
- [ ] Dissolved

ANALYSIS REQUESTED

	Sample Identification	Matrix	Date/Time Sampled	Sample Type Grab/Comp	Hold > 60 Days	Sample Container #	CCME Metals	LEPH/HEPH (inc. PAH)	Na/Cl (saturated paste)	EPH	CCME Grain Size Analysis	PAH	PHC Fractions F1-F4 (inc. BETX)	BETX	VOC	Speciated Chromium	Phenols						
1	A3BH13-1	soil	Sept. 8, 2009	grab			X				X	X											
2	A3BH14-1	soil	Sept. 8, 2009	grab			X	X	X				X										
3	A3BH14-4	soil	Sept. 8, 2009	grab			X					X											
4	A3BH14-5	soil	Sept. 8, 2009	grab			X				X	X											
5	A3BH14-6	soil	Sept. 8, 2009	grab			X					X											
6		soil	Sept. 8, 2009	grab																			
7		soil	Sept. 8, 2009	grab																			
8		soil	Sept. 8, 2009	grab																			
9		soil	Sept. 8, 2009	grab																			
10		soil	Sept. 8, 2009	grab																			
11		soil	Sept. 8, 2009	grab																			
12		soil	Sept. 8, 2009	grab																			

** For water samples, please indicate if sample container has been preserved (P) and/or filtered (F).

Relinquished By: David Pugh **Date/Time:** Sept. 9, 2009, 16:00

Signature:

COMMENTS/SPECIAL INSTRUCTIONS: CCME detection limits, CCME PHC grain size analysis

Received 10:10 09/09/10

Temperature 25.4

C of C #

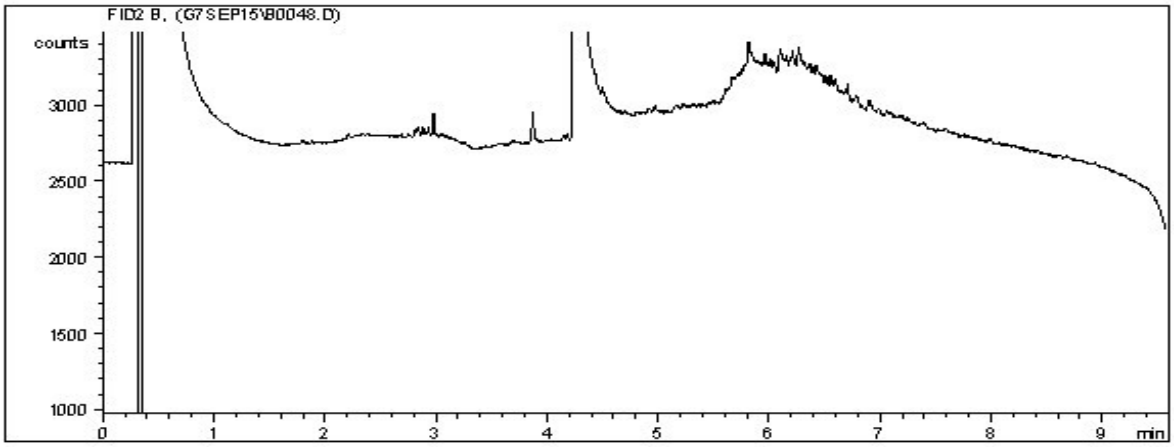
FCD - 0026 Chain of Custody R4 - April 11, 2005

08304408

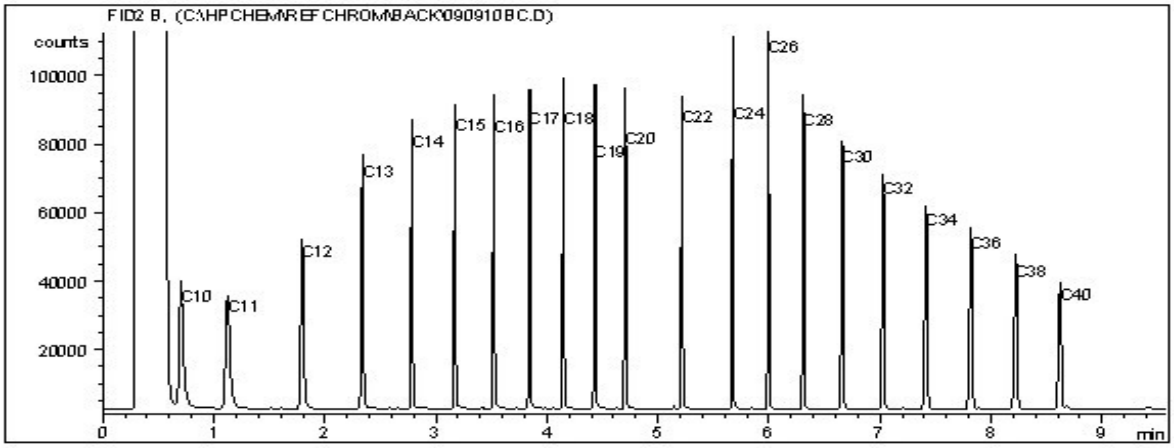
Report Date: 2009/10/29
Maxxam Job #: A949516
Maxxam Sample: Q67461

SLR CONSULTING (CANADA) LTD
Client Project #: 201.88351.04 EGD SUP. INVSTGN
Site Reference: AREA 3, ESQUIMALT GRAVING DOCK
Client ID: A3BH14-1

BC Hydrocarbons in Soil by GC/FID Chromatogram



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12		Diesel:	C8 - C22	
Varsol:	C8 - C12		Lubricating Oils:	C20 - C40	
Kerosene:	C7 - C16		Crude Oils:	C3 - C60+	

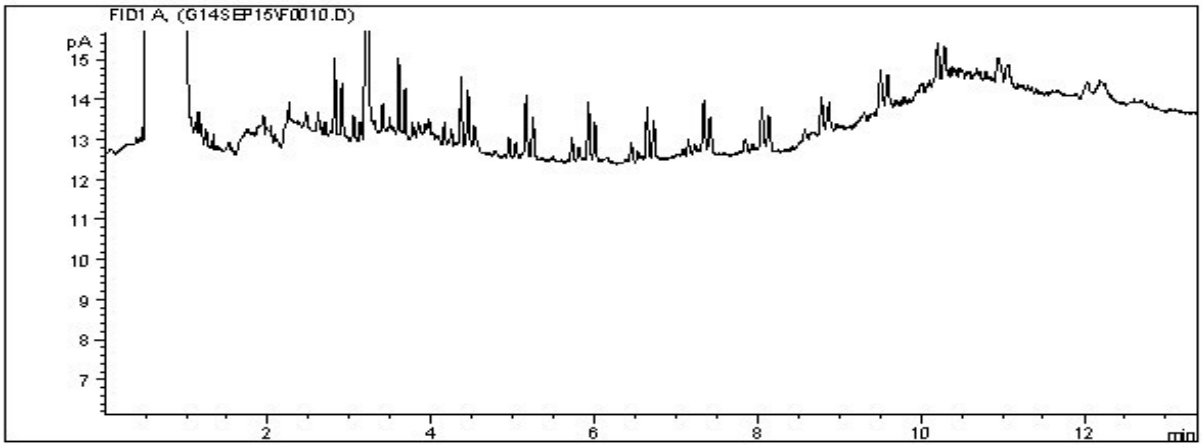
Page 1 of 1

Note: This information is provided for reference purposes only. Should detailed chemist intrepretation or fingerprinting be required to please contact the laboratory.

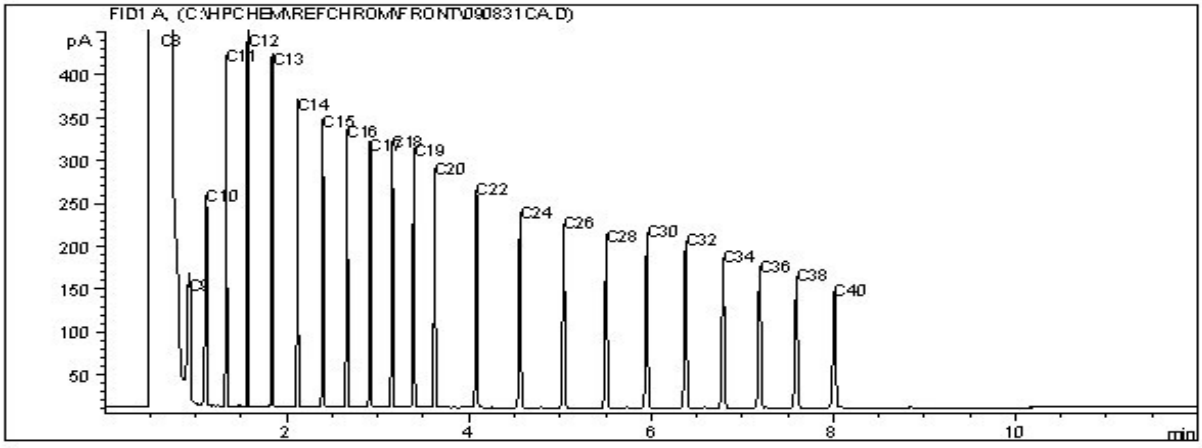
Report Date: 2009/10/29
Maxxam Job #: A949516
Maxxam Sample: Q67461

SLR CONSULTING (CANADA) LTD
Client Project #: 201.88351.04 EGD SUP. INVSTGN
Site Reference: AREA 3, ESQUIMALT GRAVING DOCK
Client ID: A3BH14-1

CCME Hydrocarbons (F2-F4 in soil) Chromatogram



Carbon Range Distribution - Reference Chromatogram



TYPICAL PRODUCT CARBON NUMBER RANGES

Gasoline:	C4 - C12	Diesel:	C8 - C22
Varsol:	C8 - C12	Lubricating Oils:	C20 - C40
Kerosene:	C7 - C16	Crude Oils:	C3 - C60+

Page 1 of 1

Note: This information is provided for reference purposes only. Should detailed chemist intrepretation or fingerprinting be required to please contact the laboratory.

Analysis Report

CANTEST LTD.

Professional
Analytical
Services

4606 Canada Way
Burnaby, B.C.
V5G 1K5

FAX: 604 731 2386

TEL: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Soil Samples

REPORTED TO: Seacor Environmental Engineering Inc.
3382 Tennyson Avenue
Victoria, B.C.
V8Z 3P6

Att'n: Mr. Kevin Pendriegh

PROJECT NAME: Esquimalt Graving Dock
PROJECT NUMBER: 201.00945.001

NUMBER OF SAMPLES: 13

REPORT DATE: April 17, 2002

DATE SUBMITTED: January 22, 2002

GROUP NUMBER: 30122037

SAMPLE TYPE: Soil

NOTE: Test results contained in this report refer only to the testing of samples submitted.

TEST METHODS:

Volatile Petroleum Hydrocarbons (VPH) in Soil - results were obtained using B.C. MOELP CSR-Analytical Method Method 5 "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water (VPH)" approved August 12, 1999. VPH is calculated by subtraction of specified MAH compounds from VH concentrations.

CCME Petroleum Hydrocarbons in Soil - analysis was performed using Canadian Council of Ministers of the Environment (CCME) "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil" approved December 2000. The method involves extraction of the different hydrocarbon fractions and analysis by gas chromatography with flame ionization detection (GC/FID).

Moisture in Soil - analysis was performed gravimetrically by heating a separate sample portion at 105 C and measuring the weight loss.

pH in Soil or Solid - analysis was performed based on procedures described in the Manual on Soil Sampling and Methods of Analysis, published by the Canadian Society of Soil Science,1993. The test was performed using a deionized water leach with measurement by pH meter.

Extractable Petroleum Hydrocarbons and Light and Heavy Extractable Petroleum Hydrocarbons in Soil - analysis was performed using B.C. MOELP CSR-Analytical Method 3 "Extractable Petroleum Hydrocarbons in Solids by GC/FID" and CSR-Analytical Method 6 "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water (LEPH & HEPH)". The method involves acetone/hexane extraction and GC/FID analysis. EPH components ranging from C10 to C19 and C19 to C32 are quantified against eicosane (n-C20). LEPH & HEPH are calculated by subtraction of specified PAH's.

(Continued)

CANTEST LTD.

Richard S. Jornitz
Supervisor, Inorganic Testing

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

Hexavalent Chromium in Soil - analysis was performed based on U.S. EPA Methods 3060A and 7196A, involving alkaline digestion followed by colorimetric analysis using UV-VIS spectrophotometry.

Polynuclear Aromatic Hydrocarbons - analysis was performed using procedures based on U.S. EPA Methods 625/8270, involving extraction, clean-up steps, and analysis using GC/MS.

Polychlorinated Biphenyls - analysis was performed using procedures based upon U.S. EPA Methods 608/8080, involving extraction, clean-up steps, and analysis using GC/ECD. Arochlors 1242, 1248, 1254 and 1260 were included.

Silver in Soil - analysis was performed using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Arsenic in Soil - analysis was performed using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Cadmium in Soil - analysis was performed using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Mercury in Soil - analysis was performed using Cold Vapour Atomic Fluorescence.

Strong Acid Leachable Metals in Soil - analysis was performed using B.C. MOELP Method "Strong Acid Leachable Metals in Soil, Version 1.0". The method involves drying the sample at 60 C, sieving using a 2 mm (10 mesh) sieve and digestion using a mixture of hydrochloric and nitric acids. Analysis was performed using Inductively Coupled Argon Plasma Spectroscopy (ICAP) or by specific techniques as described.

Selenium in Soil - analysis was using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Thallium in Soil - analysis was performed using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Volatile Organic Compounds in Water and Soil - analysis was performed using procedures based on U.S. EPA Methods 624/8240/8260, involving sparging with a Purge and Trap apparatus and analysis using GC/MS.

TEST RESULTS:

(See following pages)

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

Conventional Parameters in Soil

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Moisture	pH
AEC3 BH1-1	Jan 21/02	201220277	-	8.7
AEC3 BH1-2	Jan 21/02	201220278	15.3	8.9
AEC3 BH1-2A	Jan 21/02	201220280	0.4	8.8
AEC3 BH1-3	Jan 21/02	201220281	26.7	6.9
AEC3 BH1-6	Jan 21/02	201220282	-	8.0
AEC3 BH2-2	Jan 21/02	201220283	13.2	8.1
AEC3 BH2-3	Jan 21/02	201220284	-	7.3
AEC3 BH3-1	Jan 21/02	201220285	-	7.5
AEC3 BH3-3	Jan 21/02	201220286	12.6	7.2
AEC3 BH3-5	Jan 21/02	201220287	-	8.3
AEC3 BH4-2	Jan 21/02	201220288	-	7.9
AEC3 BH4-3	Jan 21/02	201220289	20.8	7.4
AEC3 BH4-4	Jan 21/02	201220290	-	7.3
DETECTION LIMIT			0.1	0.1
UNITS			%	pH units

% = percent

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Hexavalent Chromium Cr
AEC3 BH2-2	Jan 21/02	201220283	<
DETECTION LIMIT			2
UNITS			µg/g

µg/g = micrograms per gram, on a dry weight basis.
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH1-3	AEC3 BH3-3	
DATE SAMPLED:	Jan 21/02	Jan 21/02	
CANTEST ID:	201220281	201220286	DETECTION LIMIT
ANALYSIS DATE:	Jan 24/02	Jan 24/02	
Naphthalene	0.29	<	0.05
Acenaphthylene	0.29	<	0.05
Acenaphthene	< 0.25	<	0.05
Fluorene	< 0.25	<	0.05
Phenanthrene	0.80	0.14	0.05
Anthracene	< 0.25	<	0.05
Total LMW-PAH's	1.38	0.14	
Fluoranthene	2.5	0.37	0.05
Pyrene	2.6	0.37	0.05
Benzo(a)anthracene	1.6	0.20	0.05
Chrysene	1.9	0.25	0.05
Benzo(b)fluoranthene	3.2	0.31	0.05
Benzo(k)fluoranthene			0.05
Benzo(a)pyrene	2.1	0.21	0.05
Indeno(1,2,3-cd)pyrene	2.4	0.21	0.05
Dibenz(a,h)anthracene	< 0.25	<	0.05
Benzo(g,h,i)perylene	1.8	0.15	0.05
Total HMW-PAH's	18.1	2.07	
Total PAH's	19.5	2.21	

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit
Sample# 201220281 - Detection limits adjusted: Dilution required
NOTE: Benzo(b)fluoranthene and Benzo(k)fluoranthene reported as total.

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH1-3	AEC3 BH3-3	
DATE SAMPLED:	Jan 21/02	Jan 21/02	
CANTEST ID:	201220281	201220286	DETECTION LIMIT
ANALYSIS DATE:	Jan 23/02	Jan 23/02	
Benzene	<	<	0.01
Bromodichloromethane	<	<	0.01
Bromoform	<	<	0.01
Bromomethane	<	<	0.04
2-Butanone	<	<	0.5
Carbon Tetrachloride	<	<	0.01
Chlorobenzene	<	<	0.01
Chloroethane	<	<	0.02
Chloroform	3.4	2.0	0.01
Chloromethane	<	<	0.04
Dibromochloromethane	<	<	0.01
1,2-Dibromoethane	<	<	0.01
Dibromomethane	<	<	0.01
1,2-Dichlorobenzene	<	<	0.01
1,3-Dichlorobenzene	<	<	0.01
1,4-Dichlorobenzene	<	<	0.01
Dichlorodifluoromethane	<	<	0.02
1,1-Dichloroethane	<	<	0.01
1,2-Dichloroethane	<	<	0.02
1,1-Dichloroethene	<	<	0.01
cis-1,2-Dichloroethene	<	<	0.01
trans-1,2-Dichloroethene	<	<	0.01
1,2-Dichloropropane	<	<	0.01
cis-1,3-Dichloropropene	<	<	0.01
trans-1,3-Dichloropropene	<	<	0.01
Ethylbenzene	<	<	0.01
2-Hexanone	<	<	0.5
4-Methyl-2-pentanone	<	<	0.2
Methylene Chloride	<	<	0.3
Styrene	<	<	0.01
1,1,2,2-Tetrachloroethane	<	<	0.01

(Continued on next page)

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH1-3	AEC3 BH3-3	
DATE SAMPLED:	Jan 21/02	Jan 21/02	
CANTEST ID:	201220281	201220286	DETECTION LIMIT
ANALYSIS DATE:	Jan 23/02	Jan 23/02	
Tetrachloroethene	<	<	0.01
Toluene	<	<	0.01
1,1,1-Trichloroethane	<	<	0.01
1,1,2-Trichloroethane	<	<	0.01
Trichloroethene	<	<	0.01
Trichlorofluoromethane	<	<	0.01
Vinyl Chloride	<	<	0.02
Xylenes	<	<	0.01
Surrogate Recovery			
1,2-Dichloroethane-d4	115	84	-
Toluene-d8	108	91	-
Bromofluorobenzene	107	92	-

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

Polychlorinated Biphenyls in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH3-3	
DATE SAMPLED:	Jan 21/02	DETECTION LIMIT
CANTEST ID:	201220286	
Arochlor 1242	<	0.03
Arochlor 1248	<	0.03
Arochlor 1254	<	0.03
Arochlor 1260	<	0.03
Surrogate Recovery		
2,2',4,4',6,6'-hexabromobiphenyl	91	-

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

Extractable Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH1-2	AEC3 BH1-2A	AEC3 BH1-3	AEC3 BH2-2	
DATE SAMPLED:	Jan 21/02	Jan 21/02	Jan 21/02	Jan 21/02	DETECTION LIMIT
CANTEST ID:	201220278	201220280	201220281	201220283	
EPHs10-19	<	<	<	<	250
EPHs19-32	<	<	260	<	250
LEPHs (corrected for PAH's)	-	-	<	-	250
HEPHs (corrected for PAH's)	-	-	<	-	250

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

Extractable Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH3-3	AEC3 BH4-3	
DATE SAMPLED:	Jan 21/02	Jan 21/02	DETECTION LIMIT
CANTEST ID:	201220286	201220289	
EPHs10-19	<	<	250
EPHs19-32	<	350	250
LEPHs (corrected for PAH's)	<	-	250
HEPHs (corrected for PAH's)	<	-	250

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

Monocyclic Aromatic Hydrocarbons-Methanol Extraction- in Soil

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	VPHs
AEC3 BH1-3	Jan 21/02	201220281	<
AEC3 BH3-3	Jan 21/02	201220286	<
DETECTION LIMIT			100
UNITS			µg/g

µg/g = micrograms per gram, on a dry weight basis.
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

CCME Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH1-3	AEC3 BH3-3	
DATE SAMPLED:	Jan 21/02	Jan 21/02	DETECTION LIMIT
CANTEST ID:	201220281	201220286	
Benzene	<	<	0.04
Ethylbenzene	<	<	0.5
Toluene	<	<	0.5
Xylenes	<	<	0.5
F1 (C6-C10) uncorrected	<	<	25
F1 minus BTEX (C6-C10)	<	<	25
F2 uncorrected (C10-C16)	<	<	80
F3 uncorrected (C16-C34)	300	<	250
F4 (C34-C50)	<	<	250

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

CSR Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		AEC3 BH1-1	AEC3 BH1-2	AEC3 BH1-2A	AEC3 BH1-3	
DATE SAMPLED:		Jan 21/02	Jan 21/02	Jan 21/02	Jan 21/02	DETECTION LIMIT
CANTEST ID:		201220277	201220278	201220280	201220281	
Antimony	Sb	<	<	<	<	10
Arsenic	As	3.6	3.8	3.3	5.1	0.2
Barium	Ba	25	36	27	69	1
Beryllium	Be	<	<	<	<	1
Cadmium	Cd	<	<	<	<	0.4
Chromium	Cr	32	35	34	32	2
Cobalt	Co	4	4	3	4	1
Copper	Cu	37	30	28	61	1
Lead	Pb	33	27	26	184	5
Mercury	Hg	0.198	0.101	0.113	3.69	0.001
Molybdenum	Mo	<	<	<	<	4
Nickel	Ni	17	19	17	18	2
Selenium	Se	<	<	<	0.5	0.4
Silver	Ag	<	<	<	2.1	0.2
Thallium	Tl	<	<	<	<	0.2
Tin	Sn	<	<	<	<	5
Vanadium	V	47	54	48	50	1
Zinc	Zn	43	46	41	112	1
Aluminum	Al	12900	15100	13200	14200	10
Boron	B	10	10	7	8	1
Calcium	Ca	10300	6810	7440	5940	1
Iron	Fe	22700	26200	23800	24300	2
Magnesium	Mg	9360	9190	8940	7390	0.1
Manganese	Mn	298	398	330	315	1
Phosphorus	PO4	846	1040	873	1210	20
Potassium	K	239	599	340	531	10
Sodium	Na	156	225	164	198	5
Strontium	Sr	37	34	31	38	1
Titanium	Ti	504	536	510	481	1
Zirconium	Zr	7	8	7	7	1

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

CSR Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		AEC3 BH1-6	AEC3 BH2-2	AEC3 BH2-3	AEC3 BH3-1	
DATE SAMPLED:		Jan 21/02	Jan 21/02	Jan 21/02	Jan 21/02	DETECTION LIMIT
CANTEST ID:		201220282	201220283	201220284	201220285	
Antimony	Sb	<	<	<	<	10
Arsenic	As	1.8	4.2	4.4	21.0	0.2
Barium	Ba	20	60	57	48	1
Beryllium	Be	<	<	<	<	1
Cadmium	Cd	<	<	<	<	0.4
Chromium	Cr	17	47	30	33	2
Cobalt	Co	2	<	3	4	1
Copper	Cu	12	19	14	69	1
Lead	Pb	18	30	22	47	5
Mercury	Hg	0.059	0.083	0.083	0.306	0.001
Molybdenum	Mo	<	<	<	<	4
Nickel	Ni	9	15	16	17	2
Selenium	Se	<	<	<	<	0.4
Silver	Ag	<	<	<	<	0.2
Thallium	Tl	<	<	<	<	0.2
Tin	Sn	<	<	<	<	5
Vanadium	V	32	43	45	53	1
Zinc	Zn	22	34	42	94	1
Aluminum	Al	6950	12100	14900	13400	10
Boron	B	4	5	10	12	1
Calcium	Ca	6000	5140	10800	9450	1
Iron	Fe	14500	21900	23300	26600	2
Magnesium	Mg	3910	6370	7020	7070	0.1
Manganese	Mn	171	333	383	370	1
Phosphorus	PO4	873	991	2040	1120	20
Potassium	K	337	634	891	596	10
Sodium	Na	170	246	321	237	5
Strontium	Sr	13	32	73	37	1
Titanium	Ti	462	487	372	507	1
Zirconium	Zr	6	7	7	8	1

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

CSR Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		AEC3 BH3-3	AEC3 BH3-5	AEC3 BH4-2	AEC3 BH4-3	
DATE SAMPLED:		Jan 21/02	Jan 21/02	Jan 21/02	Jan 21/02	DETECTION LIMIT
CANTEST ID:		201220286	201220287	201220288	201220289	
Antimony	Sb	<	<	<	<	10
Arsenic	As	2.3	2.2	4.8	4.0	0.2
Barium	Ba	29	24	48	107	1
Beryllium	Be	<	<	<	<	1
Cadmium	Cd	<	<	<	1.2	0.4
Chromium	Cr	27	17	38	23	2
Cobalt	Co	<	<	3	<	1
Copper	Cu	10	10	41	56	1
Lead	Pb	15	14	29	130	5
Mercury	Hg	0.063	0.038	0.315	3.15	0.001
Molybdenum	Mo	<	<	<	<	4
Nickel	Ni	10	8	19	12	2
Selenium	Se	<	<	<	<	0.4
Silver	Ag	<	<	<	16.2	0.2
Thallium	Tl	<	<	<	<	0.2
Tin	Sn	<	<	<	9	5
Vanadium	V	32	30	52	36	1
Zinc	Zn	24	21	48	147	1
Aluminum	Al	8870	7240	14300	11500	10
Boron	B	3	46	9	4	1
Calcium	Ca	3420	4610	6420	3900	1
Iron	Fe	14900	14100	25900	17100	2
Magnesium	Mg	4770	4070	8810	5180	0.1
Manganese	Mn	182	206	361	218	1
Phosphorus	PO4	846	756	1170	1360	20
Potassium	K	509	365	566	615	10
Sodium	Na	215	181	226	217	5
Strontium	Sr	17	16	47	39	1
Titanium	Ti	418	426	557	389	1
Zirconium	Zr	6	3	8	5	1

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30122037

CSR Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		AEC3 BH4-4	
DATE SAMPLED:		Jan 21/02	DETECTION LIMIT
CANTEST ID:		201220290	
Antimony	Sb	<	10
Arsenic	As	4.0	0.2
Barium	Ba	68	1
Beryllium	Be	<	1
Cadmium	Cd	0.5	0.4
Chromium	Cr	23	2
Cobalt	Co	<	1
Copper	Cu	42	1
Lead	Pb	73	5
Mercury	Hg	1.125	0.001
Molybdenum	Mo	<	4
Nickel	Ni	14	2
Selenium	Se	<	0.4
Silver	Ag	3.6	0.2
Thallium	Tl	<	0.2
Tin	Sn	<	5
Vanadium	V	37	1
Zinc	Zn	92	1
Aluminum	Al	10400	10
Boron	B	6	1
Calcium	Ca	4500	1
Iron	Fe	18000	2
Magnesium	Mg	5360	0.1
Manganese	Mn	287	1
Phosphorus	PO4	1200	20
Potassium	K	517	10
Sodium	Na	197	5
Strontium	Sr	28	1
Titanium	Ti	425	1
Zirconium	Zr	6	1

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

Analysis Report

CANTEST®

CANTEST LTD.

Professional
Analytical
Services

4606 Canada Way
Burnaby, B.C.
V5G 1K5

FAX: 604 731 2386

TEL: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Soil Samples

REPORTED TO: Seacor Environmental Engineering Inc.
3382 Tennyson Avenue
Victoria, B.C.
V8Z 3P6

Att'n: Mr. Kevin Pendreigh

PROJECT NUMBER: 201.00945.001

NUMBER OF SAMPLES: 13

REPORT DATE: April 17, 2002

DATE SUBMITTED: January 23, 2002

GROUP NUMBER: 30123008

SAMPLE TYPE: Soil

NOTE: Test results contained in this report refer only to the testing of samples submitted.

TEST METHODS:

Volatile Petroleum Hydrocarbons (VPH) in Soil - results were obtained using B.C. MOELP CSR-Analytical Method Method 5 "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water (VPH)" approved August 12, 1999. VPH is calculated by subtraction of specified MAH compounds from VH concentrations.

CCME Petroleum Hydrocarbons in Soil - analysis was performed using Canadian Council of Ministers of the Environment (CCME) "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil" approved December 2000. The method involves extraction of the different hydrocarbon fractions and analysis by gas chromatography with flame ionization detection (GC/FID).

Moisture in Soil - analysis was performed gravimetrically by heating a separate sample portion at 105 C and measuring the weight loss.

pH in Soil or Solid - analysis was performed based on procedures described in the Manual on Soil Sampling and Methods of Analysis, published by the Canadian Society of Soil Science,1993. The test was performed using a deionized water leach with measurement by pH meter.

Extractable Petroleum Hydrocarbons and Light and Heavy Extractable Petroleum Hydrocarbons in Soil - analysis was performed using B.C. MOELP CSR-Analytical Method 3 "Extractable Petroleum Hydrocarbons in Solids by GC/FID" and CSR-Analytical Method 6 "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water (LEPH & HEPH)". The method involves acetone/hexane extraction and GC/FID analysis. EPH components ranging from C10 to C19 and C19 to C32 are quantified against eicosane (n-C20). LEPH & HEPH are calculated by subtraction of specified PAH's.

Polynuclear Aromatic Hydrocarbons - analysis was performed using procedures based on U.S. EPA Methods

(Continued)

CANTEST LTD.

Richard S. Jornitz
Supervisor, Inorganic Testing

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

Polynuclear Aromatic Hydrocarbons

625/8270, involving extraction, clean-up steps, and analysis using GC/MS.

Silver in Soil - analysis was performed using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Arsenic in Soil - analysis was performed using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Cadmium in Soil - analysis was performed using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Mercury in Soil - analysis was performed using Cold Vapour Atomic Fluorescence.

Strong Acid Leachable Metals in Soil - analysis was performed using B.C. MOELP Method "Strong Acid Leachable Metals in Soil, Version 1.0". The method involves drying the sample at 60 C, sieving using a 2 mm (10 mesh) sieve and digestion using a mixture of hydrochloric and nitric acids. Analysis was performed using Inductively Coupled Argon Plasma Spectroscopy (ICAP) or by specific techniques as described.

Selenium in Soil - analysis was using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Thallium in Soil - analysis was performed using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Volatile Organic Compounds in Water and Soil - analysis was performed using procedures based on U.S. EPA Methods 624/8240/8260, involving sparging with a Purge and Trap apparatus and analysis using GC/MS.

TEST RESULTS:

(See following pages)

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

Conventional Parameters in Soil

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Moisture	pH
AEC3 BH 5-2	Jan 22/02	201230034	23.3	6.7
AEC3 BH 6-1	Jan 22/02	201230036	21.5	8.0
AEC3 BH 6-2	Jan 22/02	201230037	13.8	7.8
AEC10 BH 1-1	Jan 22/02	201230038	16.2	6.6
AEC10 BH 1-2	Jan 22/02	201230039	15.3	6.2
AEC10 BH 1A-3	Jan 22/02	201230040	-	6.3
AEC10 BH 2-1	Jan 22/02	201230041	18.9	6.4
AEC10 BH 2-2	Jan 22/02	201230042	17.2	6.2
AEC10 BH 2-3	Jan 22/02	201230043	20.8	6.6
AEC10 BH 3-1	Jan 22/02	201230045	17.5	5.7
AEC10 BH 3-2	Jan 22/02	201230047	21.8	5.7
AEC10 BH 3-3	Jan 22/02	201230052	14.0	6.2
AEC7 BH 1-1	Jan 22/02	201230053	1.3	7.0
DETECTION LIMIT			0.1	0.1
UNITS			%	pH units

% = percent

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC10 BH 1-2	AEC10 BH 2-1	AEC10 BH 3-1	AEC7 BH 1-1	DETECTION LIMIT
DATE SAMPLED:	Jan 22/02	Jan 22/02	Jan 22/02	Jan 22/02	
CANTEST ID:	201230039	201230041	201230045	201230053	
ANALYSIS DATE:	Jan 25/02	Jan 25/02	Jan 25/02	Jan 25/02	
Naphthalene	0.10	<	<	< 0.25	0.05
Acenaphthylene	<	<	<	0.38	0.05
Acenaphthene	0.08	<	<	< 0.25	0.05
Fluorene	0.09	<	<	< 0.25	0.05
Phenanthrene	0.48	0.09	<	0.58	0.05
Anthracene	0.16	<	<	< 0.25	0.05
Total LMW-PAH's	0.89	0.09		0.96	
Fluoranthene	0.41	0.13	<	1.5	0.05
Pyrene	0.43	0.17	<	2.1	0.05
Benzo(a)anthracene	0.20	0.07	<	0.78	0.05
Chrysene	0.26	0.10	<	1.1	0.05
Benzo(b)fluoranthene	0.18	0.05	<	1.8	0.05
Benzo(k)fluoranthene					0.05
Benzo(a)pyrene	0.15	<	<	1.4	0.05
Indeno(1,2,3-cd)pyrene	0.08	<	<	1.3	0.05
Dibenz(a,h)anthracene	<	<	<	< 0.25	0.05
Benzo(g,h,i)perylene	0.09	<	<	1.1	0.05
Total HMW-PAH's	1.80	0.52		11.1	
Total PAH's	2.69	0.61		12.1	

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit
Sample# 201230053 - Detection limits adjusted: Dilution required
NOTE: Benzo(b)fluoranthene and Benzo(k)fluoranthene reported as total.

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC10 BH 1-1	AEC10 BH 2-2	
DATE SAMPLED:	Jan 22/02	Jan 22/02	
CANTEST ID:	201230038	201230042	DETECTION LIMIT
ANALYSIS DATE:	Jan 24/02	Jan 24/02	
Benzene	<	<	0.01
Bromodichloromethane	<	<	0.01
Bromoform	<	<	0.01
Bromomethane	<	<	0.04
2-Butanone	<	<	0.5
Carbon Tetrachloride	<	<	0.01
Chlorobenzene	<	<	0.01
Chloroethane	<	<	0.02
Chloroform	<	<	0.01
Chloromethane	<	<	0.04
Dibromochloromethane	<	<	0.01
1,2-Dibromoethane	<	<	0.01
Dibromomethane	<	<	0.01
1,2-Dichlorobenzene	<	<	0.01
1,3-Dichlorobenzene	<	<	0.01
1,4-Dichlorobenzene	<	<	0.01
Dichlorodifluoromethane	<	<	0.02
1,1-Dichloroethane	<	<	0.01
1,2-Dichloroethane	<	<	0.02
1,1-Dichloroethene	<	<	0.01
cis-1,2-Dichloroethene	<	<	0.01
trans-1,2-Dichloroethene	<	<	0.01
1,2-Dichloropropane	<	<	0.01
cis-1,3-Dichloropropene	<	<	0.01
trans-1,3-Dichloropropene	<	<	0.01
Ethylbenzene	<	<	0.01
2-Hexanone	<	<	0.5
4-Methyl-2-pentanone	<	<	0.2
Methylene Chloride	<	<	0.3
Styrene	<	<	0.01
1,1,2,2-Tetrachloroethane	<	<	0.01

(Continued on next page)

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC10 BH 1-1	AEC10 BH 2-2	
DATE SAMPLED:	Jan 22/02	Jan 22/02	
CANTEST ID:	201230038	201230042	DETECTION LIMIT
ANALYSIS DATE:	Jan 24/02	Jan 24/02	
Tetrachloroethene	<	<	0.01
Toluene	<	<	0.01
1,1,1-Trichloroethane	<	<	0.01
1,1,2-Trichloroethane	<	<	0.01
Trichloroethene	<	<	0.01
Trichlorofluoromethane	<	<	0.01
Vinyl Chloride	<	<	0.02
Xylenes	<	<	0.01
Surrogate Recovery			
1,2-Dichloroethane-d4	117	101	-
Toluene-d8	107	104	-
Bromofluorobenzene	102	98	-

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

Extractable Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH 5-2	AEC3 BH 6-2	AEC10 BH 1-2	AEC10 BH 2-1	
DATE SAMPLED:	Jan 22/02	Jan 22/02	Jan 22/02	Jan 22/02	DETECTION LIMIT
CANTEST ID:	201230034	201230037	201230039	201230041	
EPHs10-19	<	<	<	<	250
EPHs19-32	<	<	<	<	250
LEPHs (corrected for PAH's)	-	-	<	<	250
HEPHs (corrected for PAH's)	-	-	<	<	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

Extractable Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC10 BH 2-3	AEC10 BH 3-1	AEC10 BH 3-3	AEC7 BH 1-1	
DATE SAMPLED:	Jan 22/02	Jan 22/02	Jan 22/02	Jan 22/02	DETECTION LIMIT
CANTEST ID:	201230043	201230045	201230052	201230053	
EPHs10-19	<	<	<	<	250
EPHs19-32	<	<	<	<	250
LEPHs (corrected for PAH's)	-	<	-	<	250
HEPHs (corrected for PAH's)	-	<	-	<	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

Monocyclic Aromatic Hydrocarbons-Methanol Extraction- in Soil

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	VPHs
AEC3 BH 6-2	Jan 22/02	201230037	<
AEC10 BH 1-2	Jan 22/02	201230039	<
AEC10 BH 2-1	Jan 22/02	201230041	<
AEC10 BH 2-3	Jan 22/02	201230043	<
AEC10 BH 3-1	Jan 22/02	201230045	<
AEC10 BH 3-3	Jan 22/02	201230052	<
AEC7 BH 1-1	Jan 22/02	201230053	<
DETECTION LIMIT			100
UNITS			µg/g

µg/g = micrograms per gram, on a dry weight basis.
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

CCME Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH 6-2	AEC10 BH 1-2	AEC10 BH 2-1	AEC10 BH 2-3	
DATE SAMPLED:	Jan 22/02	Jan 22/02	Jan 22/02	Jan 22/02	DETECTION LIMIT
CANTEST ID:	201230037	201230039	201230041	201230043	
Benzene	<	<	<	<	0.04
Ethylbenzene	<	<	<	<	0.5
Toluene	<	<	<	<	0.5
Xylenes	<	<	<	<	0.5
F1 (C6-C10) uncorrected	<	<	<	<	25
F1 minus BTEX (C6-C10)	<	<	<	<	25
F2 uncorrected (C10-C16)	<	<	<	<	80
F3 uncorrected (C16-C34)	<	<	<	<	250
F4 (C34-C50)	<	<	<	<	250

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

CCME Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC10 BH 3-1	AEC10 BH 3-3	AEC7 BH 1-1	
DATE SAMPLED:	Jan 22/02	Jan 22/02	Jan 22/02	DETECTION LIMIT
CANTEST ID:	201230045	201230052	201230053	
Benzene	<	<	<	0.04
Ethylbenzene	<	<	<	0.5
Toluene	<	<	<	0.5
Xylenes	<	<	<	0.5
F1 (C6-C10) uncorrected	<	<	<	25
F1 minus BTEX (C6-C10)	<	<	<	25
F2 uncorrected (C10-C16)	<	<	<	80
F3 uncorrected (C16-C34)	<	<	<	250
F4 (C34-C50)	<	<	<	250

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

CSR Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		AEC3 BH 5-2	AEC3 BH 6-1	AEC3 BH 6-2	AEC10 BH 1-1	
DATE SAMPLED:		Jan 22/02	Jan 22/02	Jan 22/02	Jan 22/02	DETECTION LIMIT
CANTEST ID:		201230034	201230036	201230037	201230038	
Antimony	Sb	<	<	<	<	10
Arsenic	As	4.4	5.9	5.6	2.3	0.2
Barium	Ba	45	51	49	35	1
Beryllium	Be	<	<	<	<	1
Cadmium	Cd	<	<	<	<	0.4
Chromium	Cr	20	37	23	15	2
Cobalt	Co	8	10	11	<	1
Copper	Cu	36	40	39	3	1
Lead	Pb	<	<	<	12	5
Mercury	Hg	0.065	0.087	0.085	0.020	0.001
Molybdenum	Mo	<	<	<	<	4
Nickel	Ni	7	9	9	4	2
Selenium	Se	<	<	<	<	0.4
Silver	Ag	<	<	<	<	0.2
Thallium	Tl	<	<	<	<	0.2
Tin	Sn	<	<	<	<	5
Vanadium	V	40	41	41	27	1
Zinc	Zn	35	37	37	15	1
Aluminum	Al	11600	11900	13600	8930	10
Boron	B	57	57	58	22	1
Calcium	Ca	6010	9340	10300	1640	1
Iron	Fe	25800	24600	24500	11600	2
Magnesium	Mg	7110	8430	10100	2810	0.1
Manganese	Mn	342	353	364	116	1
Phosphorus	PO4	1050	983	943	448	20
Potassium	K	857	776	770	251	10
Sodium	Na	564	806	897	65	5
Strontium	Sr	27	45	59	15	1
Titanium	Ti	559	632	477	458	1
Zirconium	Zr	2	2	2	2	1

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

CSR Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		AEC10 BH 1-2	AEC10 BH 1A-3	AEC10 BH 2-1	AEC10 BH 2-2	
DATE SAMPLED:		Jan 22/02	Jan 22/02	Jan 22/02	Jan 22/02	DETECTION LIMIT
CANTEST ID:		201230039	201230040	201230041	201230042	
Antimony	Sb	<	<	<	<	10
Arsenic	As	2.7	5.0	2.4	3.2	0.2
Barium	Ba	50	49	42	39	1
Beryllium	Be	<	<	<	<	1
Cadmium	Cd	<	<	<	<	0.4
Chromium	Cr	18	29	18	16	2
Cobalt	Co	6	<	4	3	1
Copper	Cu	41	17	30	24	1
Lead	Pb	<	18	<	<	5
Mercury	Hg	0.058	0.050	0.020	0.068	0.001
Molybdenum	Mo	<	<	<	<	4
Nickel	Ni	7	10	8	8	2
Selenium	Se	<	<	<	<	0.4
Silver	Ag	<	<	<	<	0.2
Thallium	Tl	<	<	<	<	0.2
Tin	Sn	<	<	<	<	5
Vanadium	V	35	45	29	37	1
Zinc	Zn	19	24	16	17	1
Aluminum	Al	9720	11600	8380	7930	10
Boron	B	44	53	35	40	1
Calcium	Ca	2500	3230	1810	2100	1
Iron	Fe	18800	20500	14300	16800	2
Magnesium	Mg	4410	3820	4200	3790	0.1
Manganese	Mn	193	263	158	179	1
Phosphorus	PO4	124	1420	533	347	20
Potassium	K	338	339	261	255	10
Sodium	Na	273	118	263	240	5
Strontium	Sr	17	21	14	14	1
Titanium	Ti	572	452	458	484	1
Zirconium	Zr	3	3	3	2	1

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

CSR Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		AEC10 BH 2-3	AEC10 BH 3-1	AEC10 BH 3-2	AEC10 BH 3-3	
DATE SAMPLED:		Jan 22/02	Jan 22/02	Jan 22/02	Jan 22/02	DETECTION LIMIT
CANTEST ID:		201230043	201230045	201230047	201230052	
Antimony	Sb	<	<	<	<	10
Arsenic	As	5.3	2.8	2.9	3.2	0.2
Barium	Ba	59	35	30	30	1
Beryllium	Be	<	<	<	<	1
Cadmium	Cd	<	<	<	<	0.4
Chromium	Cr	29	12	15	16	2
Cobalt	Co	9	4	5	5	1
Copper	Cu	29	31	34	20	1
Lead	Pb	<	<	<	<	5
Mercury	Hg	0.068	0.065	0.058	0.044	0.001
Molybdenum	Mo	<	<	<	<	4
Nickel	Ni	13	8	4	5	2
Selenium	Se	<	<	<	<	0.4
Silver	Ag	<	<	<	<	0.2
Thallium	Tl	<	<	<	<	0.2
Tin	Sn	<	<	<	<	5
Vanadium	V	56	27	39	43	1
Zinc	Zn	43	17	16	22	1
Aluminum	Al	16200	10200	8500	9400	10
Boron	B	73	38	39	48	1
Calcium	Ca	4810	2330	1680	2870	1
Iron	Fe	31400	13700	16000	20200	2
Magnesium	Mg	8490	4140	3540	4960	0.1
Manganese	Mn	422	108	150	294	1
Phosphorus	PO4	647	975	99	546	20
Potassium	K	732	191	187	278	10
Sodium	Na	541	297	194	250	5
Strontium	Sr	30	14	15	15	1
Titanium	Ti	728	375	471	673	1
Zirconium	Zr	3	3	3	2	1

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30123008

CSR Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		AEC7 BH 1-1	
DATE SAMPLED:		Jan 22/02	DETECTION LIMIT
CANTEST ID:		201230053	
Antimony	Sb	<	10
Arsenic	As	2.6	0.2
Barium	Ba	22	1
Beryllium	Be	<	1
Cadmium	Cd	<	0.4
Chromium	Cr	25	2
Cobalt	Co	11	1
Copper	Cu	79	1
Lead	Pb	79	5
Mercury	Hg	0.230	0.001
Molybdenum	Mo	<	4
Nickel	Ni	7	2
Selenium	Se	<	0.4
Silver	Ag	<	0.2
Thallium	Tl	<	0.2
Tin	Sn	<	5
Vanadium	V	54	1
Zinc	Zn	48	1
Aluminum	Al	11700	10
Boron	B	66	1
Calcium	Ca	5230	1
Iron	Fe	31900	2
Magnesium	Mg	8880	0.1
Manganese	Mn	330	1
Phosphorus	PO4	901	20
Potassium	K	218	10
Sodium	Na	277	5
Strontium	Sr	30	1
Titanium	Ti	776	1
Zirconium	Zr	<	1

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

Analysis Report

CANTEST LTD.

Professional
Analytical
Services

4606 Canada Way
Burnaby, B.C.
V5G 1K5

FAX: 604 731 2386

TEL: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Soil Samples

REPORTED TO: Seacor Environmental Engineering Inc.
3382 Tennyson Avenue
Victoria, B.C.
V8Z 3P6

Att'n: Mr. Kevin Pendreigh

PROJECT NAME: Esquimalt Graving Dock
PROJECT NUMBER: 201.00945.001

NUMBER OF SAMPLES: 2

REPORT DATE: April 17, 2002

DATE SUBMITTED: January 22, 2002 - January 23, 2002

GROUP NUMBER: 30131002

SAMPLE TYPE: Soil

NOTE: Test results contained in this report refer only to the testing of samples submitted.

TEST METHODS:

Polynuclear Aromatic Hydrocarbons - analysis was performed using procedures based on U.S. EPA Methods 625/8270, involving extraction, clean-up steps, and analysis using GC/MS.

TEST RESULTS:

(See following page)

CANTEST LTD.

Zhenyong Gao, M.Sc.
Coordinator, Trace Organics

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30131002

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH1-3	AEC7 BH1-1	
DATE SAMPLED:	Jan 21/02	Jan 22/02	
CANTEST ID:	201310026	201310027	DETECTION LIMIT
ANALYSIS DATE:	Jan 31/02	Jan 31/02	
Naphthalene	0.25	<	0.25
Acenaphthylene	0.20	< 0.25	0.2
Acenaphthene	<	<	0.25
Fluorene	<	<	0.25
Phenanthrene	0.83	<	0.25
Anthracene	<	<	0.25
Total LMW-PAH's	1.29		
Fluoranthene	1.9	0.33	0.25
Pyrene	2.0	0.39	0.25
Benzo(a)anthracene	0.89	0.28	0.25
Chrysene	1.2	0.25	0.25
Benzo(b)fluoranthene	1.8	0.48	0.25
Benzo(k)fluoranthene			0.25
Benzo(a)pyrene	1.3	0.29	0.25
Indeno(1,2,3-cd)pyrene	1.3	0.28	0.25
Dibenz(a,h)anthracene	<	<	0.25
Benzo(g,h,i)perylene	1.2	0.27	0.25
Total HMW-PAH's	11.6	2.56	
Total PAH's	12.9	2.56	

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit
Sample# 201310027 , 201310026 - Detection limits adjusted: Dilution required
NOTE: Benzo(b)fluoranthene and Benzo(k)fluoranthene reported as total.

Analysis Report

CANTEST LTD.

Professional
Analytical
Services

4606 Canada Way
Burnaby, B.C.
V5G 1K5

FAX: 604 731 2386

TEL: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Leachate and Soil Samples

REPORTED TO: Seacor Environmental Engineering Inc.
3382 Tennyson Avenue
Victoria, B.C.
V8Z 3P6

Att'n: Mr. Kevin Pendreigh

PROJECT NAME: Esquimalt Graving Dock
PROJECT NUMBER: 201.00945.001

NUMBER OF SAMPLES: 4 REPORT DATE: April 17, 2002

DATE SUBMITTED: January 22, 2002 - January 25, 2002 GROUP NUMBER: 30206062

SAMPLE TYPE: Soil

NOTE: Test results contained in this report refer only to the testing of samples submitted.

TEST METHODS:

Moisture in Soil - analysis was performed gravimetrically by heating a separate sample portion at 105 C and measuring the weight loss.

Leachate Extraction Procedure - the samples were extracted using procedures described in both the B.C. Waste Management Act, Special Waste Regulation, Schedule 4, Part 1, and the Canadian Standards Board 164-GP-IMP, Leachate Extraction Procedures.

Mercury in LEP Leachate - analysis was performed using procedures based on U. S. EPA Method 1631, oxidative digestion using a bromination procedure, and analysis using Cold Vapour Atomic Fluorescence Spectroscopy.

Selenium in LEP Leachate - analysis was performed using Zeeman background-corrected Graphite Furnace Atomic Absorption Spectrophotometry.

Metals in LEP Leachate - analysis was performed using Plasma Spectroscopy (ICP) or by specific techniques described.

Polynuclear Aromatic Hydrocarbons - analysis was performed using procedures based on U.S. EPA Methods 625/8270, involving extraction, clean-up steps, and analysis using GC/MS.

TEST RESULTS:

(See following pages)

CANTEST LTD.

Zhenyong Gao, M.Sc.
Coordinator, Trace Organics

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30206062

LEP Extraction Procedure in Leachate

CLIENT SAMPLE IDENTIFICATION:	AEC15 SA2		
DATE SAMPLED:	Jan 24/02	DETECTION LIMIT	UNITS
CANTEST ID:	202060184		
Moisture	13.6	0.01	%
Weight of sample extracted	57.3	-	g
Initial pH	8.3	-	pH units
Volume 0.5 N acetic acid added	26	-	mL
Final pH	4.8	-	pH units

% = percent
g = grams
mL = milliliters

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30206062

Leachate Extraction Procedure Metals in Leachate

CLIENT SAMPLE IDENTIFICATION:		AEC15 SA2	
DATE SAMPLED:		Jan 24/02	DETECTION LIMIT
CANTEST ID:		202060184	
Arsenic	As	<	0.75
Barium	Ba	3.00	0.005
Boron	B	0.03	0.02
Cadmium	Cd	<	0.05
Chromium	Cr	<	0.05
Copper	Cu	6.47	0.03
Lead	Pb	<	0.1
Mercury	Hg	<	0.005
Selenium	Se	<	0.25
Silver	Ag	<	0.5
Zinc	Zn	20.4	0.05
Aluminum	Al	0.4	0.3
Antimony	Sb	<	0.3
Beryllium	Be	<	0.005
Calcium	Ca	180	0.02
Cobalt	Co	<	0.05
Iron	Fe	0.4	0.1
Magnesium	Mg	5.07	0.05
Manganese	Mn	1.69	0.01
Molybdenum	Mo	<	0.1
Nickel	Ni	0.06	0.05
Phosphorus	PO4	<	1
Silicon	SiO2	15.9	0.1
Sodium	Na	4	1
Strontium	Sr	0.58	0.005
Tin	Sn	<	0.1
Titanium	Ti	<	0.01
Vanadium	V	<	0.05

Results expressed as milligrams per liter (mg/L)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30206062

Conventional Parameters in Soil

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Moisture
AEC3 BH1-2	Jan 21/02	202060185	15.3
AEC3 BH1-4	Jan 21/02	202060186	13.8
AEC3 BH2-4	Jan 21/02	202060187	19.6
DETECTION LIMIT			0.1
UNITS			%

% = percent

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30206062

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH1-2	AEC3 BH1-4	AEC3 BH2-4	DETECTION LIMIT
DATE SAMPLED:	Jan 21/02	Jan 21/02	Jan 21/02	
CANTEST ID:	202060185	202060186	202060187	
ANALYSIS DATE:	Feb 9/02	Feb 9/02	Feb 9/02	
Naphthalene	0.24	<	<	0.05
Acenaphthylene	0.32	<	<	0.05
Acenaphthene	<	<	<	0.05
Fluorene	<	<	<	0.05
Phenanthrene	0.58	<	<	0.05
Anthracene	0.17	<	<	0.05
Total LMW-PAH's	1.3			
Fluoranthene	2.1	0.07	<	0.05
Pyrene	2.3	0.08	<	0.05
Benzo(a)anthracene	1.4	<	<	0.05
Chrysene	1.4	0.08	<	0.05
Benzo(b)fluoranthene	2.4	0.18	<	0.05
Benzo(k)fluoranthene				0.05
Benzo(a)pyrene	1.8	0.05	<	0.05
Indeno(1,2,3-cd)pyrene	1.4	<	<	0.05
Dibenz(a,h)anthracene	0.19	<	<	0.05
Benzo(g,h,i)perylene	1.0	<	<	0.05
Total HMW-PAH's	14	0.46		
Total PAH's	15.3	0.46		

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit
NOTE: Benzo(b)fluoranthene and Benzo(k)fluoranthene reported as total.

Analysis Report

CANTEST®

CANTEST LTD.

Professional
Analytical
Services

4606 Canada Way
Burnaby, B.C.
V5G 1K5

FAX: 604 731 2386

TEL: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Soil Samples

REPORTED TO: Seacor Environmental Engineering Inc.
3382 Tennyson Avenue
Victoria, B.C.
V8Z 3P6

Att'n: Mr. Kevin Pendreigh

PROJECT NAME: Esquimalt Graving Docks
PROJECT NUMBER: 201.00945.001

NUMBER OF SAMPLES: 18

REPORT DATE: April 17, 2002

DATE SUBMITTED: February 11, 2002

GROUP NUMBER: 30211033

SAMPLE TYPE: Water, Soil

NOTE: Test results contained in this report refer only to the testing of samples submitted.

TEST METHODS:

Volatile Organic Compounds in Water and Soil - analysis was performed using procedures based on U.S. EPA Methods 624/8240/8260, involving sparging with a Purge and Trap apparatus and analysis using GC/MS.

Volatile Hydrocarbons (VH) and Volatile Petroleum Hydrocarbons (VPH) in Water - analysis was performed using B.C. MOELP CSR-Analytical Method 2 "Volatile Hydrocarbons in Water by GC/FID" and CSR-Analytical Method 5 "Calculation of Volatile Petroleum Hydrocarbons in Solids or Water (VPH)" approved August 12, 1999. The method involves sparging/collection using a Purge & Trap apparatus with GC/FID analysis; VH components ranging from C6 to C10 are quantified against m-xylene and 1,2,4-trimethylbenzene. VPH is calculated by subtraction of specified MAH compounds from VH concentrations.

CCME Petroleum Hydrocarbons in Soil - analysis was performed using Canadian Council of Ministers of the Environment (CCME) "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil" approved December 2000. The method involves extraction of the different hydrocarbon fractions and analysis by gas chromatography with flame ionization detection (GC/FID).

Moisture in Soil - analysis was performed gravimetrically by heating a separate sample portion at 105 C and measuring the weight loss.

pH (Field) - sample pH was determined in the field at the time of sampling.

pH in Soil or Solid - analysis was performed based on procedures described in the Manual on Soil Sampling and Methods of Analysis, published by the Canadian Society of Soil Science,1993. The test was performed using a deionized water leach with measurement by pH meter.

(Continued)

CANTEST LTD.

Richard S. Jornitz
Supervisor, Inorganic Testing

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

Conventional Parameters - analyses were performed using procedures based on those described in "British Columbia Environmental Laboratory Manual For the Analysis of Water, Wastewater, Sediment and Biological Materials" (1994 Edition), Province of British Columbia and "Standard Methods for the Examination of Water and Wastewater" 20th Edition, (1998), published by the American Public Health Association.

Extractable Petroleum Hydrocarbons and Light and Heavy Extractable Petroleum Hydrocarbons in Soil - analysis was performed using B.C. MOELP CSR-Analytical Method 3 "Extractable Petroleum Hydrocarbons in Solids by GC/FID" and CSR-Analytical Method 6 "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water (LEPH & HEPH)". The method involves acetone/hexane extraction and GC/FID analysis. EPH components ranging from C10 to C19 and C19 to C32 are quantified against eicosane (n-C20). LEPH & HEPH are calculated by subtraction of specified PAH's.

Extractable Petroleum Hydrocarbons and Light and Heavy Extractable Petroleum Hydrocarbons in Water - analysis was performed using B.C. MOELP CSR-Analytical Method 4 "Extractable Petroleum Hydrocarbons in Water by GC/FID" and CSR-Analytical Method 6 "Calculation of Light and Heavy Extractable Petroleum Hydrocarbons in Solids or Water (LEPH & HEPH)". The method involves DCM extraction and GC/FID analysis. EPH components ranging from C10 to C19 and C19 to C32 are quantified against eicosane (n-C20). LEPH & HEPH are calculated by subtraction of specified PAH's.

Mercury in Water - analysis was performed using procedures based on U. S. EPA Method 1631, oxidative digestion using bromination, and analysis using Cold Vapour Atomic Fluorescence Spectroscopy.

Metals in Water - analysis was performed using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP), Inductively Coupled Plasma-Mass Spectroscopy (ICP/MS) or Graphite Furnace Atomic Absorption Spectrophotometry.

Polynuclear Aromatic Hydrocarbons - analysis was performed using procedures based on U.S. EPA Methods 625/8270, involving extraction, clean-up steps, and analysis using GC/MS.

Silver in Soil - analysis was performed using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Arsenic in Soil - analysis was performed using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Cadmium in Soil - analysis was performed using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Mercury in Soil - analysis was performed using Cold Vapour Atomic Fluorescence.

Strong Acid Leachable Metals in Soil - analysis was performed using B.C. MOELP Method "Strong Acid Leachable Metals in Soil, Version 1.0". The method involves drying the sample at 60 C, sieving using a 2 mm (10 mesh) sieve and digestion using a mixture of hydrochloric and nitric acids. Analysis was performed using Inductively Coupled Argon Plasma Spectroscopy (ICAP) or by specific techniques as described.

(Continued)

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

Selenium in Soil - analysis was using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Thallium in Soil - analysis was performed using Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

TEST RESULTS:

(See following pages)

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

Conventional Parameters in Water

CLIENT SAMPLE IDENTIFICATION:		AEC13 MW3	AEC13 MW4		
DATE SAMPLED:		Feb 8/02	Feb 8/02	DETECTION LIMIT	UNITS
CANTEST ID:		202110121	202110122		
pH, Field		7.26	7.06	-	pH units
Hardness	CaCO3	4300	3490	1	mg/L

mg/L = milligrams per liter

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		AEC13 MW3	AEC13 MW4	DETECTION LIMIT	UNITS
SAMPLE PREPARATION:		DISSOLVED	DISSOLVED		
DATE SAMPLED:		Feb 8/02	Feb 8/02		
CANTEST ID:		202110121	202110122		
Aluminum	Al	0.016	0.026	0.005	mg/L
Antimony	Sb	<	<	0.001	mg/L
Arsenic	As	0.012	0.010	0.001	mg/L
Barium	Ba	0.019	0.073	0.001	mg/L
Beryllium	Be	<	<	0.001	mg/L
Bismuth	Bi	<	<	0.001	mg/L
Boron	B	2.98	2.67	0.01	mg/L
Cadmium	Cd	<	<	0.0002	mg/L
Calcium	Ca	224	218	0.01	mg/L
Chromium	Cr	0.003	0.002	0.001	mg/L
Cobalt	Co	<	0.002	0.001	mg/L
Copper	Cu	0.023	0.020	0.001	mg/L
Iron	Fe	0.61	0.62	0.05	mg/L
Lead	Pb	<	<	0.001	mg/L
Lithium	Li	0.13	0.12	0.001	mg/L
Magnesium	Mg	907	715	0.05	mg/L
Manganese	Mn	0.009	0.056	0.001	mg/L
Mercury	Hg	<	<	0.02	µg/L
Molybdenum	Mo	0.009	0.009	0.001	mg/L
Nickel	Ni	0.004	0.010	0.001	mg/L
Phosphorus	PO4	0.34	0.32	0.01	mg/L
Potassium	K	262	210	0.25	mg/L
Selenium	Se	<	<	0.002	mg/L
Silicon	SiO2	2.97	3.21	0.05	mg/L
Silver	Ag	<	<	0.0001	mg/L
Sodium	Na	7310	5800	0.1	mg/L
Strontium	Sr	2.93	3.87	0.001	mg/L
Tellurium	Te	<	<	0.001	mg/L
Thallium	Tl	<	<	0.0001	mg/L
Thorium	Th	<	<	0.0005	mg/L
Tin	Sn	<	<	0.001	mg/L

(Continued on next page)

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

Metals Analysis in Water

CLIENT SAMPLE IDENTIFICATION:		AEC13 MW3	AEC13 MW4	DETECTION LIMIT	UNITS
SAMPLE PREPARATION:		DISSOLVED	DISSOLVED		
DATE SAMPLED:		Feb 8/02	Feb 8/02		
CANTEST ID:		202110121	202110122		
Titanium	Ti	0.005	0.005	0.001	mg/L
Uranium	U	0.0027	0.0026	0.0005	mg/L
Vanadium	V	0.003	0.002	0.001	mg/L
Zinc	Zn	0.021	0.019	0.005	mg/L
Zirconium	Zr	<	<	0.01	mg/L

mg/L = milligrams per liter
µg/L = micrograms per liter
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

Monocyclic Aromatic Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	AEC13 MW3	AEC13 MW4	
DATE SAMPLED:	Feb 8/02	Feb 8/02	
CANTEST ID:	202110121	202110122	DETECTION LIMIT
ANALYSIS DATE:	Feb 12/02	Feb 12/02	
Benzene	<	<	0.1
Ethylbenzene	<	<	0.1
Toluene	<	<	0.1
Xylenes	<	<	0.1
Volatile Hydrocarbons VHw6-10	<	<	100
VPHw	<	<	100
Surrogate Recovery			
Toluene-d8	114	100	-
Bromofluorobenzene	100	104	-

Results expressed as micrograms per liter (µg/L)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

Extractable Petroleum Hydrocarbons in Water

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	EPHw10-19	EPHw19-32
AEC13 MW3	Feb 8/02	202110121	<	<
AEC13 MW4	Feb 8/02	202110122	<	<
DETECTION LIMIT			250	250
UNITS			µg/L	µg/L

µg/L = micrograms per liter
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

Conventional Parameters in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC14 SA10 0-0.75	AEC14 SA10 1.0-1.5	AEC14 SA11 0-0.75	AEC14 SA12 0-0.4	
DATE SAMPLED:	Feb 8/02	Feb 8/02	Feb 8/02	Feb 8/02	DETECTION LIMIT
CANTEST ID:	202110105	202110107	202110108	202110109	
pH	6.1	6.4	7.2	6.1	0.1

Results expressed as pH units

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

Conventional Parameters in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC14 SA13 0-0.5	AEC14 SA14 0-0.4	AEC14 SA15 0-0.75	AEC14 SA16 0-0.75	
DATE SAMPLED:	Feb 8/02	Feb 8/02	Feb 8/02	Feb 8/02	DETECTION LIMIT
CANTEST ID:	202110110	202110111	202110112	202110113	
pH	4.8	6.0	5.1	4.8	0.1

Results expressed as pH units

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

Conventional Parameters in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH7-4	AEC3 BH8-4	AEC13 BH4-2	AEC13 BH4-3	DETECTION LIMIT	UNITS
DATE SAMPLED:	Feb 8/02	Feb 8/02	Feb 8/02	Feb 8/02		
CANTEST ID:	202110114	202110115	202110116	202110117		
Moisture	9.5	9.0	-	15.0	0.1	%
pH	5.8	7.4	7.2	7.5	0.1	pH units

% = percent

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

Conventional Parameters in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC13 BH4-5	AEC8/9 BH5-1	AEC8/9 BH6-1	AEC3 BH7-4A	DETECTION LIMIT	UNITS
DATE SAMPLED:	Feb 8/02	Feb 8/02	Feb 8/02	Feb 8/02		
CANTEST ID:	202110118	202110119	202110120	202110124		
Moisture	18.9	10.8	5.5	4.7	0.1	%
pH	7.6	7.1	9.4	6.7	0.1	pH units

% = percent

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH8-4		AEC8/9 BH5-1		AEC8/9 BH6-1		DETECTION LIMIT
DATE SAMPLED:	Feb 8/02		Feb 8/02		Feb 8/02		
CANTEST ID:	202110115		202110119		202110120		
ANALYSIS DATE:	Feb 13/02		Feb 13/02		Feb 13/02		
Naphthalene	0.12		<		0.31		0.05
Acenaphthylene	0.22		<		0.10		0.05
Acenaphthene	<		<		0.05		0.05
Fluorene	0.06		<		<		0.05
Phenanthrene	0.70		<		0.31		0.05
Anthracene	0.15		<		0.10		0.05
Total LMW-PAH's	1.24				0.89		
Fluoranthene	1.9		<		0.79		0.05
Pyrene	1.9		<		0.89		0.05
Benzo(a)anthracene	0.82		<		0.47		0.05
Chrysene	1.1		<		0.58		0.05
Benzo(b)fluoranthene	1.8		<		1.0		0.05
Benzo(k)fluoranthene							0.05
Benzo(a)pyrene	1.1		<		0.68		0.05
Indeno(1,2,3-cd)pyrene	0.99		<		0.58		0.05
Dibenz(a,h)anthracene	0.18		<		0.10		0.05
Benzo(g,h,i)perylene	0.88		<		0.63		0.05
Total HMW-PAH's	10.7				5.71		
Total PAH's	11.9				6.60		

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit
NOTE: Benzo(b)fluoranthene and Benzo(k)fluoranthene reported as total.

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

Extractable Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	EPHs10-19	EPHs19-32
AEC3 BH7-4	Feb 8/02	202110114	<	<
AEC13 BH4-5	Feb 8/02	202110118	550	1400
AEC3 BH7-4A	Feb 8/02	202110124	<	<
DETECTION LIMIT			250	250
UNITS			µg/g	µg/g

µg/g = micrograms per gram, on a dry weight basis.
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

CCME Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC3 BH7-4	AEC13 BH4-3	AEC13 BH4-5	AEC3 BH7-4A	
DATE SAMPLED:	Feb 8/02	Feb 8/02	Feb 8/02	Feb 8/02	DETECTION LIMIT
CANTEST ID:	202110114	202110117	202110118	202110124	
Benzene	<	<	<	<	0.04
Ethylbenzene	<	<	<	<	0.5
Toluene	<	<	<	<	0.5
Xylenes	<	<	<	<	0.5
F1 (C6-C10) uncorrected	<	<	<	<	25
F1 minus BTEX (C6-C10)	<	<	<	<	25
F2 uncorrected (C10-C16)	<	<	220	<	80
F3 uncorrected (C16-C34)	<	<	1800	<	250
F4 (C34-C50)	<	<	730	<	250

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

CSR Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		AEC14 SA10 0-0.75	AEC14 SA10 1.0-1.5	AEC14 SA11 0-0.75	AEC14 SA12 0-0.4	
DATE SAMPLED:		Feb 8/02	Feb 8/02	Feb 8/02	Feb 8/02	DETECTION LIMIT
CANTEST ID:		202110105	202110107	202110108	202110109	
Antimony	Sb	<	<	<	<	10
Arsenic	As	10.7	6.3	7.5	20.1	0.2
Barium	Ba	85	23	56	105	1
Beryllium	Be	<	<	<	<	1
Cadmium	Cd	<	<	<	0.5	0.4
Chromium	Cr	56	26	32	46	2
Cobalt	Co	<	<	<	<	1
Copper	Cu	<	<	3	278	1
Lead	Pb	67	22	59	102	5
Mercury	Hg	0.805	0.048	0.335	0.838	0.001
Molybdenum	Mo	<	<	<	<	4
Nickel	Ni	27	12	15	19	2
Selenium	Se	<	<	<	<	0.4
Silver	Ag	<	<	<	0.3	0.2
Thallium	Tl	<	<	<	<	0.2
Tin	Sn	<	<	<	<	5
Vanadium	V	48	24	26	29	1
Zinc	Zn	67	17	108	364	1
Aluminum	Al	15600	6770	8780	9920	10
Boron	B	<	100	<	<	1
Calcium	Ca	4410	2670	5390	5410	1
Iron	Fe	26200	12400	13800	19100	2
Magnesium	Mg	5900	3270	3330	4040	0.1
Manganese	Mn	715	156	185	230	1
Phosphorus	PO4	1050	666	1120	1360	20
Potassium	K	736	171	350	1100	10
Sodium	Na	187	105	131	168	5
Strontium	Sr	37	17	41	43	1
Titanium	Ti	548	418	342	332	1
Zirconium	Zr	11	3	6	6	1

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

CSR Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		AEC14 SA13 0-0.5	AEC14 SA14 0-0.4	AEC14 SA15 0-0.75	AEC14 SA16 0-0.75	
DATE SAMPLED:		Feb 8/02	Feb 8/02	Feb 8/02	Feb 8/02	DETECTION LIMIT
CANTEST ID:		202110110	202110111	202110112	202110113	
Antimony	Sb	<	<	<	<	10
Arsenic	As	13.0	12.0	7.5	7.2	0.2
Barium	Ba	97	53	94	96	1
Beryllium	Be	<	<	<	<	1
Cadmium	Cd	<	<	<	<	0.4
Chromium	Cr	47	46	33	32	2
Cobalt	Co	<	<	<	<	1
Copper	Cu	54	25	17	15	1
Lead	Pb	73	73	68	73	5
Mercury	Hg	1.020	2.400	1.130	0.952	0.001
Molybdenum	Mo	<	<	<	<	4
Nickel	Ni	15	22	14	13	2
Selenium	Se	<	<	<	<	0.4
Silver	Ag	0.2	<	<	<	0.2
Thallium	Tl	<	<	<	<	0.2
Tin	Sn	<	<	<	<	5
Vanadium	V	38	38	28	25	1
Zinc	Zn	95	77	75	75	1
Aluminum	Al	14800	12200	11600	11300	10
Boron	B	1	<	98	97	1
Calcium	Ca	2700	3830	2410	2370	1
Iron	Fe	20800	22000	14900	14600	2
Magnesium	Mg	4350	5830	2910	2790	0.1
Manganese	Mn	312	339	300	445	1
Phosphorus	PO4	519	1230	1280	1700	20
Potassium	K	1110	1090	578	481	10
Sodium	Na	98	186	82	73	5
Strontium	Sr	29	29	34	30	1
Titanium	Ti	395	451	293	265	1
Zirconium	Zr	8	9	2	1	1

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30211033

CSR Metals Analysis in Soil

CLIENT SAMPLE IDENTIFICATION:		AEC13 BH4-2	AEC8/9 BH5-1	AEC8/9 BH6-1	
DATE SAMPLED:		Feb 8/02	Feb 8/02	Feb 8/02	DETECTION LIMIT
CANTEST ID:		202110116	202110119	202110120	
Antimony	Sb	<	<	<	10
Arsenic	As	4.3	3.8	11.1	0.2
Barium	Ba	49	29	40	1
Beryllium	Be	<	<	<	1
Cadmium	Cd	<	<	<	0.4
Chromium	Cr	46	34	44	2
Cobalt	Co	<	<	<	1
Copper	Cu	<	165	45	1
Lead	Pb	47	37	77	5
Mercury	Hg	0.198	0.417	5.15	0.001
Molybdenum	Mo	<	<	<	4
Nickel	Ni	23	11	20	2
Selenium	Se	<	<	<	0.4
Silver	Ag	<	<	<	0.2
Thallium	Tl	<	<	<	0.2
Tin	Sn	<	<	<	5
Vanadium	V	43	40	42	1
Zinc	Zn	37	25	60	1
Aluminum	Al	13200	12000	11900	10
Boron	B	5	<	8	1
Calcium	Ca	8920	2840	9730	1
Iron	Fe	22700	20100	24200	2
Magnesium	Mg	7420	4520	6810	0.1
Manganese	Mn	334	259	287	1
Phosphorus	PO4	1170	785	998	20
Potassium	K	409	195	315	10
Sodium	Na	171	92	350	5
Strontium	Sr	52	28	47	1
Titanium	Ti	504	564	561	1
Zirconium	Zr	9	9	10	1

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit

Analysis Report

CANTEST LTD.

Professional
Analytical
Services

4606 Canada Way
Burnaby, B.C.
V5G 1K5

FAX: 604 731 2386

TEL: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Soil Sample

REPORTED TO: Seacor Environmental Engineering Inc.
3382 Tennyson Avenue
Victoria, B.C.
V8Z 3P6

Att'n: Mr. David Danks

PROJECT NAME: Esquimalt Graving Dock
PROJECT NUMBER: 201.00945.001

NUMBER OF SAMPLES: 1

REPORT DATE: April 17, 2002

DATE SUBMITTED: February 11, 2002

GROUP NUMBER: 30227002

SAMPLE TYPE: Soil

NOTE: Test results contained in this report refer only to the testing of samples submitted.

TEST METHODS:

Moisture in Soil - analysis was performed gravimetrically by heating a separate sample portion at 105 C and measuring the weight loss.

Polynuclear Aromatic Hydrocarbons - analysis was performed using procedures based on U.S. EPA Methods 625/8270, involving extraction, clean-up steps, and analysis using GC/MS.

TEST RESULTS:

(See following pages)

CANTEST LTD.

Zhenyong Gao, M.Sc.
Coordinator, Trace Organics

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30227002

Conventional Parameters in Soil

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Moisture
AEC 3 BH 7-3	Feb 8/02	202270003	31.1
DETECTION LIMIT			0.1
UNITS			%

% = percent

REPORTED TO: Seacor Environmental Engineering Inc.

REPORT DATE: April 17, 2002

GROUP NUMBER: 30227002

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	AEC 3 BH 7-3	
DATE SAMPLED:	Feb 8/02	
CANTEST ID:	202270003	DETECTION LIMIT
ANALYSIS DATE:	Mar 6/02	
Naphthalene	0.31	0.1
Acenaphthylene	0.07	0.05
Acenaphthene	<	0.05
Fluorene	<	0.1
Phenanthrene	0.33	0.1
Anthracene	0.09	0.1
Total LMW-PAH's	0.80	
Fluoranthene	0.60	0.1
Pyrene	0.66	0.1
Benzo(a)anthracene	0.30	0.1
Chrysene	0.33	0.1
Benzo(b)fluoranthene	0.49	0.1
Benzo(k)fluoranthene		0.1
Benzo(a)pyrene	0.33	0.1
Indeno(1,2,3-c,d)pyrene	0.22	0.1
Dibenz(a,h)anthracene	<	0.05
Benzo(g,h,i)perylene	0.20	0.1
Total HMW-PAH's	3.13	
Total PAH's	3.93	

Results expressed as micrograms per gram, on a dry weight basis. (µg/g)
< = Less than detection limit
Sample# 202270003 - Detection limits adjusted: Dilution required
NOTE: Benzo(b)fluoranthene and Benzo(k)fluoranthene reported as total.

Analysis Report

CANTEST LTD.

Professional
Analytical
Services

4606 Canada Way
Burnaby, B.C.
V5G 1K5

Fax: 604 731 2386

Tel: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Soil Samples

REPORTED TO: Seacor Environmental Inc.
3382 Tennyson Avenue
Victoria, B.C.
V8Z 3P6

Att'n: Mr. Aaron Haegele

PROJECT NAME: EGD
PROJECT NUMBER: 205.02945.001

NUMBER OF SAMPLES: 24

REPORT DATE: December 30, 2002

DATE SUBMITTED: December 7, 2002

GROUP NUMBER: 31211065

SAMPLE TYPE: Soil

NOTE: Results contained in this report refer only to the testing of samples submitted.

TEST METHODS:

CCME Petroleum Hydrocarbons in Soil - analysis was performed using Canadian Council of Ministers of the Environment (CCME) "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil" approved December 2000. The method involves extraction of the different hydrocarbon fractions and analysis by gas chromatography with flame ionization detection (GC/FID).

Moisture in Soil - analysis was performed gravimetrically by heating a separate sample portion at 105 C and measuring the weight loss.

pH in Soil or Solid - analysis was performed based on procedures described in the Manual on Soil Sampling and Methods of Analysis, published by the Canadian Society of Soil Science,1993. The test was performed using a deionized water leach with measurement by pH meter.

Polynuclear Aromatic Hydrocarbons - analysis was performed using procedures based on U.S. EPA Methods 625/8270, involving extraction, clean-up steps, and analysis using GC/MS.

Cadmium in Soil - analysis was performed using background-corrected Flame Atomic Absorption Spectrophotometry.

Mercury in Soil - analysis was performed using Cold Vapour Atomic Fluorescence.

Strong Acid Leachable Metals in Soil - analysis was performed using B.C. MOELP Method "Strong Acid Leachable Metals in Soil, Version 1.0". The method involves drying the sample at 60 C, sieving using a 2 mm (10 mesh) sieve and digestion using a mixture of hydrochloric and nitric acids. Analysis was performed using

(Continued)

CANTEST LTD.

Walter Brandl, B.Sc.
Manager, Environmental Services

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

Strong Acid Leachable Metals in Soil

Inductively Coupled Argon Plasma Spectroscopy (ICAP) or by specific techniques as described.

Selenium in Soil - analysis was performed using Graphite Furnace Atomic Absorption Spectrophotometry or Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Volatile Organic Compounds in Water and Soil - analysis was performed using procedures based on U.S. EPA Methods 624/8240/8260, involving sparging with a Purge and Trap apparatus and analysis using GC/MS.

TEST RESULTS:

(See following pages)

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

Conventional Parameters in Soil

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Moisture	pH
BH3-12A	Dec 6/02	212110212	21.7	-
BH3-12G	Dec 6/02	212110220	16.6	-
BH3-12H	Dec 6/02	212110221	14.7	-
BH13-13A	Dec 6/02	212110222	16.5	-
BH13-13B	Dec 6/02	212110224	17.0	6.9
BH13-13E	Dec 6/02	212110230	14.2	-
BH13-13F	Dec 6/02	212110231	14.1	7.5
BH13-13G	Dec 6/02	212110233	10.5	-
BH13-13H	Dec 6/02	212110253	14.5	7.5
BH4-2A	Dec 6/02	212110254	10.0	-
BH4-2C	Dec 6/02	212110256	9.8	-
BH4-12A	Dec 6/02	212110262	13.8	-
BH4-12B	Dec 6/02	212110264	9.8	7.3
BH13-12M	Dec 6/02	212110265	23.3	-
BH13-12N	Dec 6/02	212110266	19.8	7.3
BH13-6A	Dec 6/02	212110268	16.7	-
BH13-6B	Dec 6/02	212110269	17.3	7.6
BH13-6C	Dec 6/02	212110275	11.4	-
BH13-6D	Dec 6/02	212110276	14.8	7.7
BH13-6K	Dec 6/02	212110278	20.8	-
BH13-6L	Dec 6/02	212110279	21.0	7.9
BH13-11A	Dec 6/02	212110280	2.8	-
BH13-11B	Dec 6/02	212110281	2.0	7.8
BH13-11F	Dec 6/02	212110282	7.8	8.1
DETECTION LIMIT			0.1	0.1
UNITS			%	pH units

% = percent

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	BH3-12A	BH3-12G	BH3-12H	BH13-13B	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110212	212110220	212110221	212110224	DETECTION LIMIT
ANALYSIS DATE:	Dec 19/02	Dec 19/02	Dec 19/02	Dec 20/02	
Naphthalene	<	<	<	< 0.5	0.05
Acenaphthylene	<	<	<	1.6	0.05
Acenaphthene	<	<	<	< 0.5	0.05
Fluorene	<	<	<	1.1	0.05
Phenanthrene	0.09	<	<	15	0.05
Anthracene	<	<	<	3.0	0.05
Total LMW-PAH's	0.09			20.7	
Fluoranthene	0.19	<	<	17	0.05
Pyrene	0.20	<	<	16	0.05
Benzo(a)anthracene	0.10	<	<	7.8	0.05
Chrysene	0.08	<	<	8.0	0.05
Benzo(b)fluoranthene	0.17	<	<	11	0.05
Benzo(k)fluoranthene					0.05
Benzo(a)pyrene	0.11	<	<	6.4	0.05
Indeno(1,2,3-cd)pyrene	0.08	<	<	5.2	0.05
Dibenz(a,h)anthracene	<	<	<	0.85	0.05
Benzo(g,h,i)perylene	0.06	<	<	3.8	0.05
Total HMW-PAH's	0.99			76.0	
Total PAH's	1.08			96.7	

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit
Sample# 212110224 - Detection limits adjusted: Dilution required
NOTE: Benzo(b)fluoranthene and Benzo(k)fluoranthene reported as total.

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	BH13-13F	BH13-13H	BH4-2A	BH4-2C	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110231	212110253	212110254	212110256	DETECTION LIMIT
ANALYSIS DATE:	Dec 19/02	Dec 20/02	Dec 20/02	Dec 20/02	
Naphthalene	< 0.5	< 0.05	<	<	0.01
Acenaphthylene	< 0.5	0.11	<	0.035	0.005
Acenaphthene	< 0.5	< 0.05	<	<	0.005
Fluorene	0.5	0.13	<	0.01	0.01
Phenanthrene	8.8	2.1	<	0.13	0.01
Anthracene	1.3	0.32	<	0.03	0.01
Total LMW-PAH's	11	2.66		0.21	
Fluoranthene	6.4	1.8	<	0.28	0.01
Pyrene	5.9	1.7	<	0.28	0.01
Benzo(a)anthracene	2.6	0.85	<	0.16	0.01
Chrysene	2.6	0.72	<	0.17	0.01
Benzo(b)fluoranthene	3.0	1.1	<	0.28	0.01
Benzo(k)fluoranthene					0.01
Benzo(a)pyrene	1.7	0.63	<	0.16	0.01
Indeno(1,2,3-c,d)pyrene	1.1	0.48	<	0.12	0.01
Indeno(1,2,3-cd)pyrene	1.1	0.48	<	0.12	0.01
Dibenz(a,h)anthracene	< 0.5	0.09	<	0.006	0.005
Benzo(g,h,i)perylene	0.8	0.35	<	0.09	0.01
Total HMW-PAH's	24	7.72		1.54	
Total PAH's	35	10.4		1.75	

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit
Sample# 212110231 - Detection limits adjusted: Dilution required
NOTE: Benzo(b)fluoranthene and Benzo(k)fluoranthene reported as total.

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	BH4-12B	BH13-12N	BH13-6B	BH13-6D	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110264	212110266	212110269	212110276	DETECTION LIMIT
ANALYSIS DATE:	Dec 19/02	Dec 19/02	Dec 19/02	Dec 19/02	
Naphthalene	<	<	<	<	0.05
Acenaphthylene	<	<	<	<	0.05
Acenaphthene	<	<	<	<	0.05
Fluorene	<	<	<	<	0.05
Phenanthrene	0.12	<	<	<	0.05
Anthracene	<	<	<	<	0.05
Total LMW-PAH's	0.12				
Fluoranthene	0.11	<	0.09	<	0.05
Pyrene	0.10	<	0.09	<	0.05
Benzo(a)anthracene	0.05	<	<	<	0.05
Chrysene	0.08	<	<	<	0.05
Benzo(b)fluoranthene	0.07	<	0.08	<	0.05
Benzo(k)fluoranthene					0.05
Benzo(a)pyrene	<	<	<	<	0.05
Indeno(1,2,3-cd)pyrene	<	<	<	<	0.05
Dibenz(a,h)anthracene	<	<	<	<	0.05
Benzo(g,h,i)perylene	<	<	<	<	0.05
Total HMW-PAH's	0.41		0.26		
Total PAH's	0.53		0.26		

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit
NOTE: Benzo(b)fluoranthene and Benzo(k)fluoranthene reported as total.

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	BH13-13B	BH13-13F	BH13-13H	BH4-2A	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110224	212110231	212110253	212110254	DETECTION LIMIT
ANALYSIS DATE:	Dec 16/02	Dec 16/02	Dec 16/02	Dec 16/02	
Benzene	<	<	<	<	0.01
Bromodichloromethane	<	<	<	<	0.01
Bromoform	<	<	<	<	0.01
Bromomethane	<	<	<	<	0.04
2-Butanone	<	<	<	<	0.5
Carbon Tetrachloride	<	<	<	<	0.01
Chlorobenzene	<	<	<	<	0.01
Chloroethane	<	<	<	<	0.02
Chloroform	<	<	<	<	0.01
Chloromethane	<	<	<	<	0.04
Dibromochloromethane	<	<	<	<	0.01
1,2-Dibromoethane	<	<	<	<	0.01
Dibromomethane	<	<	<	<	0.01
1,2-Dichlorobenzene	<	<	<	<	0.01
1,3-Dichlorobenzene	<	<	<	<	0.01
1,4-Dichlorobenzene	<	<	<	<	0.01
Dichlorodifluoromethane	<	<	<	<	0.02
1,1-Dichloroethane	<	<	<	<	0.01
1,2-Dichloroethane	<	<	<	<	0.02
1,1-Dichloroethene	<	<	<	<	0.01
cis-1,2-Dichloroethene	<	<	<	<	0.01
trans-1,2-Dichloroethene	<	<	<	<	0.01
1,2-Dichloropropane	<	<	<	<	0.01
cis-1,3-Dichloropropene	<	<	<	<	0.01
trans-1,3-Dichloropropene	<	<	<	<	0.01
Ethylbenzene	<	<	<	<	0.01
2-Hexanone	<	<	<	<	0.5
4-Methyl-2-pentanone	<	<	<	<	0.2
Methylene Chloride	<	<	<	<	0.3
Styrene	<	<	<	<	0.01
1,1,2,2-Tetrachloroethane	<	<	<	<	0.01

(Continued on next page)

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	BH13-13B	BH13-13F	BH13-13H	BH4-2A	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110224	212110231	212110253	212110254	
ANALYSIS DATE:	Dec 16/02	Dec 16/02	Dec 16/02	Dec 16/02	DETECTION LIMIT
Tetrachloroethene	<	<	<	<	0.01
Toluene	<	<	<	<	0.01
1,1,1-Trichloroethane	<	<	<	<	0.01
1,1,2-Trichloroethane	<	<	<	<	0.01
Trichloroethene	<	<	<	<	0.01
Trichlorofluoromethane	<	<	<	<	0.01
Vinyl Chloride	<	<	<	<	0.02
Xylenes	<	<	<	<	0.01
Surrogate Recovery					
1,2-Dichloroethane-d4	112	114	118	119	-
Toluene-d8	97	98	98	91	-
Bromofluorobenzene	100	102	104	113	-

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	BH4-2C	BH4-12B	BH13-12N	BH13-6B	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110256	212110264	212110266	212110269	
ANALYSIS DATE:	Dec 16/02	Dec 16/02	Dec 16/02	Dec 16/02	DETECTION LIMIT
Benzene	<	<	<	<	0.01
Bromodichloromethane	<	<	<	<	0.01
Bromoform	<	<	<	<	0.01
Bromomethane	<	<	<	<	0.04
2-Butanone	<	<	<	<	0.5
Carbon Tetrachloride	<	<	<	<	0.01
Chlorobenzene	<	<	<	<	0.01
Chloroethane	<	<	<	<	0.02
Chloroform	<	<	<	<	0.01
Chloromethane	<	<	<	<	0.04
Dibromochloromethane	<	<	<	<	0.01
1,2-Dibromoethane	<	<	<	<	0.01
Dibromomethane	<	<	<	<	0.01
1,2-Dichlorobenzene	<	<	<	<	0.01
1,3-Dichlorobenzene	<	<	<	<	0.01
1,4-Dichlorobenzene	<	<	<	<	0.01
Dichlorodifluoromethane	<	<	<	<	0.02
1,1-Dichloroethane	<	<	<	<	0.01
1,2-Dichloroethane	<	<	<	<	0.02
1,1-Dichloroethene	<	<	<	<	0.01
cis-1,2-Dichloroethene	<	<	<	<	0.01
trans-1,2-Dichloroethene	<	<	<	<	0.01
1,2-Dichloropropane	<	<	<	<	0.01
cis-1,3-Dichloropropene	<	<	<	<	0.01
trans-1,3-Dichloropropene	<	<	<	<	0.01
Ethylbenzene	<	<	<	<	0.01
2-Hexanone	<	<	<	<	0.5
4-Methyl-2-pentanone	<	<	<	<	0.2
Methylene Chloride	<	<	<	<	0.3
Styrene	<	<	<	<	0.01
1,1,2,2-Tetrachloroethane	<	<	<	<	0.01

(Continued on next page)

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	BH4-2C	BH4-12B	BH13-12N	BH13-6B	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110256	212110264	212110266	212110269	DETECTION LIMIT
ANALYSIS DATE:	Dec 16/02	Dec 16/02	Dec 16/02	Dec 16/02	
Tetrachloroethene	<	<	<	<	0.01
Toluene	<	<	<	<	0.01
1,1,1-Trichloroethane	<	<	<	<	0.01
1,1,2-Trichloroethane	<	<	<	<	0.01
Trichloroethene	<	<	<	<	0.01
Trichlorofluoromethane	<	<	<	<	0.01
Vinyl Chloride	<	<	<	<	0.02
Xylenes	<	<	<	<	0.01
Surrogate Recovery					
1,2-Dichloroethane-d4	115	111	104	111	-
Toluene-d8	82	97	94	91	-
Bromofluorobenzene	112	100	100	114	-

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	BH13-6D	BH13-6L	BH13-11B	BH13-11F	DETECTION LIMIT
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110276	212110279	212110281	212110282	
ANALYSIS DATE:	Dec 16/02	Dec 16/02	Dec 16/02	Dec 16/02	
Benzene	<	<	<	<	0.01
Bromodichloromethane	<	<	<	<	0.01
Bromoform	<	<	<	<	0.01
Bromomethane	<	<	<	<	0.04
2-Butanone	<	<	<	<	0.5
Carbon Tetrachloride	<	<	<	<	0.01
Chlorobenzene	<	<	<	<	0.01
Chloroethane	<	<	<	<	0.02
Chloroform	<	<	<	<	0.01
Chloromethane	<	<	<	<	0.04
Dibromochloromethane	<	<	<	<	0.01
1,2-Dibromoethane	<	<	<	<	0.01
Dibromomethane	<	<	<	<	0.01
1,2-Dichlorobenzene	<	<	<	<	0.01
1,3-Dichlorobenzene	<	<	<	<	0.01
1,4-Dichlorobenzene	<	<	<	<	0.01
Dichlorodifluoromethane	<	<	<	<	0.02
1,1-Dichloroethane	<	<	<	<	0.01
1,2-Dichloroethane	<	<	<	<	0.02
1,1-Dichloroethene	<	<	<	<	0.01
cis-1,2-Dichloroethene	<	<	<	<	0.01
trans-1,2-Dichloroethene	<	<	<	<	0.01
1,2-Dichloropropane	<	<	<	<	0.01
cis-1,3-Dichloropropene	<	<	<	<	0.01
trans-1,3-Dichloropropene	<	<	<	<	0.01
Ethylbenzene	<	<	<	<	0.01
2-Hexanone	<	<	<	<	0.5
4-Methyl-2-pentanone	<	<	<	<	0.2
Methylene Chloride	<	<	<	<	0.3
Styrene	<	<	<	<	0.01
1,1,2,2-Tetrachloroethane	<	<	<	<	0.01

(Continued on next page)

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	BH13-6D	BH13-6L	BH13-11B	BH13-11F	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110276	212110279	212110281	212110282	DETECTION LIMIT
ANALYSIS DATE:	Dec 16/02	Dec 16/02	Dec 16/02	Dec 16/02	
Tetrachloroethene	<	<	<	<	0.01
Toluene	<	<	<	<	0.01
1,1,1-Trichloroethane	<	<	<	<	0.01
1,1,2-Trichloroethane	<	<	<	<	0.01
Trichloroethene	<	<	<	<	0.01
Trichlorofluoromethane	<	<	<	<	0.01
Vinyl Chloride	<	<	<	<	0.02
Xylenes	<	<	<	<	0.01
Surrogate Recovery					
1,2-Dichloroethane-d4	98	119	105	94	-
Toluene-d8	85	103	88	83	-
Bromofluorobenzene	105	99	110	106	-

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

CCME Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	BH13-13A	BH13-13E	BH13-13G	BH4-2A	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	DETECTION LIMIT
CANTEST ID:	212110222	212110230	212110233	212110254	
Benzene	<	<	<	<	0.04
Ethylbenzene	<	<	<	<	0.5
Toluene	<	<	<	<	0.5
Xylenes	<	<	<	<	0.5
F1 (C6-C10) uncorrected	<	<	<	<	25
F1 minus BTEX (C6-C10)	<	<	<	<	25
F2 uncorrected (C10-C16)	<	<	<	<	80
F3 uncorrected (C16-C34)	1700	<	<	<	250
F2-napth (C10-C16)	-	-	-	<	80
F4 (C34-C50)	740	<	<	<	250
F3-pah (C16-C34)	-	-	-	<	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

CCME Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	BH4-2C	BH4-12A	BH13-12M	BH13-6A	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	DETECTION LIMIT
CANTEST ID:	212110256	212110262	212110265	212110268	
Benzene	<	<	<	<	0.04
Ethylbenzene	<	<	<	<	0.5
Toluene	<	<	<	<	0.5
Xylenes	<	<	<	<	0.5
F1 (C6-C10) uncorrected	<	<	<	<	25
F1 minus BTEX (C6-C10)	<	<	<	<	25
F2 uncorrected (C10-C16)	<	<	<	<	80
F3 uncorrected (C16-C34)	<	<	<	<	250
F2-napth (C10-C16)	<	-	-	-	80
F4 (C34-C50)	280	<	<	<	250
F3-pah (C16-C34)	<	-	-	-	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

CCME Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	BH13-6C	BH13-6K	BH13-11A	BH13-11F	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	DETECTION LIMIT
CANTEST ID:	212110275	212110278	212110280	212110282	
Benzene	<	<	<	<	0.04
Ethylbenzene	<	<	<	<	0.5
Toluene	<	<	<	<	0.5
Xylenes	<	<	<	<	0.5
F1 (C6-C10) uncorrected	<	<	<	<	25
F1 minus BTEX (C6-C10)	<	<	<	<	25
F2 uncorrected (C10-C16)	<	90	<	<	80
F3 uncorrected (C16-C34)	<	570	1100	370	250
F2-napth (C10-C16)	-	-	-	<	80
F4 (C34-C50)	<	260	2000	490	250
F3-pah (C16-C34)	-	-	-	330	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Strong Acid Soluble Metals in Soil

CLIENT SAMPLE IDENTIFICATION:		BH13-13B	BH13-13F	BH13-13H	BH4-12B	
DATE SAMPLED:		Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	DETECTION LIMIT
CANTEST ID:		212110224	212110231	212110253	212110264	
Antimony	Sb	<	<	<	<	10
Arsenic	As	<	<	<	<	10
Barium	Ba	65	48	57	51	1
Beryllium	Be	<	<	<	<	1
Cadmium	Cd	<	<	<	<	1
Chromium	Cr	31	21	23	24	2
Cobalt	Co	15	10	11	10	1
Copper	Cu	73	44	50	69	1
Lead	Pb	11	<	<	13	5
Mercury	Hg	0.40	0.05	0.07	0.12	0.01
Molybdenum	Mo	<	<	<	<	4
Nickel	Ni	38	22	24	23	2
Selenium	Se	<	<	<	<	2
Silver	Ag	<	<	<	<	2
Tin	Sn	<	<	<	<	5
Vanadium	V	60	47	53	44	1
Zinc	Zn	65	32	36	51	1
Aluminum	Al	22300	14200	16300	14000	10
Boron	B	5	4	5	4	1
Calcium	Ca	7190	4360	4380	7810	1
Iron	Fe	24300	17700	19300	17700	2
Magnesium	Mg	14100	7730	8310	7730	0.1
Manganese	Mn	448	317	334	300	1
Phosphorus	PO4	1500	1040	1140	1370	20
Potassium	K	1230	807	928	623	10
Sodium	Na	663	3060	3440	1130	5
Strontium	Sr	40	21	25	35	1
Titanium	Ti	659	662	686	629	1
Zirconium	Zr	6	4	4	5	1

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Strong Acid Soluble Metals in Soil

CLIENT SAMPLE IDENTIFICATION:		BH13-12N	BH13-6B	BH13-6D	BH13-6L	
DATE SAMPLED:		Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	DETECTION LIMIT
CANTEST ID:		212110266	212110269	212110276	212110279	
Antimony	Sb	<	<	15	<	10
Arsenic	As	11	<	14	<	10
Barium	Ba	85	92	96	150	1
Beryllium	Be	<	<	<	<	1
Cadmium	Cd	<	<	<	<	1
Chromium	Cr	33	36	36	33	2
Cobalt	Co	14	15	16	17	1
Copper	Cu	54	70	103	84	1
Lead	Pb	12	13	32	78	5
Mercury	Hg	0.39	0.24	0.65	0.53	0.01
Molybdenum	Mo	<	<	<	<	4
Nickel	Ni	34	40	37	37	2
Selenium	Se	<	<	<	<	2
Silver	Ag	<	<	<	<	2
Tin	Sn	<	<	<	<	5
Vanadium	V	59	63	65	63	1
Zinc	Zn	64	133	210	88	1
Aluminum	Al	21600	24100	21200	23900	10
Boron	B	7	4	4	9	1
Calcium	Ca	3740	10200	14700	13200	1
Iron	Fe	23900	24900	25500	24300	2
Magnesium	Mg	10200	13000	11900	13100	0.1
Manganese	Mn	358	440	430	493	1
Phosphorus	PO4	1070	1700	1660	2010	20
Potassium	K	1720	1040	885	1420	10
Sodium	Na	5970	1760	1600	4520	5
Strontium	Sr	30	56	64	95	1
Titanium	Ti	656	690	745	667	1
Zirconium	Zr	6	6	6	6	1

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Strong Acid Soluble Metals in Soil

CLIENT SAMPLE IDENTIFICATION:		BH13-11B	BH13-11F	
DATE SAMPLED:		Dec 6/02	Dec 6/02	DETECTION LIMIT
CANTEST ID:		212110281	212110282	
Antimony	Sb	<	<	10
Arsenic	As	<	<	10
Barium	Ba	48	22	1
Beryllium	Be	<	<	1
Cadmium	Cd	<	<	1
Chromium	Cr	27	41	2
Cobalt	Co	12	18	1
Copper	Cu	78	138	1
Lead	Pb	27	18	5
Mercury	Hg	0.55	0.29	0.01
Molybdenum	Mo	<	<	4
Nickel	Ni	28	35	2
Selenium	Se	<	<	2
Silver	Ag	<	<	2
Tin	Sn	<	<	5
Vanadium	V	53	70	1
Zinc	Zn	65	72	1
Aluminum	Al	17700	23100	10
Boron	B	3	5	1
Calcium	Ca	7690	15400	1
Iron	Fe	20800	26200	2
Magnesium	Mg	11700	18500	0.1
Manganese	Mn	378	376	1
Phosphorus	PO4	1540	1810	20
Potassium	K	457	525	10
Sodium	Na	417	3190	5
Strontium	Sr	37	91	1
Titanium	Ti	678	637	1
Zirconium	Zr	4	2	1

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

Batch Quality Control for CCME Petroleum Hydrocarbons in Soil (QC# 38371)

Parameter	Blank (ug/g)	Blank Limits	Duplicate (R.P.D.) 212110202	Duplicate Limits	Gasoline Spike (% Recovery)	Gasoline Spike Limits
Benzene	< 0.04	0.5	NC	20	-	-
Ethylbenzene	< 0.5	0.5	NC	20	-	-
Toluene	< 0.5	0.5	NC	20	-	-
Xylenes	< 0.5	0.5	NC	20	-	-
F1 (C6-C10) uncorrected	< 25	10	NC	30	111	80 - 120

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

Batch Quality Control for CCME Petroleum Hydrocarbons in Soil (QC# 38510)

Parameter	Blank (ug/g)	Blank Limits	Diesel (/Oil) Spike (% Recovery)	Diesel (/Oil) Spike Limits	Duplicate (R.P.D.) 212110254	Duplicate Limits
F2 uncorrected (C10-C16)	< 80	20	83	75 - 125	NC	20
F3 uncorrected (C16-C34)	< 250	20	-	-	NC	20
F4 (C34-C50)	< 250	20	-	-	NC	20

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Batch Quality Control for CCME Petroleum Hydrocarbons in Soil (QC# 38573)

Parameter	Blank (ug/g)	Blank Limits	Diesel (/Oil) Spike (% Recovery)	Diesel (/Oil) Spike Limits	Duplicate (R.P.D.) 212110280	Duplicate Limits
F2 uncorrected (C10-C16)	< 80	20	108	75 - 125	NC	20
F3 uncorrected (C16-C34)	< 250	20	-	-	8.7	20
F4 (C34-C50)	< 250	20	-	-	18.2	20

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

Batch Quality Control for Polycyclic Aromatic Hydrocarbons in Soil (QC# 38534)

Parameter	Blank (ug/g)	Blank Limits	NRC HS-5 Cert. Ref. Material (% Recovery)	NRC HS-5 Cert. Ref. Material Limits
Naphthalene	< 0.05	0.05	88	57 - 111
Acenaphthylene	< 0.05	0.05	93	45 - 135
Acenaphthene	< 0.05	0.05	-	-
Fluorene	< 0.05	0.05	-	-
Phenanthrene	< 0.05	0.05	77	49 - 97
Anthracene	< 0.05	0.05	79	54 - 129
Fluoranthene	< 0.05	0.05	87	59 - 124
Pyrene	< 0.05	0.05	69	46 - 84
Benzo(a)anthracene	< 0.05	0.05	-	-
Chrysene	< 0.05	0.05	93	53 - 114
Benzo(b)fluoranthene	< 0.05	0.05	-	-
Benzo(a)pyrene	< 0.05	0.05	-	-
Indeno(1,2,3-cd)pyrene	< 0.05	0.05	71	49 - 102
Dibenz(a,h)anthracene	< 0.05	0.05	80	61 - 126
Benzo(g,h,i)perylene	< 0.05	0.05	-	-

ug/g = micrograms per gram

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Batch Quality Control for Strong Acid Soluble Metals in Soil (QC# 38479)

Parameter		Blank (ug/g)	Blank Limits	Duplicate (R.P.D.) 212110193	Duplicate Limits	Duplicate (R.P.D.) 212110281	Duplicate Limits
Antimony	Sb	< 10	0.15	0	30	0	30
Arsenic	As	< 10	0.25	0	30	0	30
Barium	Ba	< 1	0.1	6.5	30	14.7	30
Beryllium	Be	< 1	0.003	0	30	0	30
Cadmium	Cd	< 1	0.02	NC	30	NC	30
Chromium	Cr	< 2	0.05	10.2	30	3.8	30
Cobalt	Co	< 1	0.02	10.5	30	0	30
Copper	Cu	< 1	0.05	5.2	30	14	30
Lead	Pb	< 5	0.08	8.1	30	14.8	30
Mercury	Hg	< 0.001	0.05	0	30	(*)	30
Molybdenum	Mo	< 4	0.04	0	30	0	30
Nickel	Ni	< 2	0.025	0	30	0	30
Selenium	Se	< 2	0.003	NC	20	NC	20
Silver	Ag	< 2	0.05	-	-	-	-
Tin	Sn	< 5	0.1	28.6	30	0	30
Vanadium	V	< 1	0.01	11.5	30	1.9	30
Zinc	Zn	< 1	0.3	8.8	30	18.5	30

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.
(*) = Quality Control results exceeded internally set limits; after review by Quality Assurance Unit, non-conformance overridden and batch sample analysis results released for reporting

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

CANTEST®

Batch Quality Control for Strong Acid Soluble Metals in Soil (QC# 38479)

Parameter		Duplicate (R.P.D.) 212110386	Duplicate Limits	Duplicate (R.P.D.) 212130431	Duplicate Limits	NIST 2711 Montana Soil-SALM (% Recovery)	NIST 2711 Montana Soil-SALM Limits
Antimony	Sb	0	30	0	30	-	-
Arsenic	As	0	30	0	30	86	79 - 100
Barium	Ba	4.3	30	8.5	30	25	19 - 39
Beryllium	Be	0	30	0	30	-	-
Cadmium	Cd	NC	30	NC	30	-	-
Chromium	Cr	5.4	30	0	30	-	-
Cobalt	Co	7.4	30	18.2	30	-	-
Copper	Cu	7.4	30	9.5	30	86	78 - 115
Lead	Pb	0	30	0	30	83	77 - 115
Mercury	Hg	0	30	8.2	30	101	84 - 122
Molybdenum	Mo	0	30	0	30	-	-
Nickel	Ni	5.4	30	6.1	30	75	41 - 120
Selenium	Se	NC	20	NC	20	76	56 - 134
Tin	Sn	0	30	0	30	-	-
Vanadium	V	3.9	30	7.7	30	39	39 - 97
Zinc	Zn	2	30	6.7	30	87	80 - 110

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

Batch Quality Control for Volatile Organic Compounds in Soil (QC# 38565)

Parameter	Duplicate (R.P.D.) 212110331	Duplicate Limits
Benzene	NC	20
Bromodichloromethane	NC	20
Bromoform	NC	20
Carbon Tetrachloride	NC	20
Chlorobenzene	NC	20
Chloroform	NC	20
Dibromochloromethane	NC	20
1,2-Dibromoethane	NC	20
Dibromomethane	NC	20
1,2-Dichlorobenzene	NC	20
1,3-Dichlorobenzene	NC	20
1,4-Dichlorobenzene	NC	20
1,1-Dichloroethane	NC	20
1,2-Dichloroethane	NC	20
1,1-Dichloroethene	NC	20
cis-1,2-Dichloroethene	NC	20
trans-1,2-Dichloroethene	NC	20
1,2-Dichloropropane	NC	20
cis-1,3-Dichloropropene	NC	20
trans-1,3-Dichloropropene	NC	20
Ethylbenzene	NC	20
Styrene	NC	20
1,1,2,2-Tetrachloroethane	NC	20
Tetrachloroethene	NC	20
Toluene	NC	20
1,1,1-Trichloroethane	NC	20
1,1,2-Trichloroethane	NC	20
Trichloroethene	NC	20
Trichlorofluoromethane	NC	20
Xylenes	NC	20

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

Batch Quality Control Frequency Summary

MeOH Extr'n Prep BTEX/VPH Soil (Batch# 38371)

QC Type	No. Samples
Blank	1
Duplicate	1
Gasoline Spike	1

SALM in Soil Digestion (Batch# 38479)

QC Type	No. Samples
NIST 2711 Montana Soil-SALM	1
Blank	3
Duplicate	4

CCME HCs - SOIL PREP (Batch# 38510)

QC Type	No. Samples
Blank	1
Diesel (/Oil) Spike	1
Duplicate	1

PAH's in Soil Sample Prep (Batch# 38534)

QC Type	No. Samples
Blank	1
NRC HS-5 Cert. Ref. Material	1

Volatiles Analysis (Batch# 38565)

QC Type	No. Samples
Blank	1
Duplicate	1
Volatiles Soil Spike	1
Volatiles Water Spike	1

(Continued on next page)

Batch Quality Control Frequency Summary

CCME HCs - SOIL PREP (Batch# 38573)

QC Type	No. Samples
Blank	1
Diesel (/Oil) Spike	1
Duplicate	1

SALM Metals in Soil Sieve (Batch# 38360)

QC Type	No. Samples
Batch Size	38

MeOH Extr'n Prep BTEX/VPH Soil (Batch# 38371)

QC Type	No. Samples
Batch Size	42

SALM in Soil Digestion (Batch# 38479)

QC Type	No. Samples
Batch Size	40

CCME HCs - SOIL PREP (Batch# 38510)

QC Type	No. Samples
Batch Size	18

(Continued on next page)

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211065

Batch Quality Control Frequency Summary

PAH's in Soil Sample Prep (Batch# 38534)

QC Type	No. Samples
Batch Size	20

Volatiles Analysis (Batch# 38565)

QC Type	No. Samples
Batch Size	41

CCME HCs - SOIL PREP (Batch# 38573)

QC Type	No. Samples
Batch Size	18

Analysis Report

CANTEST LTD.

Professional
Analytical
Services

4606 Canada Way
Burnaby, B.C.
V5G 1K5

Fax: 604 731 2386

Tel: 604 734 7276

1 800 665 8566

REPORT ON: Analysis of Soil Samples

REPORTED TO: Seacor Environmental Inc.
3382 Tennyson Avenue
Victoria, B.C.
V8Z 3P6

Att'n: Mr. Aaron Haegele

PROJECT NAME: Esquimalt Graving Dock
PROJECT NUMBER: 205.02945.001

NUMBER OF SAMPLES: 17

REPORT DATE: December 30, 2002

DATE SUBMITTED: December 7, 2002

GROUP NUMBER: 31211077

SAMPLE TYPE: Soil

NOTE: Results contained in this report refer only to the testing of samples submitted.

TEST METHODS:

CCME Petroleum Hydrocarbons in Soil - analysis was performed using Canadian Council of Ministers of the Environment (CCME) "Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil" approved December 2000. The method involves extraction of the different hydrocarbon fractions and analysis by gas chromatography with flame ionization detection (GC/FID).

Moisture in Soil - analysis was performed gravimetrically by heating a separate sample portion at 105 C and measuring the weight loss.

pH in Soil or Solid - analysis was performed based on procedures described in the Manual on Soil Sampling and Methods of Analysis, published by the Canadian Society of Soil Science,1993. The test was performed using a deionized water leach with measurement by pH meter.

Polynuclear Aromatic Hydrocarbons - analysis was performed using procedures based on U.S. EPA Methods 625/8270, involving extraction, clean-up steps, and analysis using GC/MS.

Polychlorinated Biphenyls - analysis was performed using procedures based upon U.S. EPA Methods 608/8080, involving extraction, clean-up steps, and analysis using GC/ECD. Arochlors 1242, 1248, 1254 and 1260 were included.

Cadmium in Soil - analysis was performed using background-corrected Flame Atomic Absorption Spectrophotometry.

Mercury in Soil - analysis was performed using Cold Vapour Atomic Fluorescence.

(Continued)

CANTEST LTD.

Walter Brandl, B.Sc.
Manager, Environmental Services

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

Strong Acid Leachable Metals in Soil - analysis was performed using B.C. MOELP Method "Strong Acid Leachable Metals in Soil, Version 1.0". The method involves drying the sample at 60 C, sieving using a 2 mm (10 mesh) sieve and digestion using a mixture of hydrochloric and nitric acids. Analysis was performed using Inductively Coupled Argon Plasma Spectroscopy (ICAP) or by specific techniques as described.

Selenium in Soil - analysis was performed using Graphite Furnace Atomic Absorption Spectrophotometry or Inductively Coupled Plasma Mass Spectrometry (ICP/MS).

Volatile Organic Compounds in Water and Soil - analysis was performed using procedures based on U.S. EPA Methods 624/8240/8260, involving sparging with a Purge and Trap apparatus and analysis using GC/MS.

TEST RESULTS:

(See following pages)

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

Conventional Parameters in Soil

CLIENT SAMPLE IDENTIFICATION:	SAMPLE DATE	CANTEST ID	Moisture	pH
BH3-9A	Dec 6/02	212110284	3.1	-
BH4-1A	Dec 6/02	212110286	3.6	-
BH4-1I	Dec 6/02	212110292	8.5	-
BH4-1J	Dec 6/02	212110293	8.4	-
BH5-1A	Dec 6/02	212110295	2.2	-
BH5-2A	Dec 6/02	212110296	12.3	-
BH3-11A	Dec 6/02	212110298	8.4	-
BH3-11C	Dec 6/02	212110299	15.9	-
TP18-4A	Dec 6/02	212110300	11.7	-
TP18-4B	Dec 6/02	212110303	13.7	6.7
TP18-4C	Dec 6/02	212110307	12.4	-
TP18-5A	Dec 6/02	212110309	18.7	-
TP18-5B	Dec 6/02	212110311	19.6	5.9
TP18-6A	Dec 6/02	212110312	18.0	-
TP18-6B	Dec 6/02	212110314	18.4	5.4
TP18-7A	Dec 6/02	212110318	16.0	-
TP18-7B	Dec 6/02	212110320	17.1	5.4
DETECTION LIMIT			0.1	0.1
UNITS			%	pH units

% = percent

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	BH3-9A	BH4-1A	BH4-1I	BH4-1J	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110284	212110286	212110292	212110293	DETECTION LIMIT
ANALYSIS DATE:	Dec 19/02	Dec 20/02	Dec 20/02	Dec 20/02	
Naphthalene	< 0.5	0.3	< 0.5	< 0.5	0.1
Acenaphthylene	2.9	0.49	< 0.25	< 0.25	0.05
Acenaphthene	0.8	0.68	< 0.25	< 0.25	0.05
Fluorene	1.3	0.72	< 0.5	< 0.5	0.1
Phenanthrene	23	7.1	< 0.5	< 0.5	0.1
Anthracene	5.8	3.3	< 0.5	< 0.5	0.1
Total LMW-PAH's	34	12.6			
Fluoranthene	45	20	0.6	0.7	0.1
Pyrene	47	20	0.9	0.9	0.1
Benzo(a)anthracene	21	14	0.4	0.5	0.1
Chrysene	22	13	0.7	0.6	0.1
Benzo(b)fluoranthene	32	18	3.3	3.1	0.1
Benzo(k)fluoranthene					0.1
Benzo(a)pyrene	19	10	1.0	0.9	0.1
Indeno(1,2,3-c,d)pyrene	15	4.9	2.0	1.9	0.1
Indeno(1,2,3-cd)pyrene	15	4.9	2.0	1.9	0.1
Dibenz(a,h)anthracene	2.2	1.2	0.31	0.35	0.05
Benzo(g,h,i)perylene	12	3.9	1.9	1.8	0.1
Total HMW-PAH's	215	105	11.1	10.7	
Total PAH's	249	117	11.1	10.7	

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit
Sample# 212110284 , 212110292 , 212110293 - Detection limits adjusted: Dilution required
NOTE: Benzo(b)fluoranthene and Benzo(k)fluoranthene reported as total.

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	BH5-1A	BH5-2A	BH3-11A	BH3-11C	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110295	212110296	212110298	212110299	DETECTION LIMIT
ANALYSIS DATE:	Dec 20/02	Dec 20/02	Dec 20/02	Dec 20/02	
Naphthalene	0.98	0.1	< 0.05	0.09	0.01
Acenaphthylene	5.1	0.03	< 0.05	< 0.05	0.005
Acenaphthene	< 0.25	<	< 0.05	< 0.05	0.005
Fluorene	0.39	0.15	< 0.05	< 0.05	0.01
Phenanthrene	5.7	0.03	< 0.05	< 0.05	0.01
Anthracene	3.0	<	< 0.05	< 0.05	0.01
Total LMW-PAH's	15.2	0.32		0.09	
Fluoranthene	47	0.30	0.05	< 0.05	0.01
Pyrene	51	0.30	0.05	< 0.05	0.01
Benzo(a)anthracene	26	0.17	< 0.05	< 0.05	0.01
Chrysene	28	0.18	< 0.05	< 0.05	0.01
Benzo(b)fluoranthene	47	0.29	0.08	< 0.05	0.01
Benzo(k)fluoranthene					0.01
Benzo(a)pyrene	30	0.18	< 0.05	< 0.05	0.01
Indeno(1,2,3-c,d)pyrene	22	0.13	< 0.05	< 0.05	0.01
Indeno(1,2,3-cd)pyrene	22	0.13	< 0.05	< 0.05	0.01
Dibenz(a,h)anthracene	3.5	0.016	< 0.05	< 0.05	0.005
Benzo(g,h,i)perylene	16	0.11	< 0.05	< 0.05	0.01
Total HMW-PAH's	270	1.67	0.18		
Total PAH's	285	1.98	0.18	0.09	

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit
Sample# 212110295 - Detection limits adjusted: Dilution required
NOTE: Benzo(b)fluoranthene and Benzo(k)fluoranthene reported as total.

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

Polycyclic Aromatic Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	TP18-4B	TP18-5B	TP18-6B	TP18-7B	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110303	212110311	212110314	212110320	DETECTION LIMIT
ANALYSIS DATE:	Dec 20/02	Dec 20/02	Dec 20/02	Dec 20/02	
Naphthalene	<	<	<	<	0.05
Acenaphthylene	<	<	0.06	<	0.05
Acenaphthene	<	<	<	<	0.05
Fluorene	<	<	<	<	0.05
Phenanthrene	<	0.16	0.42	0.32	0.05
Anthracene	<	<	0.08	<	0.05
Total LMW-PAH's		0.16	0.56	0.32	
Fluoranthene	0.07	0.44	0.74	0.45	0.05
Pyrene	0.08	0.47	0.75	0.42	0.05
Benzo(a)anthracene	0.06	0.23	0.35	0.15	0.05
Chrysene	0.05	0.33	0.45	0.18	0.05
Benzo(b)fluoranthene	0.10	0.53	0.65	0.35	0.05
Benzo(k)fluoranthene					0.05
Benzo(a)pyrene	0.09	0.29	0.36	0.18	0.05
Indeno(1,2,3-cd)pyrene	0.07	0.26	0.27	0.15	0.05
Dibenz(a,h)anthracene	<	<	<	<	0.05
Benzo(g,h,i)perylene	<	0.22	0.22	0.11	0.05
Total HMW-PAH's	0.52	2.8	3.8	2.0	
Total PAH's	0.52	2.96	4.36	2.32	

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit
NOTE: Benzo(b)fluoranthene and Benzo(k)fluoranthene reported as total.

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	BH4-1A	BH4-1I	BH4-1J	BH5-1A	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110286	212110292	212110293	212110295	DETECTION LIMIT
ANALYSIS DATE:	Dec 16/02	Dec 16/02	Dec 16/02	Dec 16/02	
Benzene	<	<	<	<	0.01
Bromodichloromethane	<	<	<	<	0.01
Bromoform	<	<	<	<	0.01
Bromomethane	<	<	<	<	0.04
2-Butanone	<	<	<	<	0.5
Carbon Tetrachloride	<	<	<	<	0.01
Chlorobenzene	<	<	<	<	0.01
Chloroethane	<	<	<	<	0.02
Chloroform	<	<	<	<	0.01
Chloromethane	<	<	<	<	0.04
Dibromochloromethane	<	<	<	<	0.01
1,2-Dibromoethane	<	<	<	<	0.01
Dibromomethane	<	<	<	<	0.01
1,2-Dichlorobenzene	<	<	<	<	0.01
1,3-Dichlorobenzene	<	<	<	<	0.01
1,4-Dichlorobenzene	<	<	<	<	0.01
Dichlorodifluoromethane	<	<	<	<	0.02
1,1-Dichloroethane	<	<	<	<	0.01
1,2-Dichloroethane	<	<	<	<	0.02
1,1-Dichloroethene	<	<	<	<	0.01
cis-1,2-Dichloroethene	<	<	<	<	0.01
trans-1,2-Dichloroethene	<	<	<	<	0.01
1,2-Dichloropropane	<	<	<	<	0.01
cis-1,3-Dichloropropene	<	<	<	<	0.01
trans-1,3-Dichloropropene	<	<	<	<	0.01
Ethylbenzene	<	<	<	<	0.01
2-Hexanone	<	<	<	<	0.5
4-Methyl-2-pentanone	<	<	<	<	0.2
Methylene Chloride	<	<	<	<	0.3
Styrene	<	<	<	<	0.01
1,1,2,2-Tetrachloroethane	<	<	<	<	0.01

(Continued on next page)

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	BH4-1A	BH4-1I	BH4-1J	BH5-1A	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	
CANTEST ID:	212110286	212110292	212110293	212110295	DETECTION LIMIT
ANALYSIS DATE:	Dec 16/02	Dec 16/02	Dec 16/02	Dec 16/02	
Tetrachloroethene	<	<	<	<	0.01
Toluene	<	<	<	<	0.01
1,1,1-Trichloroethane	<	<	<	<	0.01
1,1,2-Trichloroethane	<	<	<	<	0.01
Trichloroethene	<	<	<	<	0.01
Trichlorofluoromethane	<	<	<	<	0.01
Vinyl Chloride	<	<	<	<	0.02
Xylenes	<	<	<	<	0.01
Surrogate Recovery					
1,2-Dichloroethane-d4	86	115	108	89	-
Toluene-d8	80	82	80	82	-
Bromofluorobenzene	95	117	104	97	-

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	BH5-2A	
DATE SAMPLED:	Dec 6/02	
CANTEST ID:	212110296	DETECTION LIMIT
ANALYSIS DATE:	Dec 16/02	
Benzene	<	0.01
Bromodichloromethane	<	0.01
Bromoform	<	0.01
Bromomethane	<	0.04
2-Butanone	<	0.5
Carbon Tetrachloride	<	0.01
Chlorobenzene	<	0.01
Chloroethane	<	0.02
Chloroform	<	0.01
Chloromethane	<	0.04
Dibromochloromethane	<	0.01
1,2-Dibromoethane	<	0.01
Dibromomethane	<	0.01
1,2-Dichlorobenzene	<	0.01
1,3-Dichlorobenzene	<	0.01
1,4-Dichlorobenzene	<	0.01
Dichlorodifluoromethane	<	0.02
1,1-Dichloroethane	<	0.01
1,2-Dichloroethane	<	0.02
1,1-Dichloroethene	<	0.01
cis-1,2-Dichloroethene	<	0.01
trans-1,2-Dichloroethene	<	0.01
1,2-Dichloropropane	<	0.01
cis-1,3-Dichloropropene	<	0.01
trans-1,3-Dichloropropene	<	0.01
Ethylbenzene	<	0.01
2-Hexanone	<	0.5
4-Methyl-2-pentanone	<	0.2
Methylene Chloride	<	0.3
Styrene	<	0.01
1,1,2,2-Tetrachloroethane	<	0.01

(Continued on next page)

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

Volatile Organic Compounds in Soil

CLIENT SAMPLE IDENTIFICATION:	BH5-2A	
DATE SAMPLED:	Dec 6/02	
CANTEST ID:	212110296	DETECTION LIMIT
ANALYSIS DATE:	Dec 16/02	
Tetrachloroethene	<	0.01
Toluene	<	0.01
1,1,1-Trichloroethane	<	0.01
1,1,2-Trichloroethane	<	0.01
Trichloroethene	<	0.01
Trichlorofluoromethane	<	0.01
Vinyl Chloride	<	0.02
Xylenes	<	0.01
Surrogate Recovery		
1,2-Dichloroethane-d4	115	-
Toluene-d8	86	-
Bromofluorobenzene	103	-

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

Polychlorinated Biphenyls in Soil

CLIENT SAMPLE IDENTIFICATION:	TP18-4B	TP18-4C	TP18-5B	TP18-6B	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	DETECTION LIMIT
CANTEST ID:	212110303	212110307	212110311	212110314	
Arochlor 1242	<	<	<	<	0.03
Arochlor 1248	<	<	<	<	0.03
Arochlor 1254	<	<	<	<	0.03
Arochlor 1260	<	<	<	<	0.03
Surrogate Recovery					
2,2',4,4',6,6'-hexabromobiphenyl	108	98	95	91	-

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

Polychlorinated Biphenyls in Soil

CLIENT SAMPLE IDENTIFICATION:	TP18-7B	
DATE SAMPLED:	Dec 6/02	DETECTION LIMIT
CANTEST ID:	212110320	
Arochlor 1242	<	0.03
Arochlor 1248	<	0.03
Arochlor 1254	<	0.03
Arochlor 1260	<	0.03
Surrogate Recovery		
2,2',4,4',6,6'-hexabromobiphenyl	90	-

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
Surrogate recoveries expressed as percent (%)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

CCME Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	BH4-1A	BH4-1I	BH4-1J	BH5-1A	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	DETECTION LIMIT
CANTEST ID:	212110286	212110292	212110293	212110295	
Benzene	<	<	<	-	0.04
Ethylbenzene	<	<	<	-	0.5
Toluene	<	<	<	-	0.5
Xylenes	<	<	<	-	0.5
F1 (C6-C10) uncorrected	<	<	<	-	25
F1 minus BTEX (C6-C10)	<	<	<	-	25
F2 uncorrected (C10-C16)	<	1900	2700	<	80
F3 uncorrected (C16-C34)	1000	2200	3200	950	250
F2-napth (C10-C16)	<	1900	2700	<	80
F4 (C34-C50)	3400	<	<	1400	250
F3-pah (C16-C34)	880	2200	3200	670	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

CCME Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	BH5-2A	TP18-4A	TP18-5A	TP18-6A	
DATE SAMPLED:	Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	DETECTION LIMIT
CANTEST ID:	212110296	212110300	212110309	212110312	
Benzene	-	<	<	<	0.04
Ethylbenzene	-	<	<	<	0.5
Toluene	-	<	<	<	0.5
Xylenes	-	<	<	<	0.5
F1 (C6-C10) uncorrected	-	<	<	<	25
F1 minus BTEX (C6-C10)	-	<	<	<	25
F2 uncorrected (C10-C16)	<	<	<	<	80
F3 uncorrected (C16-C34)	<	<	<	<	250
F2-napth (C10-C16)	<	-	-	-	80
F4 (C34-C50)	<	<	<	<	250
F3-pah (C16-C34)	<	-	-	-	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CCME Petroleum Hydrocarbons in Soil

CLIENT SAMPLE IDENTIFICATION:	TP18-7A	
DATE SAMPLED:	Dec 6/02	DETECTION LIMIT
CANTEST ID:	212110318	
Benzene	<	0.04
Ethylbenzene	<	0.5
Toluene	<	0.5
Xylenes	<	0.5
F1 (C6-C10) uncorrected	<	25
F1 minus BTEX (C6-C10)	<	25
F2 uncorrected (C10-C16)	<	80
F3 uncorrected (C16-C34)	<	250
F4 (C34-C50)	<	250

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

Strong Acid Soluble Metals in Soil

CLIENT SAMPLE IDENTIFICATION:		TP18-4B	TP18-5B	TP18-6B	TP18-7B	
DATE SAMPLED:		Dec 6/02	Dec 6/02	Dec 6/02	Dec 6/02	DETECTION LIMIT
CANTEST ID:		212110303	212110311	212110314	212110320	
Antimony	Sb	<	<	<	<	10
Arsenic	As	<	<	<	<	10
Barium	Ba	122	206	110	111	1
Beryllium	Be	<	<	<	<	1
Cadmium	Cd	<	<	<	<	1
Chromium	Cr	30	27	28	26	2
Cobalt	Co	19	14	15	15	1
Copper	Cu	26	34	29	26	1
Lead	Pb	10	152	7	7	5
Mercury	Hg	0.06	0.77	0.06	0.06	0.01
Molybdenum	Mo	<	<	<	<	4
Nickel	Ni	30	29	28	28	2
Selenium	Se	<	<	<	<	2
Silver	Ag	<	<	<	<	2
Tin	Sn	<	8	<	<	5
Vanadium	V	59	56	55	56	1
Zinc	Zn	62	84	58	57	1
Aluminum	Al	28500	28100	26900	27500	10
Boron	B	3	2	1	2	1
Calcium	Ca	7560	5310	3800	3600	1
Iron	Fe	22500	20400	20800	20400	2
Magnesium	Mg	8260	8390	7780	7840	0.1
Manganese	Mn	765	596	680	791	1
Phosphorus	PO4	873	2010	976	911	20
Potassium	K	664	556	643	578	10
Sodium	Na	262	175	203	177	5
Strontium	Sr	50	46	25	26	1
Titanium	Ti	693	542	477	471	1
Zirconium	Zr	4	3	2	2	1

Results expressed as micrograms per gram, on a dry weight basis. (μg/g)
< = Less than detection limit

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

Batch Quality Control for CCME Petroleum Hydrocarbons in Soil (QC# 38371)

Parameter	Blank (ug/g)	Blank Limits	Duplicate (R.P.D.) 212110202	Duplicate Limits	Gasoline Spike (% Recovery)	Gasoline Spike Limits
Benzene	< 0.04	0.5	NC	20	-	-
Ethylbenzene	< 0.5	0.5	NC	20	-	-
Toluene	< 0.5	0.5	NC	20	-	-
Xylenes	< 0.5	0.5	NC	20	-	-
F1 (C6-C10) uncorrected	< 25	10	NC	30	111	80 - 120

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

Batch Quality Control for CCME Petroleum Hydrocarbons in Soil (QC# 38572)

Parameter	Blank (ug/g)	Blank Limits	Diesel (/Oil) Spike (% Recovery)	Diesel (/Oil) Spike Limits	Duplicate (R.P.D.) 212110187	Duplicate Limits
F2 uncorrected (C10-C16)	< 80	20	88	75 - 125	NC	20
F3 uncorrected (C16-C34)	< 250	20	-	-	NC	20
F4 (C34-C50)	< 250	20	-	-	NC	20

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

Batch Quality Control for Polycyclic Aromatic Hydrocarbons in Soil (QC# 38534)

Parameter	Blank (ug/g)	Blank Limits	NRC HS-5 Cert. Ref. Material (% Recovery)	NRC HS-5 Cert. Ref. Material Limits
Naphthalene	< 0.05	0.05	88	57 - 111
Acenaphthylene	< 0.05	0.05	93	45 - 135
Acenaphthene	< 0.05	0.05	-	-
Fluorene	< 0.05	0.05	-	-
Phenanthrene	< 0.05	0.05	77	49 - 97
Anthracene	< 0.05	0.05	79	54 - 129
Fluoranthene	< 0.05	0.05	87	59 - 124
Pyrene	< 0.05	0.05	69	46 - 84
Benzo(a)anthracene	< 0.05	0.05	-	-
Chrysene	< 0.05	0.05	93	53 - 114
Benzo(b)fluoranthene	< 0.05	0.05	-	-
Benzo(a)pyrene	< 0.05	0.05	-	-
Indeno(1,2,3-cd)pyrene	< 0.05	0.05	71	49 - 102
Dibenz(a,h)anthracene	< 0.05	0.05	80	61 - 126
Benzo(g,h,i)perylene	< 0.05	0.05	-	-

ug/g = micrograms per gram

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

Batch Quality Control for Polycyclic Aromatic Hydrocarbons in Soil (QC# 38580)

Parameter	Blank (ug/g)	Blank Limits	Duplicate (R.P.D.) 212110298	Duplicate Limits	NRC HS-5 Cert. Ref. Material (% Recovery)	NRC HS-5 Cert. Ref. Material Limits
Naphthalene	< 0.05	0.05	NC	40	88	57 - 111
Acenaphthylene	< 0.05	0.05	NC	40	93	45 - 135
Acenaphthene	< 0.05	0.05	NC	40	-	-
Fluorene	< 0.05	0.05	NC	40	-	-
Phenanthrene	< 0.05	0.05	NC	40	85	49 - 97
Anthracene	< 0.05	0.05	NC	40	79	54 - 129
Fluoranthene	< 0.05	0.05	18.2	40	79	59 - 124
Pyrene	< 0.05	0.05	18.2	40	79	46 - 84
Benzo(a)anthracene	< 0.05	0.05	NC	40	-	-
Chrysene	< 0.05	0.05	NC	40	86	53 - 114
Benzo(b)fluoranthene	< 0.05	0.05	22.2	40	-	-
Benzo(a)pyrene	< 0.05	0.05	NC	40	-	-
Indeno(1,2,3-cd)pyrene	< 0.05	0.05	NC	40	74	49 - 102
Dibenz(a,h)anthracene	< 0.05	0.05	NC	40	90	61 - 126
Benzo(g,h,i)perylene	< 0.05	0.05	NC	40	-	-

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

Batch Quality Control for Polychlorinated Biphenyls in Soil (QC# 91697)

Parameter	Blank (ug/g)	Blank Limits	Duplicate (R.P.D.) 212110307	Duplicate Limits	Spike (% Recovery)	Spike Limits
Arochlor 1242	< 0.03	0.03	NC	25	-	-
Arochlor 1248	< 0.03	0.03	NC	25	-	-
Arochlor 1254	< 0.03	0.03	NC	25	90	75 - 125
Arochlor 1260	< 0.03	0.03	NC	25	-	-

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

Instrument Quality Control for the GC#HP5 w/ FID(TEH) or ECD(PCB) (QC# 91697)

QC Type: Calibration Verification

Parameter	% Recovery	Limits
Arochlor 1242	0	75 - 120
Arochlor 1248	0	75 - 120
Arochlor 1254	105	75 - 120
Arochlor 1260	105	75 - 120

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

Batch Quality Control for Strong Acid Soluble Metals in Soil (QC# 38479)

Parameter		Blank (ug/g)	Blank Limits	Duplicate (R.P.D.) 212110193	Duplicate Limits	Duplicate (R.P.D.) 212110281	Duplicate Limits
Antimony	Sb	< 10	0.15	0	30	0	30
Arsenic	As	< 10	0.25	0	30	0	30
Barium	Ba	< 1	0.1	6.5	30	14.7	30
Beryllium	Be	< 1	0.003	0	30	0	30
Cadmium	Cd	< 1	0.02	NC	30	NC	30
Chromium	Cr	< 2	0.05	10.2	30	3.8	30
Cobalt	Co	< 1	0.02	10.5	30	0	30
Copper	Cu	< 1	0.05	5.2	30	14	30
Lead	Pb	< 5	0.08	8.1	30	14.8	30
Mercury	Hg	< 0.001	0.05	0	30	(*)	30
Molybdenum	Mo	< 4	0.04	0	30	0	30
Nickel	Ni	< 2	0.025	0	30	0	30
Selenium	Se	< 2	0.003	NC	20	NC	20
Silver	Ag	< 2	0.05	-	-	-	-
Tin	Sn	< 5	0.1	28.6	30	0	30
Vanadium	V	< 1	0.01	11.5	30	1.9	30
Zinc	Zn	< 1	0.3	8.8	30	18.5	30

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.
(*) = Quality Control results exceeded internally set limits; after review by Quality Assurance Unit, non-conformance overridden and batch sample analysis results released for reporting

REPORTED TO: Seacor Environmental Inc.

REPORT DATE: December 30, 2002

GROUP NUMBER: 31211077

CANTEST®

Batch Quality Control for Strong Acid Soluble Metals in Soil (QC# 38479)

Parameter		Duplicate (R.P.D.) 212110386	Duplicate Limits	Duplicate (R.P.D.) 212130431	Duplicate Limits	NIST 2711 Montana Soil-SALM (% Recovery)	NIST 2711 Montana Soil-SALM Limits
Antimony	Sb	0	30	0	30	-	-
Arsenic	As	0	30	0	30	86	79 - 100
Barium	Ba	4.3	30	8.5	30	25	19 - 39
Beryllium	Be	0	30	0	30	-	-
Cadmium	Cd	NC	30	NC	30	-	-
Chromium	Cr	5.4	30	0	30	-	-
Cobalt	Co	7.4	30	18.2	30	-	-
Copper	Cu	7.4	30	9.5	30	86	78 - 115
Lead	Pb	0	30	0	30	83	77 - 115
Mercury	Hg	0	30	8.2	30	101	84 - 122
Molybdenum	Mo	0	30	0	30	-	-
Nickel	Ni	5.4	30	6.1	30	75	41 - 120
Selenium	Se	NC	20	NC	20	76	56 - 134
Tin	Sn	0	30	0	30	-	-
Vanadium	V	3.9	30	7.7	30	39	39 - 97
Zinc	Zn	2	30	6.7	30	87	80 - 110

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

Batch Quality Control for Volatile Organic Compounds in Soil (QC# 38565)

Parameter	Duplicate (R.P.D.) 212110331	Duplicate Limits
Benzene	NC	20
Bromodichloromethane	NC	20
Bromoform	NC	20
Carbon Tetrachloride	NC	20
Chlorobenzene	NC	20
Chloroform	NC	20
Dibromochloromethane	NC	20
1,2-Dibromoethane	NC	20
Dibromomethane	NC	20
1,2-Dichlorobenzene	NC	20
1,3-Dichlorobenzene	NC	20
1,4-Dichlorobenzene	NC	20
1,1-Dichloroethane	NC	20
1,2-Dichloroethane	NC	20
1,1-Dichloroethene	NC	20
cis-1,2-Dichloroethene	NC	20
trans-1,2-Dichloroethene	NC	20
1,2-Dichloropropane	NC	20
cis-1,3-Dichloropropene	NC	20
trans-1,3-Dichloropropene	NC	20
Ethylbenzene	NC	20
Styrene	NC	20
1,1,2,2-Tetrachloroethane	NC	20
Tetrachloroethene	NC	20
Toluene	NC	20
1,1,1-Trichloroethane	NC	20
1,1,2-Trichloroethane	NC	20
Trichloroethene	NC	20
Trichlorofluoromethane	NC	20
Xylenes	NC	20

ug/g = micrograms per gram
R.P.D. = Relative Percent Difference
NC = Not Calculated. Duplicate sample results were less than the detection limit. Relative Percent Difference calculation is not defined for analyte levels of less than detection limit.

Batch Quality Control Frequency Summary

MeOH Extr'n Prep BTEX/VPH Soil (Batch# 38371)

QC Type	No. Samples
Blank	1
Duplicate	1
Gasoline Spike	1

SALM in Soil Digestion (Batch# 38479)

QC Type	No. Samples
NIST 2711 Montana Soil-SALM	1
Blank	3
Duplicate	4

PAH's in Soil Sample Prep (Batch# 38534)

QC Type	No. Samples
Blank	1
NRC HS-5 Cert. Ref. Material	1

Volatiles Analysis (Batch# 38565)

QC Type	No. Samples
Blank	1
Duplicate	1
Volatiles Soil Spike	1
Volatiles Water Spike	1

CCME HCs - SOIL PREP (Batch# 38572)

QC Type	No. Samples
Blank	1
Diesel (/Oil) Spike	1
Duplicate	1

(Continued on next page)

Batch Quality Control Frequency Summary

PAH's in Soil Sample Prep (Batch# 38580)

QC Type	No. Samples
Blank	1
Duplicate	1
NRC HS-5 Cert. Ref. Material	1

SALM Metals in Soil Sieve (Batch# 38360)

QC Type	No. Samples
Batch Size	38

MeOH Extr'n Prep BTEX/VPH Soil (Batch# 38371)

QC Type	No. Samples
Batch Size	42

SALM in Soil Digestion (Batch# 38479)

QC Type	No. Samples
Batch Size	40

PAH's in Soil Sample Prep (Batch# 38534)

QC Type	No. Samples
Batch Size	20

(Continued on next page)

Batch Quality Control Frequency Summary

Volatiles Analysis (Batch# 38565)

QC Type	No. Samples
Batch Size	41

CCME HCs - SOIL PREP (Batch# 38572)

QC Type	No. Samples
Batch Size	18

PAH's in Soil Sample Prep (Batch# 38580)

QC Type	No. Samples
Batch Size	20

Levelton Consultants Ltd.
www.levelton.com

150-12791 Clarke Place
Richmond, BC V6V 2H9
Canada

Tel: 604-278-1411
Fax: 604-278-1042
E-Mail: info@levelton.com

Construction Materials
Building Science
Geotechnical
Metallurgy and Corrosion
Environmental
Physical Testing

February 7, 2013

File: AB12-2410-00

ISL Engineering Ltd.
503-4190 Lougheed Hwy
Burnaby BC V5C 6A8

Attention: Ms. Janet Tong, P.Eng.

Project: Esquimalt Graving Dock

Subject: Assessment of Graving Dock Slab

Dear Ms. Tong,

ISL Engineering Ltd. (ISL) retained Levelton Consultants Ltd. (Levelton) to conduct an assessment of the slab-on-grade at the Esquimalt Graving Dock. The intent of the assessment was to determine the general condition of the slab and to present rehabilitation options that will mitigate possible environmental contamination. We understand that the soil surrounding the graving dock had been contaminated in the past as a result of contaminants leaking through the dock concrete.

BACKGROUND

The graving dock was commissioned in 1887 and is 361 m (1186 feet) long, 38 m (126 feet) wide (at bottom) and 12 m (40 feet) high. The slab is approximately 1.4 m thick with three longitudinal rows of granite blocks (between 2.7 and 3.1 m wide). The slab has control joints at 5.5 m (transverse) and 9.9 m (longitudinal).Drainage and sumps are installed near the perimeter of the slab. Photos 1 and 2 (Appendix A) show the general arrangement of the graving dock.

SCOPE

Levelton's assessment of the graving dock included the following:

- Reviewed the original construction drawings.
- Visual review of the slab surface to identify evidence of concrete deterioration such as cracks, spalls, delaminations and previous repairs. The review was intended to identify types of deterioration and did not include a detailed quantity take-off.

- Removal of concrete core samples for laboratory testing (compressive strength and uranyl acetate testing to identify the possibility of alkali aggregate reactivity).

We did not perform any chemical analysis on the concrete as the slab is unreinforced.

OBSERVATIONS

Considering the age of the structure and the exposure conditions, the slab is visually in relatively good condition. The slab has impact damage resulting in localized spalls (Photos 3 and 4). Numerous previous patch repairs are present throughout the entire slab surface and the majority of these patches appear to be performing reasonably well although debonding along edges was observed (Photos 5 and 6). It appears that patch repairs have been ongoing for many years with the patches being of various ages. Most of the deterioration appears to be a result of impact and abrasion damage from the heavy industrial work associated with ship repairs and is not a result of concrete deterioration or inferior concrete quality. Our investigation was conducted during heavy rain; the slab surface is not well drained towards the drains and water is ponding in many areas (Photo 7).

A trial patch was placed adjacent to the sill with the intent of diverting any run-off towards the drain. We understand that the patch was placed in the last year (Photo 8). We sounded the patch and identified debonding along the edges of the concrete where the patch was applied relatively thinly.

Sounding using the chain drag method identified some small localized delaminations, most of which were debonding of previous patch repairs.

LABORATORY TESTING

We removed eleven core samples from the various locations of the slab. Several of the cores were removed at patch locations to determine the thickness of the patches as well as the condition of the patch concrete. Visually, the original concrete is generally sound for all cores with no evidence of deterioration. The patches range in thickness from approximately 65 to over 300 mm with the majority being in the order of 80 to 100 mm thick. Some of the cores separated at the interface between the patches and the original concrete during removal, indicating relatively weak tensile bond strength at the interface. Core photographs and logs are attached in Appendix B and core locations are referenced on the sketch attached in Appendix C.

We tested the cores for unit mass and compressive strength. Unit mass is relatively consistent and ranges between 2,403 and 2,616 kg/m^3. These values are consistent with Vancouver Island aggregate sources. The compressive strength varies between 42.3 and 60.1 MPa which indicates sound concrete, particularly when considering the age. Core test records are attached in Appendix B.

LEVELTON

DISCUSSION

Overall, the slab concrete is in relatively sound condition, especially when considering its age. There is evidence of physical damage throughout the slab with localized surface spalls. There are many localized patch repairs of different age located throughout the entire slab. Some of the patches have subsequently cracked or debonded from the substrate but most have performed reasonably well. We do not have a record of any of the patch repairs with respect to age and type.

Dirt and contamination has accumulated in spalled areas and make clean-up difficult. Contaminants also accumulate along joints and cracks and over time may migrate through these locations to the surrounding environment. In addition, the slab surface has very little soloing towards the drains, resulting in water ponding in many areas.

We did not evaluate the drainage system but leakage in the drainage system should be considered.

We understand that Public Works requires that the slab provide positive drainage towards drains and that the surface be relatively smooth to ease regular cleanup. The intent is to mitigate the risk of contamination on the exterior of the graving dock.

To rehabilitate and re-slope the slab surface, the application of a bonded concrete topping should be considered. We would anticipate that changing the final slab elevation is not feasible due to overall geometry of the dock structure and the presence of the granite blocks. Thus, removal by milling of the existing concrete will be required. In order to meet the industrial requirements of the slab, the installation of a steel-fibre reinforced concrete topping between 75 and 150 mm thick would be the most suitable rehabilitation option. A thicker topping has several advantages, including the removal of most existing concrete repairs (most patches appear to be in the order of 100 mm thick) to avoid multiple bond lines and use of larger aggregate size to mitigate shrinkage and associated cracking. Some mechanical dowels would also be required to ensure proper bonding of the topping. We note that the original concrete is sound to receive a new topping.

The application of a new bonded topping could be performed in stages to address scheduling and budget constraints.

Thinner toppings, including the use of proprietary materials may be considered but would require some further research and involvement of the manufacturers. Also, thinner toppings would most likely require replacement on a more frequent basis.

The application of coatings to the slab surface is not considered feasible due to the heavy industrial exposure and possible associated damage. Also, polymeric coatings would not bond to a slab that is subject to constant moisture vapour emissions.

In addition to installing a new topping, joint details and drainage will have to be addressed. Joints will have to be sealed by either epoxy injection or the use of a joint sealant. Injection will provide a more permanent seal but will not allow any movement.

LEVELTON

SUMMARY

We recommend a discussion between Public Works, ISL and Levelton to determine the requirements with respect to clean-up, service life, drainage and containment prior to finalizing a rehabilitation approach. Considering the size of the structured, any work would most likely have to be staged to meet scheduled and budget requirements.

Yours truly,

LEVELTON CONSULTANTS LTD.

[Original signed and stamped by]

Per: Oliver K. Gepraegs, MASc., P.Eng.
Regional Manager
ogepraegs@levelton.com

Attachment: Appendices

APPENDIX A

Photographs

Photo 1: Graving dock looking east

Photo 2: Graving dock looking west

Photo 3: Typical slab surface with localized damage

Photo 4: Deterioration of slab surface

Photo 5: Patch repairs

Photo 6: Patch repairs

Photo 7: Poor drainage (no positive sloping towards drains)

Photo 8: Trial patch sloping towards drains

APPENDIX B

Core Logs and Laboratory Test Results

Esquimalt Graving Dock Core Log	
Photos	**Core Observations**
	**Core #1** **Location**: GL #23; 17 metres from North wall **Diameter:** 93 mm **Length**: 251 mm to 271 mm **Total Patch Depth**: 65 mm to 89 mm **Max. Size Agg.:** 50 mm **Comments:** Patch between 65 and 89 mm thick Max. aggregate in patch 20 mm
	**Core #2** **Location**: GL #23; 1.5 metres from south wall **Diameter:** 93 mm **Length**: 244 mm to 265 mm **Max. Size Agg.**: 50 mm
	**Core #3** **Location**: GL #30; 10 metres from north wall **Diameter:** 93 mm **Length**: 258 mm to 280 mm **Max. Size Agg.**: 50 mm **Comments:** Patch 100 to 112 mm thick with 20 mm max. size aggregate

Esquimalt Graving Dock Core Log	
Photos	**Core Observations**
	**Core #4** **Location**: GL #19-20; 18 meters from south wall **Diameter:** 93 mm **Length**: 245 mm to 270 mm **Max. Size Agg.**: 50 mm **Comments:** Patch 80 to 95 mm thick with 20 mm max. size aggregate
	**Core #5** **Location**: GL #17-18; 18 meters from north wall **Diameter:** 93 mm **Length**: 291 mmto 305 mm **Max. Size Agg.**: 50 mm

Esquimalt Graving Dock Core Log	
Photos	**Core Observations**
	**Core #6** **Location**: GL #14; 18 meters from south wall **Diameter:** 93 mm **Length**: 223 mm to 253 mm **Max. Size Agg.**: 50 mm **Max. Aggregate of Patch:** 30mm **Comments:** Patch 110 to 130 mm thick with 20 mm max. size aggregate Patch debonded from substrate
	**Core #7** **Location**: GL #11; 11 meters from south wall **Diameter:** 93 mm **Length**: 279 mm to 285 mm **Max. Size Agg**: 50 mm **Comments:** Gap graded aggregate distribution, Some aggregate segregation

Esquimalt Graving Dock Core Log	
Photos	**Core Observations**
	**Core #8** **Location**: GL #9-10; 10 meters from north wall **Diameter:** 93mm **Length**: 270 mm to 286 mm **Max. Size Agg.**: 15 mm **Comments:** Entire core appears to be newer concrete
	**Core #9** **Location**: GL #3-4; 2 meters from north wall **Diameter:** 93 mm **Length**: 275 mm to 281 mm **Max. Size Agg.**: 50 mm **Comments:** 100 mm thick patch well bonded
	**Core #10** **Location**: GL #3-4; 2 meters from north wall **Diameter:** 93 mm **Length:** 244 mm to 273 mm **Max. Size Agg.**: 50 mm

Esquimalt Graving Dock Core Log	
Photos	**Core Observations**
	**Core #11** **Location**: GL #2; 19 meters from south wall **Diameter:** 93 mm **Length**: 200 mm to 245 mm **Max. Size Agg.**: 50 mm **Comments:** Minor consolidation voids, patch between 80 and 112 mm thick, maximum size aggregate in patch 20 mm

Levelton Consultants Ltd.

760 Enterprise Crescent
Victoria, BC
Canada V8Z 6R4
Tel: 250-475-1000
Fax: 250-475-2211
e-mail: victoria@levelton.com
Web Site: www.levelton.com

CORE TEST RECORD
(CSA - A23.2 - 14C)

CLIENT:	ISL Engineering and Land Services Ltd	**DATE TESTED:**	**January 18th, 2013**
PROJECT:	Esquimalt Graving Dock - Slab	**FILE NO:**	AB12-2410-00
			REPORT NO.:

SAMPLE NO.	DRILLED LENGTH	DIMENSIONS, mm				LOAD (kN)	STRENGTH (MPa)		UNIT MASS kg/m^3	REMARKS
		LENGTH		DIAM.	L/D		TESTED	CORRECTED		
		TRIM	CAP							
1	184*	117	128	93	1.26	321.9	47.4	44.1	2598	
2	255*	182	192	93	1.96	287.1	42.3	42.3	2614	
3	162*	90	102	93	0.97	405.7	59.7	52.0	2590	
4	169*	94	106	93	1.01	375.2	55.2	48.1	2579	
5	298*	182	190	93	1.96	316.1	46.5	46.5	2559	
7	282*	182	189	93	1.96	408.1	60.1	60.1	2525	
8	278	182	192	93	1.96	381.4	56.1	56.1	2403	
9	278	108	118	93	1.16	445.0	65.5	59.0	2592	
10	259*	183	190	93	1.97	346.5	51.0	51.0	2533	
11	126*	93	100	93	1.00	395.9	58.3	50.7	2569	

TECHNICIAN: PKF/GG **CAPPING MATERIAL USED:** Sulfur **CONDITIONING:** Dry-conditioned

REMARKS: ***Drilled length for original concrete only. Does not include any surface patching.**

DISTRIBUTION:

Type of Failure:

A B C D E F

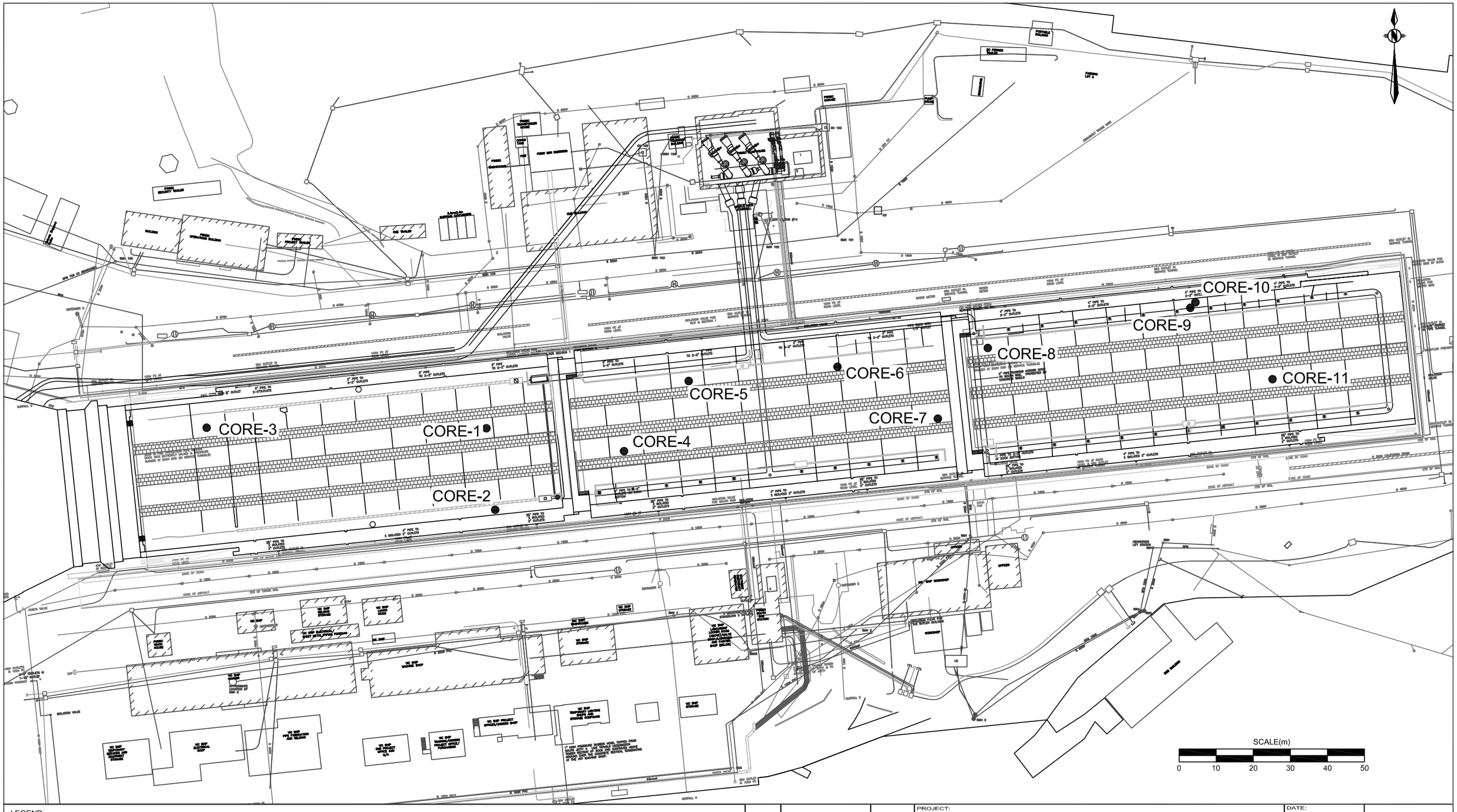
This report represents a testing service only.
No engineering interpretation is expressed or implied.
Engineering review and interpretation can be provided on written request.

C:\JOYCE\LETTERS\CMD\Cores\core test form.doc

LEVELTON CONSULTANTS LTD.

APPENDIX C

Core Locations



LEGEND:

● APPROXIMATE CORE LOCATION

REV. :	DESCRIPTION:	DATE : (M/D/YR)

PROJECT: ESQUIMALT GRAVING DOCK SLAB

CLIENT: ISL ENGINEERING AND SERVICES LTD.

TITLE: CORE LOCATION PLAN

DATE: FEB 2013
DESIGN BY: PKF
DRAWN BY: GDC
CHECKED BY: OG
SCALE: AS SHOWN

LEVELTON

PROJECT No.: AB12-2410-00

FIGURE NO.: 1

D

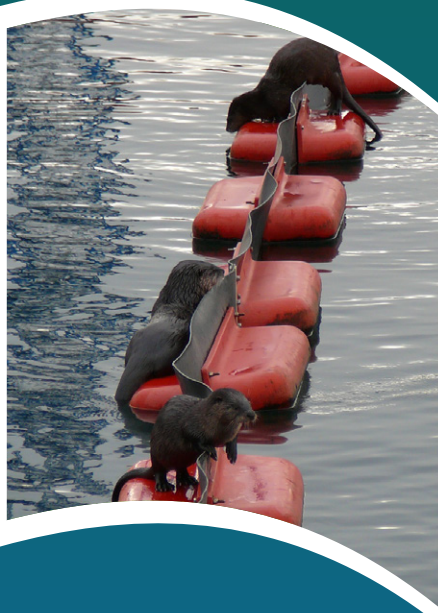
ESQUIMALT GRAVING DOCK

ENVIRONMENTAL BEST MANAGEMENT PRACTICES

Number of Pages: 51

EGD
Esquimalt Graving Dock

Environmental Best Management Practices



Prepared by:
Public Services and Procurement Canada
Environmental Services

October 2016
Version: 05

INDEX

Overview

Risk Management Policy

EGD Site Map

EBMP #1: Pressure Washing (*High and Ultra High*)

EBMP #2: Abrasive Blasting

EBMP #3: Painting and Coating

EBMP #4: Dry Dock Floor Management and Clean Up

EBMP #5: Hazardous Materials Handling and Storage

EBMP #6: Waste Management and Recycling

EBMP #7: Fuelling and Oil Transfer

EBMP #8: Invasive Species

EBMP #9: Fish and Wildlife Management

EBMP #10: Water Use

EBMP #11: Energy Conservation

EBMP #12: Nuisance Pollution (*Noise/Odour/Light*)

EBMP #13: Sanitary Waste Management and Sewer Use

EBMP #14: Spill Preparedness and Response

EBMP #15: In-Water Hull Cleaning and Maintenance

EBMP #16: Housekeeping

EBMP #17: Stormwater Management

EBMP #18: Property and Infrastructure Maintenance, Modifications and Construction

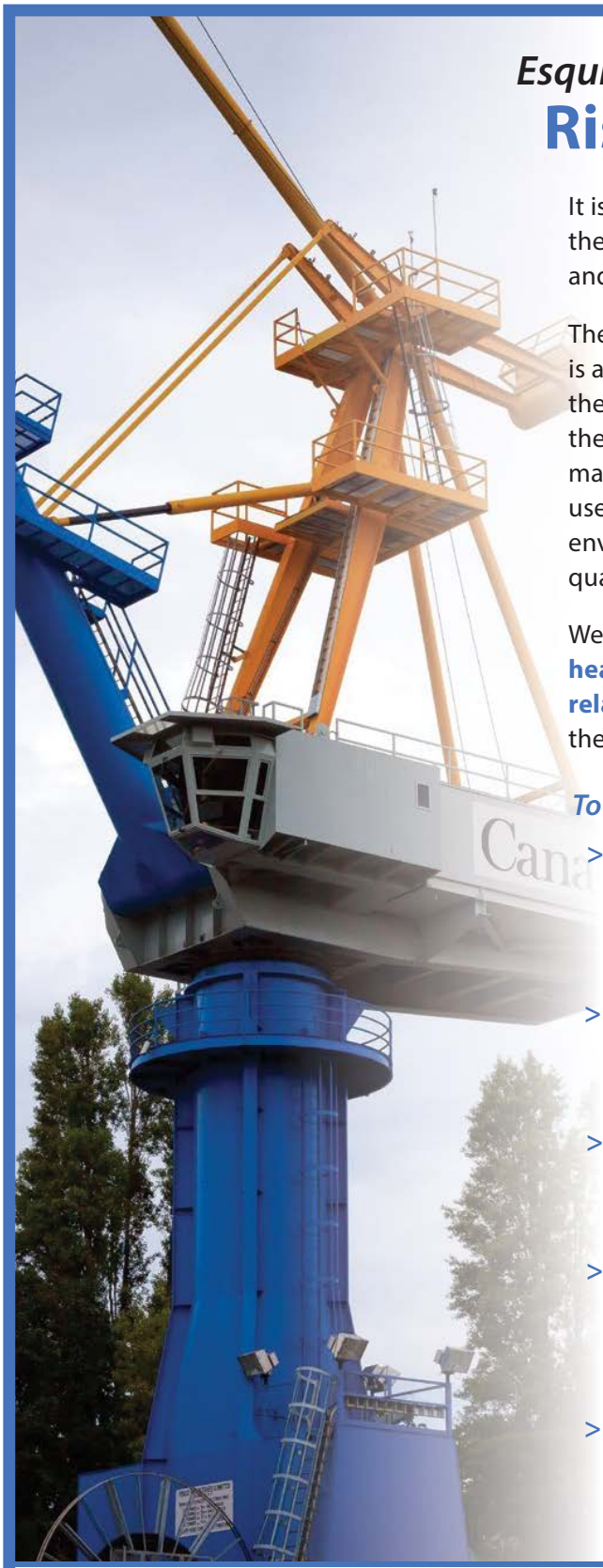
OVERVIEW

The **Esquimalt Graving Dock** (*EGD*) is a federal government owned and operated, multi-user ship repair and maintenance facility located in Esquimalt, British Columbia. The facility has been in operation since 1925, and provides service to local, Federal, and international vessels. The vessel repair and maintenance work at the EGD is carried out by privately owned shipyard repair contractors that rent the required sections of the drydock, lease upland work space from the government, and pay a fee for services such as cranes, compressed air, water, sewer and power.

The EGD is committed to managing the actual and potential health and safety, environmental, security, financial and public relations risks, while ensuring quality operations and services. In order to identify and manage these risks, the EGD has implemented an **Environmental Management System** (*EMS*) and a Risk Management Framework (*in conformance with the internationally recognized standards ISO 14001 and ISO 31000*). The EMS provides the framework for identifying environmental impacts, and ensures adequate controls are in place to effectively manage them.

This manual contains a series of **Environmental Best Management Practices** (*EBMPs*) developed to reduce impact to the environment related to common activities and operations at the Esquimalt Graving Dock. The manual contains guidance and recommendations for those operating at the EGD, and is intended to complement existing environmental legislation. It does not remove the responsibility of all contractors and companies operating at the EGD to abide by all applicable regulatory requirements and industry standards. All users of the facility are expected to follow the EBMPs.

For additional information contact the EGD Environmental Services Department.



Esquimalt Graving Dock

Risk Management Policy

It is the goal of the Esquimalt Graving Dock, in partnership with the ship repair industry, to be the premier ship repair, construction and maintenance facility on the west coast of North America.

The Esquimalt Graving Dock acknowledges that risk management is an integral part of attaining this goal. We recognize that risk is the effect of uncertainty on our operations and is inherent within the ship repair industry. Our objective is to identify, monitor and manage risk in order to prevent the harm of our employees, site users, contractors, neighbours, other stakeholders, the environment and our facility, while ensuring and maintaining quality operations and services.

We are committed to managing the actual and potential **health & safety, environmental, security, financial and public relation risks** pertaining to strategies, policies and practices at the Esquimalt Graving Dock.

To meet our commitment we will:

> *Implement systems and processes to consistently identify, measure, mitigate, minimize and report on risks, while continuing to uphold and adapt the established Environmental Management System and other relevant Management Frameworks.*

> *Meet or exceed applicable federal, provincial and municipal legislation and regulations, departmental policies, industry standards, practices and other requirements.*

> *Communicate openly with our employees to ensure they are aware of and understand our Risk Management Framework, the nature of our operations and their roles and responsibilities in managing risk.*

> *Monitor and review our Risk Management Framework to ensure we are meeting our goals. Ongoing oversight of the effectiveness of our Risk Management Framework is the responsibility of the Esquimalt Graving Dock Risk Management Team.*

> *Provide the necessary resources to effectively implement our Risk Management Framework, while continuing to improve our programs, procedures and operations.*

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

Jim Milne
Director
Esquimalt Graving Dock
Engineering Assets
Strategy Sector

David Latoski
Operations Manager
Esquimalt Graving Dock
Engineering Assets
Strategy Sector

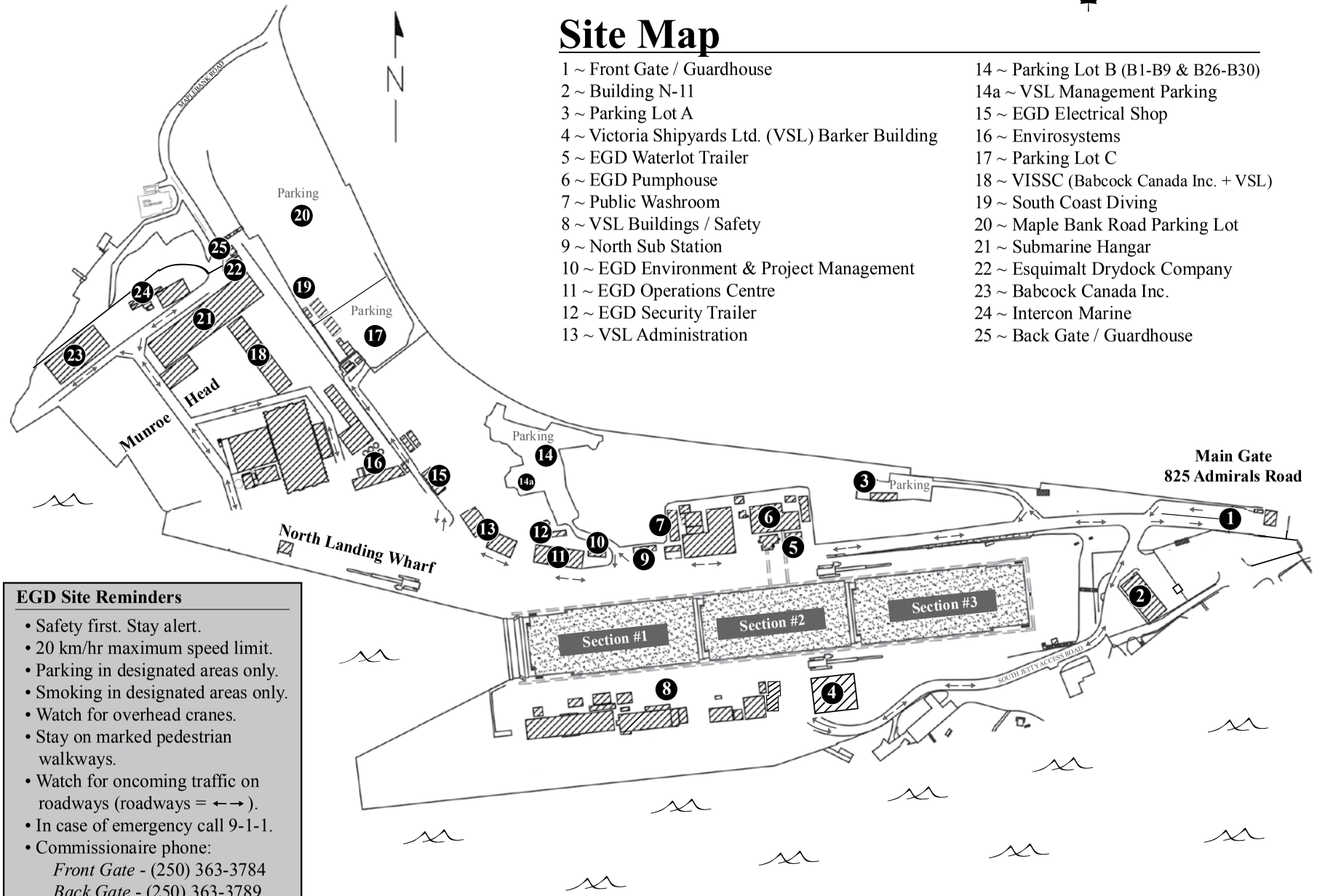
Canada

August 2015

EGD
Esquimalt Graving Dock

Site Map

1 ~ Front Gate / Guardhouse
2 ~ Building N-11
3 ~ Parking Lot A
4 ~ Victoria Shipyards Ltd. (VSL) Barker Building
5 ~ EGD Waterlot Trailer
6 ~ EGD Pumphouse
7 ~ Public Washroom
8 ~ VSL Buildings / Safety
9 ~ North Sub Station
10 ~ EGD Environment & Project Management
11 ~ EGD Operations Centre
12 ~ EGD Security Trailer
13 ~ VSL Administration
14 ~ Parking Lot B (B1-B9 & B26-B30)
14a ~ VSL Management Parking
15 ~ EGD Electrical Shop
16 ~ Envirosystems
17 ~ Parking Lot C
18 ~ VISSC (Babcock Canada Inc. + VSL)
19 ~ South Coast Diving
20 ~ Maple Bank Road Parking Lot
21 ~ Submarine Hangar
22 ~ Esquimalt Drydock Company
23 ~ Babcock Canada Inc.
24 ~ Intercon Marine
25 ~ Back Gate / Guardhouse



EGD Site Reminders

- Safety first. Stay alert.
- 20 km/hr maximum speed limit.
- Parking in designated areas only.
- Smoking in designated areas only.
- Watch for overhead cranes.
- Stay on marked pedestrian walkways.
- Watch for oncoming traffic on roadways (roadways = ←→).
- In case of emergency call 9-1-1.
- Commissionaire phone:
  Front Gate - (250) 363-3784
  Back Gate - (250) 363-3789

Environmental Best Management Practices

EBMP #1: Pressure Washing (High and Ultra High)

One of the first activities to occur on a drydocked vessel is pressure washing of the hull to remove salts, marine growth and residual paint, prior to surface preparation or painting. This typically involves pressure washing the underwater hull and/or super structure with water at 2,000 – 3,500 psi. This activity produces large volumes of paint contaminated wastewater (*e.g. washwater*). Ship repair contractors may also use an Ultra High Pressure (*UHP)* washing process (*from 40,000 – 55,000 psi*) to completely remove all paints, often eliminating the need for further surface preparation (*e.g. sandblasting*) prior to painting. UHP generates even larger volumes of wastewater and slurry solids. All wastewater created from pressure washing and UHP requires management (*i.e. assessment, collection, handling, treatment and disposal*).

Management of Wastewater on the Graving Dock Floor

- Ensure all wastes and wastewater discharges, resulting from hull and anchor chain washing, as well as dock bottom clean-up activities, are collected and disposed of properly.
- Close all sump well valves in the drydock floor collection system prior to and during pressure washing operations.
- Manage pumps to ensure they are handling the volume of washwater sufficiently.
- Manage washwater storage containers to ensure they are not overfilled.
- Divert contaminated wastewater, that falls outside of the drydock floor collection system, away from the tunnel drains.
- Direct non-contaminated water (*e.g. ballast water, cooling water, dock wall/moon pool leakage water*) away from contaminants on the drydock floor.
- Collect and dispose of stormwater that comes into contact with contaminants.
- Do not use detergents or additives in washwater.

Opening Sump Well Valves

Sump well valves in the drydock floor can be opened to manage rainwater under the following conditions ONLY:

- Dock floor has been pre-cleaned, prior to the completion of the work period.
- A filter cloth has been installed to reduce the migration of debris.

All wastewater containing paint contaminants must be directed to the collection trench drains and sump wells on the drydock floor, collected, and sent for proper treatment.

Antifoulant contaminated washwater entering the collection system (trench drains and sump wells) on the drydock floor.

The sill diversion pump removes clean seawater from the pool at the front of Section 1 (moon pool) and discharges into the tunnel drains through a hard pipe on the graving dock wall.

Sediment from the harbour often settles on dock bottom after dewatering. If this becomes contaminated with paint, etc., it must be disposed of.

The hull of a cruise ship being ultra high pressure washed.

Section 1 Considerations:
Caisson and Dock Wall Leakage & Drydock Floor Sediment

Managing Caisson and Dock Wall Leakage:

- Divert caisson leakage water away from pressure washing areas.
- Water leakage from the caisson can be diverted by using a sump pump connected to the PVC diversion pipe installed on the north wall of the drydock Section 1.
- Divert water leakage from the graving dock walls, during high tide, directly into the drainage tunnel.

Managing Entrained Sediment:

Harbour sediment may accumulate in the corners, trenches, keel blocks and sumps of the drydock Section 1 during normal docking procedure. Users of the section will need to consider management of this sediment and are responsible for removal and proper disposal if it becomes contaminated from their operations and activities on dock floor (*e.g. pressure washing wastewater, sandblast grit, paint chips, paint overspray, and other contaminants*).

Ultra High Pressure (UHP) Washing

Ultra high-pressure washing generates significant volumes of wastewater and sludge that may pose a challenge for collection and disposal.

- Prepare in advance for the management of UHP waste.
- Remove all water, sludge and debris, generated from UHP washing, from the drydock.
- Ensure the washwater and sludge is disposed of at an appropriately permitted facility.
- Disposal certificates may be requested, by EGD Management, to ensure washwater is being properly managed.

Management of Pressure Wastewater in Upland Areas/Dockside

- Perform pressure washing of small vessels and parts, in designated areas only, where wastewater management can be effectively achieved.
- Approval for pressure washing in upland areas (*including the use of a stormwater trench for water collection*) is required from EGD Management
- Wash vessel parts in a suitable contained area (*e.g. enclosed skip*).
- Completely block all drains in the area where pressure washing will occur (*e.g. cover nearby trench drains with filter cloth, place a foam bung in the trench drain to prevent migration of wash water should an incident occur*).
- Ensure sufficient equipment (*e.g. pumps, totes, tanks, foam blocks and sandbags*) is available for the timely collection, control and removal of washwater.
- Contaminated washwater requires proper treatment for disposal. Label containers.

A small vessel is power washed on the North Landing Wharf (NLW).

The trench drain is blocked and a sump pump is installed to collect wash water into a tote.

Example of high density styrofoam blocks used as a drain blocker on the NLW.

Large tank dockside with an attendant.

EBMP #2: Abrasive Blasting

Abrasive blasting is a common operation performed at the Esquimalt Graving Dock (*EGD*) to prepare vessel surfaces for painting. However, this operation creates challenges with respect to controlling air emissions and the waste materials generated.

The dust emissions generated from abrasive blasting operations can contain harmful environmental pollutants and have the potential to negatively effect employees, facility users, neighbours, equipment and infrastructure if it is not properly managed. Fugitive dust may also impact the local marine environment by entering the Esquimalt Harbour directly, or via stormwater runoff, and through direct deposit to uplands soil.

Waste grit may be highly contaminated with antifouling paint and other metals, which also poses a risk to the environment if not handled and disposed of properly.

Dust Control

- Establish dust suppression controls in advance of starting any work.
- Do not abrasive blast during conditions that render containment ineffective *(e.g. during windy conditions)*.
- No abrasive blasting of vessels shall be performed while vessels are docked alongside the North Landing Wharf or South Jetty.
- Minimize dust emissions by ensuring blast nozzles are angled perpendicular to the vessel and aimed slightly downward during blasting.
- Properly manage (*contained, covered and secure*) all sandblast product and wastes during transport.

ADEQUATE containment.

Hoarding (*Physical Containment*)

- Use containment such as tarps, shrouds or portable structures to prevent airborne particles from entering the atmosphere and surface waters.
- Containment should be large enough to adequately enclose or segregate the working area and reach the dock floor or walls.
- Ensure containment is properly installed (*connected and overlapped*) so there are no gaps.
- Used tarps with tears and holes should be replaced, repaired or doubled with additional layers.

INADEQUATE containment.

Water Use (*Fugitive Dust Suppression*)

- Where physical containment techniques are not sufficient to prevent fugitive dust emissions, water may be used to mitigate dust.
- Users may requisition use of Dust Suppression Units (*e.g. Dust Boss*) from the EGD. The units are highly effective at mitigating dust.
- Monitor areas where dust escapes physical containment and adjust dust suppression unit water spray accordingly.
- Do not allow water from the dust suppression units to enter other sections of the dock, especially in the case where another user occupies it.
- Do not allow water from the dust suppression units to come in contact with contaminants on the drydock floor or other work areas. Adjust water spray and relocate contaminants to mitigate impacts.
- Fire nozzle "water curtains" may only be used to control dust emissions when approved by EGD Management in advance. The dust suppression units generates a more effective water mist and uses significantly less fresh water during operation.

Waste Grit Management

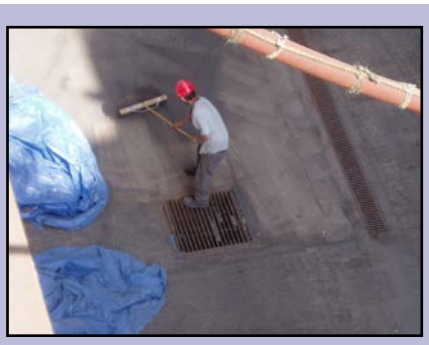
- Cover trench drains and tunnel grates in work areas with filter cloth. Replace the cloth as required.
- Manage waste grit by sweeping it into central areas, away from trenches, tunnel grates and dock floor traffic.
- Remove waste grit from work areas as soon as possible.
- Store all waste grit in appropriate containers to prevent leakage.
- Cover all skips, storage bins, tanks, and hoppers to prevent dust emissions and spills.
- Characterize and dispose of waste grit in accordance with applicable provincial regulations.

Dust suppression unit in operation.

Store all waste grit away from drains, to prevent contaminates migrating into the marine environment.

INADEQUATE waste grit storage.

ADEQUATE waste grit storage.



Clean up waste grit to prevent it from being washed into the drainage system by clean water (e.g. cooling water discharge, stormwater, dust suppression unit spray).

Store waste grit in appropriate containers.

Remove waste grit from work areas as soon as possible to prevent migration of contaminates throughout the drydock floor.

Keel / Bilge Blocks

Keel and bilge blocks on dock bottom present a challenge for the clean up of spent waste grit.

Waste grit must be removed from areas around excess blocks stored in the dock bottom. To prevent grit from collecting between the blocks, they can be relocated or covered prior to sandblasting.

Power washing at the base of the blocks can be effective in removing contaminants.

EBMP #3: Painting and Coating

Ship repair and maintenance often requires the painting and coating of vessel surfaces to protect them from corrosion or to inhibit the growth of marine life. The industrial nature of marine paints and solvents, in particular antifouling paints, may result in negative impacts to the environment and surrounding infrastructure, if not properly managed.

Spray Painting

Paint overspray has the potential to impact the marine environment, soils, neighbouring residences, and nearby equipment and infrastructure.

- Use containment such as tarps, shrouds or portable structures to prevent airborne particles from entering the atmosphere and surface waters.
    - Containment should be large enough to adequately enclose or segregate the working area.
    - Ensure containment is secured so there are no gaps.
    - Ensure that containment reaches the dock floor or walls.
    - Do not use keel blocks, dock floor or dock walls to test paint sprayers.
- Do not spray paint during conditions that render containment ineffective (*e.g. windy*).
- Place containment beneath and around structures being painted on dock floor and in work areas to ensure overspray does not reach the surrounding area (*e.g. during painting of anchor chains, or grates*).
- Manage overspray on the drydock floor to prevent safety hazards (*e.g. slippage*).
- When spray painting materials inside the stabilizer pockets, ensure the area is sealed and that the walls and floors are covered.
- For vessels docked in Section 1, ensure that overspray does not reach the caisson sill/moon pool water. Avoid docking vessels so they extend over sill area.

Spray Painting

ADEQUATE containment.

INADEQUATE containment.

INADEQUATE containment. Ensure tarps are in place to prevent overspray impacting the surrounding work area.

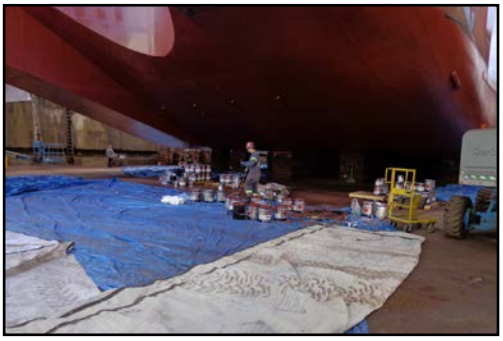
ADEQUATE containment on stablizer pocket doors.

Paint overspray due to INADEQUATE containment stablizer pocket doors.

Manual Painting

Painting by hand (*roller, brush*) can be conducted without shrouding the work area; however, the potential remains for product to migrate into the environment. Work spaces and product handling must be managed with care, similar to dockside painting.

- Containment should be large enough to adequately cover the work area and provide a barrier between the work and the environment (*e.g. dock floor, ocean and soil*).
- Ensure containment is secured so there are no gaps.
- Product container lids are to be secured.



ADEQUATE containment.

Painting Dockside

- Do not spray paint vessels docked alongside the wharves or jetties *(e.g. North Landing Wharf)*.
- Use rollers and brushes to paint vessels dockside.
- Ensure tarps are in place below work areas, as well as in between the vessel and the dock, to prevent spills and drips from entering the water.
- Ensure paint cans are stored securely when working alongside vessel edges.
- Ensure floor grates of manlifts are covered to prevent spills from going into the marine environment.
- Waste generated from painting and other activities such as grinding, hand tooling and welding, must be prevented from entering the marine environment.

While painting vessels docked alongside the wharves or jetties, do not spray paint. Take sufficient measures to prevent paint from entering the marine environment.

Environmental Best Management Practices

Empty paint cans must be properly stored on dock bottom and dock side.

Temporary Paint Storage/Mixing Areas

- Must be under cover to protect from inclement weather.
- Only in designated areas.
- Must be on secondary containment (*a tarp at minimum*).
- Ensure empty paint cans and other associated wastes from painting are stored properly, protected from the weather, and removed from dock bottom as soon as possible.
- Ensure empty paint containers being dried for disposal are protected from rain.
- Do not dispose of used paint containers that still contain wet paint.

IMPORTANT!

In rare situations (*e.g. shape of the vessel, combined with ideal weather conditions*) containment may not be necessary to prevent overspray from escaping the area.

In this situation, the User must notify EGD Management prior to beginning the work, and obtain approval (*in writing*) to paint without completely enclosing the vessel.

Restrictions and monitoring requirements will be applied.

To this date this has only been allowed in three situations:

- Painting underneath a flat bottom barge.
- Painting the underwater hull portion of the midsection of a cruise ship.
- Painting of a C-class ferry underwater hull area, during calm wind conditions.

Environmental Best Management Practices

EBMP #4: Dry Dock Floor Management and Clean Up

Drain Management

- All sump well valves must be closed prior to and during power washing operations.
- Cover all tunnel drains and net cages during sandblasting, painting and power washing to prevent contaminants from entering the marine environment.
- In the case of a spill or release on dock bottom all sump well valves must be closed and all contaminated material contained and removed from dock bottom.
- Direct all contaminated water to the trench drain system, to avoid entering the tunnel drains.
- Collect and properly dispose of all contaminated water. Ensure sufficient equipment is available for contaminated water collection.
- Ensure all non-contaminated water is directed away from work areas and into the tunnel drain system (*e.g. ballast water, cooling water, caisson sill water*).

Hazardous Materials Managementt

- Store hazardous materials (*e.g. fuel, paint, waste oils*) away from the drains on dock bottom.
- Store hazardous materials to the inside of the trench drains so that any spills or releases can be captured.
- Store hazardous materials in areas protected from the weather, water curtains and other water sources.
- Ensure adequate spill response equipment is in close proximity to hazardous material transfer operations. At a minimum one spill kit is required per section of the graving dock.

Collect and properly dispose of all contaminated water.

Sediment Management

- Segregate any marine sediment, that may enter the dock during vessel transfer, from the waste generated during vessel repair. This is to reduce the amount of wastes requiring disposal.
- Collect and properly dispose of marine sediment that becomes contaminated with waste generated from vessel repair.
- Remove all contaminants and residues from the trench drains and sump wells prior to flooding at the end of work period.

Housekeeping

- Remove waste sandblast grit from the work area as soon as possible to prevent migration of grit contaminants into tunnel drain system.
- Store wastes collected from the dock floor in appropriate secondary containment and remove from dock bottom as soon as possible.

Residual paint in the cans may drip out of the skip and enter the marine environment through the drain systems.

Leaving garbage around the work site attracts wildlife such as seagulls, racoons and rats.

When cleaning dock bottom, skips of waste sandblast grit may leak contaminated water and should be removed as soon as possible.

All hazardous materials must be stored in appropriate containment and away from tunnel drain system.

Inspection and Cleanliness

- Prior to flooding, the drydock must be cleaned to meet the Esquimalt Graving Dock (*EGD*) *Standard of Cleanliness (see below),* as determined by the EGD undocking supervisor.
- Users must ensure that the dock floor is free of deleterious substances prior to flooding.
- Water may be used to clean the dock floor; however, any wastewater generated must be collected and disposed of properly.
- If a vessel occupies a shared portion of a dock section each User must clean the trench drains up to and including the section sump well.

ADEQUATE:
Example of a dock floor that would pass inspection.

INADEQUATE:
Example of a dock floor that would not pass inspection.

EGD Standards of Cleanliness

Due to the importance of drydock cleanliness prior to flooding, and since quantitative testing is impractical due to time and cost restrictions, the following guidelines will be used to assess cleanliness of drydock surfaces.

- All drydock surfaces, including stairwells and sills must meet the standard for "**residue free**" prior to flooding of the drydock. "**Residue free**" is considered met when a person of normal visual acuity, while standing, is unable to detect visible accumulations of potential pollutants.
- This includes, but is not restricted to:
    - the removal of abrasive grit,
    - paint residues or paint chips,
    - cutting and grinding wastes,
    - oil and grease,
    - food and drink containers,
    - ear plugs,
    - dust masks,
    - rope,
    - cigarette butts, or
    - any other refuse that may have been deposited during the work period.
- Debris of natural origin that may have been deposited during the previous flooding of the drydock, such as wood, sand, silt, seaweed, or marine life may be exempt from these requirements, as long as it will not contaminate the environment upon reintroduction.

AREAS IN NEED OF *SPECIAL ATTENTION*

ACCEPTABLE		NOT ACCEPTABLE
	**RAMPS**	
	**SILLS**	
	**KEEL BLOCKS**	
	**TRENCH DRAINS**	
	**SUMP WELLS**	

Environmental Best Management Practices

EBMP #5: Hazardous Materials Handling and Storage

A variety of hazardous materials are used, stored and transported by Users at the Esquimalt Graving Dock (*EGD*). If not handled appropriately, these materials have the potential to negatively impact worker health and safety, infrastructure and the environment. Hazardous materials commonly used at the EGD include: antifoulant paint, fuels and oils, antifreeze.

Storage

Users must have designated storage areas suitable for the materials they use on site. Where applicable, these areas must:

- Have appropriate secondary containment suitable to the quantity and nature of the material in that area.
- Ensure materials are stored in accordance with compatibility requirements.
- Be protected from the weather (*covered, lids secured, valves closed*).
- Have placards and proper ventilation.
- Have controlled access.
- Be located away from pathways to the marine environment.
- Be located on impervious surfaces (*e.g. concrete*).

Handling

All hazardous materials must be:

- Labelled appropriately with the owner name, product name, first aid information, and PPE requirements.
- Secured appropriately during transport.
- Transported by equipment that can sufficiently handle its weight and size.
- Transported in containers that are stable and not in need of repair (*e.g. totes with broken feet, excessive rust, faulty valves*).

ADEQUATE storage.

ADEQUATE storage.

INADEQUATE storage.

Any container holding hazardous materials must be clearly and properly labelled.

Areas to Avoid Storing Hazardous Materials

Trench Storm Drains
Any containers placed directly over top or beside a trench drain have the potential to spill to the drain leading directly to the ocean.

Storm Drains
Any containers placed directly over top or beside a storm drain have the potential to spill to the drain leading directly to the ocean.

Alongside Wharves and Jetties
Any containers placed alongside the edge of the wharves and jetties at the EGD have the potential to spill directly to the ocean, as there are no berms or secondary containment available.

Dock Floor Trench Drains
If a tote or drum is placed directly over or beside a trench drain, hazardous materials have the potential to flow down the drain and into the marine environment. Although the drains are designed for rapid containment and recovery, there is no guarantee that workers will be present to close drain valves during an incident.

Dock Floor Sump Wells
When the sump well valve is open the sump drains directly into the marine environment. Any containers placed on top of or adjacent to the sump well have the potential to enter the ocean if a spill were to occur.

Dock Floor Tunnel Grate Drains
Tunnel grate drains lead directly to the marine environment. Any containers placed directly over top of or beside a tunnel grate have the potential to impact the marine environment, should a spill occur.

Environmental Best Management Practices

Safety Data Sheet *(formerly Material Data Safety Sheet)*

A Safety Data Sheet (SDS) is a document that contains information on the potential hazards (*health, fire, reactivity and environmental*) and how to work safely with the product. SDSs also contains information on the use, storage, handling and emergency procedures all related to the hazards of the material. SDSs must be available (*electronically or hardcopy*) for all products stored on site and be readily available to all employees.

Storage Tanks and Totes

Storage tanks and totes are used for a variety of materials at the EGD, including: washwater, fuel products, bilge water, waste oil/fuel and other waste liquids. Storage tanks and totes may be considered portable/mobile, temporary or permanent. The regulatory requirements for proper use of these tanks vary and is dependent on a variety of factors.

Federal Regulation for Fuel Storage Tanks

The EGD is a Federal facility; therefore, storage tanks onsite need to comply with the Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations. Users may be required to register their tanks with Environment Canada. **Contact EGD Environmental Services for information.**

There are four different fuel tanks at the Esquimalt Graving Dock.

National Fire Code

The National Fire Code outlines the requirements for containment, labelling and location of flammable liquid storage.

Environmental Best Management Practices

EBMP #6: Waste Management and Recycling

Operations at the Esquimalt Graving Dock (*EGD*) generate a variety of waste streams including hazardous waste, controlled waste, biological waste, international waste, and general refuse and recyclables.

Hazardous Waste

Hazardous wastes generated at the EGD may include waste oil and oil filters, antifreeze, batteries, paint and solvents, oily rags and absorbent materials, spent grit, solids generated during power washing, mercury, PCB containing equipment and asbestos. Appropriate management of hazardous waste will reduce environmental liability associated with inappropriate disposal and storage as well as reduce the risk of human injury and environmental impact.

Hazardous waste storage should be segregated from new product storage.

- Ensure designated storage areas are away from active work areas.
- Ensure areas are covered to reduce exposure to environment and wildlife.
- Ensure that waste accumulation areas are organized.

Hazardous waste should be segregated into separate containers.

- Ensure containers used are appropriate for the type of waste (*e.g. separate drums for waste oil, oil filters, antifreeze, batteries, paint and solvents, oily rags and absorbent material, spent grit*).
- Store batteries in a manner that prevents leakage of acid to the environment.
- Properly dispose of contaminated clean-up materials (*e.g. absorbents, rags, etc.*).
- Do not dilute or mix hazardous waste, other hazardous or non-hazardous wastes.
- Cover waste containers to prevent exposure to weather (*e.g. rain*).

All hazardous waste must be carefully stored and disposed of.

Asbestos

All asbestos containers and asbestos-containing materials must be identified by signage and labelling in accordance with applicable legislation.

Companies that engage in asbestos related work at the EGD must be qualified to do so.

Clearly label all hazardous waste containers.

- Labels should include: type of waste, generator/company name, and contact information.

Controlled Waste

Controlled waste such as animal feces, sewage, contaminated grit, stormwater catch basin waste, creosote wood and dead animals can be disposed of at the **Capital Regional District (*CRD*) Hartland Landfill.**

Controlled waste disposal at requires a permit.

For more information about Controlled Waste disposal contact the CRD Hotline at (250) 360-3030.

Large scale food waste bin.

An example of a Waste Management Area at the EGD.

Food Waste

During normal activity at the EGD, food waste is collected in conveniently located and accessible receptacles onsite and disposed of at the landfill. During larger projects, however, alternative measures are taken to account for the increase in generated wastes.

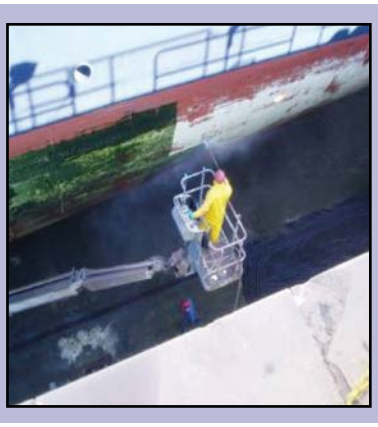
General Refuse

General refuse should be separated into categories to enable easy disposal. Users are responsible for properly disposing of refuse and recyclable materials. There are many containers throughout the site for disposal of common refuse materials (*e.g. steel, wood, glass, cardboard etc.*).

Biological Waste

Marine life removed from vessel hulls and sea chests may contain paint contaminants. This waste may be considered a controlled or hazardous waste and would need to be handled and disposed of accordingly.

Biological waste should be stored out of the sun, covered and removed from the facility quickly to prevent any odours from emanating.



Recycling

All Users of the EGD are responsible for collecting and disposing of the solid waste they generate from their activities, properties and vessels they are responsible for.

- Recycle solid waste such as plastic, glass, aluminum, mixed paper and cardboard. Recycling areas should be conveniently located and easily identifiable.
- Segregate other solid waste, such as scrap metal, wood, electronics, polystyrene foam and soft plastics for recycling at an approved facility.
- Leaf and yard waste collected on property should be composted or disposed of appropriately.
- Construction and demolition waste should be reused or recycled wherever cost effective and technically feasible.
- Encourage the use of recyclable products to reduce the solid waste impact on the environment.

International Waste

Like hazardous waste, International Wastes may pose a threat to human health and the environment.

Dunnage from vessels has been known to carry invasive species to local areas. Foreign dunnage must be identified, stored, and disposed of at an approved facility without delay.

Food wastes may carry pathogenic organisms that could cause illness to those handling it. Food wastes shall be kept in separate, closed containers. The **Canadian Food Inspection Agency *(CFIA)*** will inspect foreign vessels and issue directions on disposal.

EBMP #7:
Fuelling and Oil Transfer

The transfer of fuel and oil is a common activity at the Esquimalt Graving Dock (*EGD*). Transfer may be from ship to shore (*e.g. removal of waste fuel/oil*), from shore to ship (*e.g. refuelling a vessel from a truck)* or land based.

An accidental release during these operations has the potential to negatively impact the environment and health and safety of those at the facility.

- Prior to any fuelling or oil transfer operations:
    - the ***EGD Oil Transfer Checklist*** must be complete;
    - an emergency plan must be in place and readily available;
    - adequate spill response equipment must be available; and
    - personnel must be aware of spill response procedures.
- All transfer and storage equipment must be in good condition, tested, and properly connected.
- Do not place storage and transfer equipment near pathways to the marine environment (*e.g. storm drains, trench drains, edge of the dock*) without effective mitigation measures in place.

Vessel Fuelling and Bulk Oil Transfer
Definition of Oil: as described in the Canada Shipping Act **oil** is considered petroleum in any form, including: crude oil, fuel oil, sludge, oil refuse, gasoline, lube oil and refined products.

Berthed Vessels

- ALL berthed vessels receiving fuel from a truck or a barge require a containment boom.
- Transfers of fuel and oil to and from ALL berthed vessels require a containment boom.
- An ***EGD Oil Transfer Checklist*** must be filled out and signed by representatives from the truck and the vessel and submitted to EGD representatives in the Pumphouse prior to fuelling or oil transfer operations.
- Transfer operations must comply with the *Canada Shipping Act, Regulations for the Prevention of Pollution from Ships and for Dangerous Chemicals Subdivision 5*.

Vessels in Drydock

- ALL fuel and oil transfers occurring in the drydock require spill kits to be placed nearby and are not to be completed next to drainage pathways to the marine environment (*e.g. trench drains, sump wells, tunnel grate drains*).

On Land Transfers

- ALL fuel and oil transfers occurring on land require spill kits to be placed nearby and are not to be completed next to drainage pathways to the marine environment (*e.g. storm drains, edge of dock*).

Containment Boom Requisition

The Esquimalt Graving Dock has containment boom and deployment equipment available for requisition. To arrange for booking or rental, contact the EGD Operations Manager.

An orange inshore containment boom fully surrounds the vessel while being fuelled.

The hydraulic powered deployment reel with inshore containment boom available for requisition.

EXAMPLE SCENARIO REQUIREMENTS

Scenario 1: FUELLING A BERTHED VESSEL

- Completed and signed ***EGD Oil Transfer Checklist*** submitted to EGD Pumphouse.
- Containment boom deployed and effectively secured at both ends.
- Emergency response plan in place.
- Adequate spill response equipment and qualified personnel available.

EXAMPLE SCENARIO REQUIREMENTS (*Continued*)

Scenario 2: BULK OIL TRANSFER FROM A BERTHED VESSEL

- Completed and signed ***EGD Oil Transfer Checklist*** submitted to EGD Pumphouse.
- Containment boom deployed and adequately secured at both ends.
- Receiving containers located away from pathways to the harbour (*e.g. storm drains, edge of dock*).
- Receiving containers in secondary containment and in good condition.
- Emergency response plan in place.
- Adequate spill response equipment and qualified personnel available.

Scenario 3: FUELLING A VESSEL OR BULK OIL TRANSFER IN THE DRYDOCK

- Pumphouse operation on site prepared to shut down auxiliary pumps in case of an emergency.
- Receiving containers located away from pathways to the harbour (*e.g. trench drains, sump wells, tunnel grate drains*).
- Receiving containers in secondary containment and in good condition.
- Emergency response plan in place.
- Adequate spill response equipment and qualified personnel available.

Scenario 4: ONSHORE OIL TRANSFER BETWEEN CONTAINERS

- All containers located away from pathways to the harbour (*e.g. storm drains, edge of dock)*.
- Receiving containers in secondary containment and in good condition.
- Emergency response plan in place.
- Adequate spill response equipment and qualified personnel available.

Environmental Best Management Practices

EBMP #8: Invasive Species

Invasive species are a significant threat to the marine ecosystems of British Columbia. The Esquimalt Harbour is known to have a disproportionately high number of non-indigenous species. It has been widely recognized that the primary source of non indigenous marine species in local waters are the ballast tanks and hull surfaces of transoceanic vessels. Ship repair contractors are encouraged to report unusual species observed during hull cleaning activities.

Ballast Water

- Vessels must follow *Transport Canada Ballast Water Control and Management Regulations*

Ballast Tank Sediment

- Shipyards must follow *Transport Canada Ballast Water Control and Management Regulations*
- Sediments removed from the ballast tanks at the EGD must be contained, collected and disposed of at an authorized facility.
- Sediments must not be allowed to enter the harbour.

Anchor chain-growth

- All biological material removed from anchor chains must be contained, collected and disposed of appropriately.

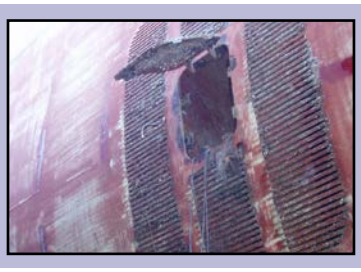
Sea chests

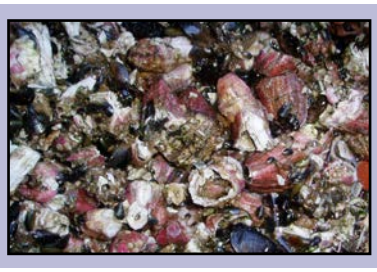
- All biological material removed from sea chests must be contained, covered and disposed of appropriately.
- Material must be stored away from direct sunlight/heat and disposed of as soon as possible, to avoid nuisance odour pollution.

Marine growth removed from vessel hulls must not be allowed to enter the harbour through the drydock drainage system.

INADEQUATE containment: Biological waste on drydock floor near drains.

INADEQUATE containment: Biological growth mixed with paint waste on drydock floor.





Sea chests, such as this one from a cruise ship docked at the EGD, often contain a significant amount of marine life.

If not managed appropriately, this marine life has the potential to negatively impact the local ecosystem of the harbour.

EBMP #9: Fish and Wildlife Management

The daily operations and activities of the Esquimalt Graving Dock (*EGD*) have the potential to negatively impact wildlife that frequents the property. The *EGD Wildlife Management Plan* has been developed to assist EGD employees and Users to properly manage interaction with fish and wildlife that are common to the facility.

Fish

Fish and other marine life have the potential to become stranded in the drydock during normal vessel docking/undocking operations. This may include, but is not limited to: salmon and other fish species, seals and octopus.

- The bubble curtain must be employed during vessel transfer into and out of the drydock.
- EGD employees must monitor the drydock for stranded fish and/or other marine life during dewatering and report cases to EGD Environmental Services.
- Whenever possible, EGD employees must retrieve fish and marine life and safely return them to the Esquimalt Harbour.
- Users are prohibited from removing fish and marine life from the drydock.

Report all cases of fish and marine life interaction with the drydock to EGD Environmental Services.

Wildlife

A variety of wildlife is known to occupy areas of the EGD property. In some cases wildlife may use the facility as a nesting/breeding ground, while others are present for short periods of time during migration or to feed. Activities and operations at the EGD have the potential to impact the well being of wildlife at the facility.

Such wildlife includes: deer, raccoon, mink, river otter, great blue heron, osprey, raven, Canada goose and a variety of other common waterfowl, nesting and songbirds and pollinators *(e.g. bats, native bees)*.

Bubble curtain employed during vessel transfer.

Stranded marine life must be carefully returned back to the Harbour.

Fisheries Act - Destruction of Fish

The EGD has received authorization for the destruction of fish associated with normal operation of the drydock from the Department of Fisheries and Oceans (*DFO*).

Conditions of the Authorization:

- Take all reasonable precautions to prevent the trapping and mortality of fish.
- Monitor the success of preventative measures and retrieval success.
- Report to the DFO annually.

Environmental Best Management Practices

- ALL wildlife must be left alone. Do not approach or handle newborn or juvenile wildlife.
- Injured or orphaned wildlife must not be handled without proper experience and equipment.
- Dispose of dead wildlife appropriately.
- Report observations of injured or deceased animals to EGD Environmental Services.
- Prior approval from EGD Environmental Services is required for the relocation or removal of nesting wildlife; a Migratory Bird Damage or Danger Permit is required to remove nests and retrieve eggs of migratory birds (*e.g. seagulls*).
- Never mistreat, remove or destroy any areas that could provide habitat for wildlife without prior approval and receipt of appropriate permits from the relevant authority.

Contact EGD Environmental Services for wildlife related information, incidents and interactions.
Contact the Front Gate Commissionaires for afterhours assistance.

A variety of wildlife is known to occupy areas of the Esquimalt Graving Dock property.

Incidents with wildlife are managed on a case by case basis.
Direction and/or assistance must be taken from the appropriate authority when required.

EBMP #10: Water Use

The Esquimalt Graving Dock (*EGD*) is considered a major consumer of fresh water. Water is provided to the facility by the Capital Regional District (*CRD*) distribution system, on a fee for use basis. Inefficient use of water may result in a negative economic and environmental impact. Water consumption and the quality of water are both considerations of the environmental management systems at the EGD.

Water Consumption

Large volumes of water are used during normal operations at the facility; because of this, the EGD is considered a high volume user of fresh water in the CRD. Users must be conscious of activities that consume high volumes of water and work to mitigate any water waste.

In order to reduce the amount of water consumed onsite:

- Mitigate dust in problem areas using high efficiency Dust Suppression Units, when physical containment techniques are not sufficient to prevent fugitive dust emissions.
- Use fire nozzle water curtains only when all other attempts to contain particulate emissions from sandblasting have failed. Water curtain use must be approved by EGD Management in advance.
- Avoid use of freshwater to clean work areas, where possible.
- Maintain fittings in buildings and on equipment to prevent leakages.

Water Consuming Activities

Activities associated with vessel surface preparation and dust control use significant amounts of water.

Conventional pressure washing and ultra high pressure (UHP) washing use large amounts of water at high pressure to scour paint and biological material from the hulls of ships.

Dust Suppression Units

Dust Suppression Units are used to mitigate the escape of dust from sandblasting operations in the drydock.

Water Quality

The water distribution system at the EGD was originally designed as a fire suppression system; therefore, the water in certain areas of the system may not be considered potable.

- Potable water is not available throughout the facility (*this includes intake to vessels moored alongside or in the drydock*).
- Users of the facility are responsible for ensuring that the water they use meets the guidelines for the purpose intended.
- Users must use backflow prevention when accessing the water distribution system.

The EGD maintains the fresh water distribution system.

- Flushing of the entire system is conducted on an annual basis.
- Collection and analysis of water, in comparison to drinking water quality guidelines, is conducted on an annual basis.

Metered Water Use at the Esquimalt Graving Dock

- Users of the facility must ensure that water is accessed from a metered line when connecting to the water distribution system.
- Portable meters are to be used when required.
- The EGD Pumphouse must be contacted for proper access to the water distribution system.

EBMP #11: Energy Conservation

The Esquimalt Graving Dock (*EGD*), as an industrial facility, is a major consumer of energy. Inefficient energy use may result in negative economic and environmental impacts. Economic impacts are associated with inefficient electrical usage (e.g. cost), while environmental impacts include those associated with the consumption of fuel (*e.g. air emissions*).

Energy consumption also results in the production and release of greenhouse gas emissions through the combustion of fossil fuels. Every aspect of work at the EGD results in the release of greenhouse gases, whether it is operating the cranes or printing a report. It is important to minimize energy consumption wherever possible to reduce the release of harmful greenhouse gases and conserve energy.

Electrical Consumption

There are a number of opportunities to increase the efficiency of electrical usage at the EGD:

- Turn off lights and equipment when not in use (*e.g. flood lights, office buildings*).
- Install energy efficient devices in buildings (*e.g. sensor switches, efficient light bulbs*).
- Use energy efficient equipment whenever possible and consider energy efficient options when purchasing new equipment.
- Stagger equipment start-up to decrease load on electrical system.

Environmental Best Management Practices

Fuel Consumption and Emissions

Opportunities to decrease the amount of fuel consumed by day to day activities include:

- Using energy efficient vehicles.
- Using alternative fuels where possible (*e.g. Biofuels*).
- Using alternative energy sources where possible (*e.g. LED, solar, rechargeable*).
- Avoid idling vehicles (*e.g. delivery vehicles*).
- Use shore power where possible.
- Encourage staff to try alternative means for commuting to work (*e.g. carpool, public transit, cycling*).

Be aware of the potential impacts of emmissions on neighours near the EGD.

Idling Vehicles

- Do not idle vehicles near building doorways or air intakes
- Vehicles must be turned off if idling for more than 3 minutes in a 60-minute period.

Idling vehicles produce unnecessary air emissions and noise.

Shore Power

For vessels moored alongside at the North Landing Wharf and in the drydock it is important that they utilize shore power when possible. With shore power, the auxiliary generator can be turned off, thereby saving fuel and preventing the release of harmful air pollutants.

Did You Know?

Shore Power may be accessed at the EGD:

- 208V and 480V available on the North Landing Wharf and drydock.

EBMP #12:
Nuisance Pollution (Noise/Odour/Light)

The daily operations of the Esquimalt Graving Dock (*EGD*) Users have the potential to negatively impact neighbouring residents and businesses, as well as the immediate work area. Nuisance pollution is often created by noise, odour and light.

Noise

- Noise pollution can be generated and recognized in decibel levels, pitch, oscillation and duration.
- The main sources of noise at the EGD include sandblasting, drilling, hammering, compressors, generators and the crane warning bell. Even general shop repair activities generate large amounts of noise.
- Sound carries. Operational noise, vehicle noise and loud voices can be heard in nearby areas. Site Users must be aware of the potential impacts of all activities taking place at EGD and be respectful of neighbours.
- Schedule noisy activities for daytime hours 0700 hrs to 2300 hrs on weekdays, weekends and holidays. Through worker education and good practice the generation of high-level intermittent or non-continuous noises can be minimized.
- Personal vehicles, including motorcycles, can disturb neighbouring residents. Your vigilance is appreciated especially during quiet hours. Warning signs are posted at parking areas to remind personnel to be respectful of neighbours when arriving and departing the EGD.
- The EGD recognizes applicable municipal laws and regulations. Operations will consider the requirements of the *Municipality of Esquimalt Bylaw 2826 Maintenance of Property, Unsightly Properties and Nuisance Bylaw Part III Nuisances Noise Contro*l.

The EGD is located in close proximity to residential areas.

Personal vehicles with loud engines can disturb neighbouring residents.

Warning signs in parking areas act as a reminder to minimize noise at EGD.

Responses to nuisance pollution complaints will be taken on a concern-by-concern basis.

To submit a nuisance complaint contact the Esquimalt Graving Dock Information Line at (250) 363-0227.

Environmental Best Management Practices

Odour

- Daily dock operations often create strong and unpleasant odours whether from the release of VOCs, H2S, organic materials, or chemicals. An offensive smell can reduce the quality of the work environment for neighbouring tenants and residents. Biological material removed from bilges, sea chests and hulls must be contained, covered and disposed of appropriately. Be proactive in planning for timely transport and proper disposal of material; a permit may be required for disposal.
- Material must be stored away from direct sunlight/heat and disposed of in a timely manner, to avoid nuisance odour pollution.
- Odour mitigating measures may be required, if odours are negatively affecting neighbouring properties or onsite personnel.
- The EGD recognizes applicable municipal laws and regulations. Operations will consider the requirements of the *Municipality of Esquimalt Bylaw 2826 Maintenance of Property, Unsightly Properties and Nuisance Bylaw Part III Odour and Disturbances*.

ADEQUATE containment of odorous waste.

INADEQUATE containment of odorous waste.

Light

- Night time dock operations require spotlights to provide a safe work environment. Be aware that strong spotlights can be a significant intrusion for residential neighbours.
- Only utilize spotlights when absolutely necessary. This will help prevent disturbing the neighbours, as well as to ensure a more energy efficient work environment.
- Changing the direction of stationary and portable lights in the workplace may reduce the effect they have on the neighbours.
- Turn off any unnecessary lights.
- The EGD recognizes applicable municipal laws and regulations. Operations will consider the requirements of the *Municipality of Esquimalt Bylaw 2826 Maintenance of Property, Unsightly Properties and Nuisance Bylaw Part III Odour and Disturbances.*

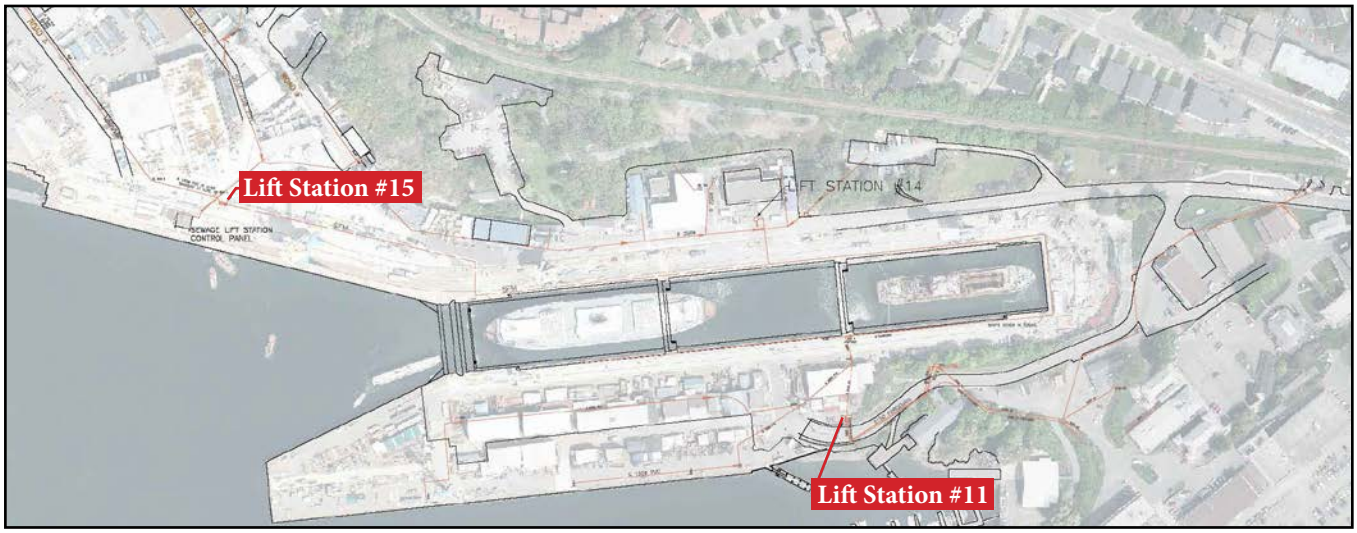
Only utilize spotlights when necessary.

Changing the direction of spotlights can reduce light impact on neighbours.

EBMP #13:
Sanitary Waste Management and Sewer Use

The Esquimalt Graving Dock (*EGD*) is authorized by the Capital Regional District (*CRD*) as a ship and boat waste disposal facility. The authorization allows for the proper discharge of sanitary waste, grey water and superchlorinated water at designated locations at the EGD, and stipulates the requirements that must be met prior to discharge.

Discharge to the sanitary sewer at any location other than at LS#15, LS#11 or at vessel connections located in the services tunnels of the drydock is prohibited.



Lift Station #11.

Lift Station Maintenance.

The EGD is authorized to discharge to the sanitary sewer at:

- Lift Station #15 (*LS#15*),
- Lift Station #11 (*LS#11*), and
- Vessel connections in the drydock.

Permitted wastes include:

- Sanitary waste, *
- Grey water, and
- Treated superchlorinated water.**

Sanitary Waste: *must contain <50,000 ppm total solids.*

***Superchlorinated Water:** must not be discharged to the sanitary sewer unless it has been de-chlorinated to less than 5 ppm chlorine.*

Prohibited wastes include:

- Bilge and ballast water,
- Wastewater sludge, and
- Fuel and oil, paint, paint thinner, solvents, and products containing toxic chemicals.

Other Wastes

Other wastes may be considered for discharge to the sanitary sewer on a case-by-case basis; approval *must be* requested from EGD Management prior to discharge.

Discharge to the sanitary sewer at locations other than those authorized may be considered on a case-by-case basis; approval *must be* requested from EGD Management prior to discharge.

Waste Discharge Notification

Envirosystems Inc. will, as a standard operating procedure, notify the EGD Pumphouse prior to large volume discharges to the sewer system (*e.g. any "batch discharge" in excess of 20,000 litres*). Coordination of discharge may be required depending on usage of the sanitary sewer system at the time.

Envirosystems Inc. will contact the Pumphouse on a regular work day if Envirosystems Inc. is planning to discharge large volumes during times other than Monday to Friday, day shift (*0730 hrs to 1600 hrs*) or on statutory holidays.

Envirosystems Inc. must contact EGD Management if there is a change in normal discharge operations (*e.g. increase in daily volume*).

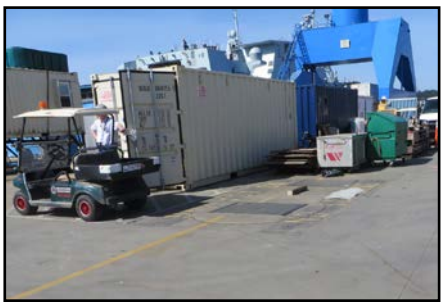
Access to the Sanitary Sewer

- Users must notify the Pumphouse before conducting any discharges to the sanitary sewer. Typical methods of discharge include: large (*direct connection and discharge from a vessel*), and small (*portable discharges from totes and tanks*).
- Users must complete a ***Sanitary Sewage Discharge Form*** and provide it to the Pumphouse prior to discharging to the sanitary sewer.
    - Pumphouse Operators will ensure that sanitary sewer discharges are in accordance with applicable regulations and authorizations.
    - Pumphouse Operators will provide all completed ***Sanitary Sewer Discharge Forms*** to EGD Environmental Services.
- Users must ensure a sample collection point is accessible at the point of discharge.
- Users must request approval from EGD Management to connect directly to the sanitary sewer for regular domestic waste (*e.g. washrooms, sinks, toilets*). Any other waste is prohibited from being discharged of through these lines.

Lift Station Maintenance

- Commissionaires will contact the Pumphouse on radio Channel 4 when DND sewer maintenance personnel enter the facility.
- Pumphouse staff will supervise DND personnel work on the lift stations where required.

AUTHORIZED Sanitary Sewer Discharge point, Lift Station #11.



AUTHORIZED Sanitary Sewer Discharge point, Lift Station #15.

UNAUTHORIZED Sanitary Sewer Discharge point (i.e. storm drain).

UNAUTHORIZED Sanitary Sewer Discharge point (i.e. trench drains).

UNAUTHORIZED Sanitary Sewer Discharge point (i.e. sewer manhole).

EBMP #14: Spill Preparedness and Response

The Esquimalt Graving Dock (*EGD*) is committed to the protection of human health and the environment. Safety and environmental management programs have been implemented at the EGD to reduce the potential for accidents and spills. Emphasis is placed on the prevention of spills, and although the potential for spills can be reduced through these programs, spills do still happen.

All Users operating at the EGD must have the capability to effectively manage spills resulting from their activities and operations.

- User employees must have adequate training in spill response.
- User employees must have access to spill response equipment and materials appropriate to the work they are performing.
- Users must have plans and procedures in place to respond to spills.

For spills which are beyond the capability of the User or are not being effectively responded to by the User, the EGD will provide assistance. The EGD has additional resources available, including:

- Spill kits and response materials for land and water based spills.
- Containment boom, deployment reels and boat.
- Pneumatic skimmer with drum and brush recovery modules, deployment and retrieval services.
- Staff trained to deal with land and water based spills.

For spills beyond the capability of the facility to manage, contact *Emergency Management* (EM*BC*). Additional resources will be coordinated for response to land and water based spills.

ALL Spills at the Facility
MUST BE REPORTED to EGD Management.
Details are to be provided in an *Incident or Spill Report*.

Spill response training at EGD.

Spill response training at EGD.

Spill response equipment: Skimmer.

Spill response equipment: Spill Kit.

Environmental Best Management Practices

Assess the situation.

Stop product flow.

Secure the area.

Steps to Spill Response

Assess the Situation

- Never rush in. Warn others in the immediate area.
- Stay upwind of the spill and avoid low lying areas.
- Quickly and accurately gather details that may need to be communicated to spill response personnel and the authorities including:
    - What equipment or work activity is involved?
    - What hazards are associated with the spilled product?
    - How large is the spill?
    - Is the situation under control or is it escalating?
    - What areas are or could be affected?
    - Proposed strategy to contain/control the spill.
    - Notify others in the area of the spill.

Stop Product Flow

- Act quickly to stop product flow, ONLY IF SAFE TO DO SO.
- Activate emergency shutdowns (*if applicable*).
- Close delivery truck manifold valves, etc. (*if applicable*).

Secure the Area

- Clear the area of public and untrained personnel.
- Ensure those onsite are wearing appropriate PPE.
- If spill is indoors, ensure the building is evacuated.
- Isolate large spills in all directions.
- Limit or prevent access to the site.
- Enforce safety procedures.

Contain the Spill

- Approach the spill from an upwind direction and avoid low lying areas.
- Use appropriate PPE (*e.g. gloves, eye protection, respirator*).
- Follow safe work procedures.
- Block drains, culverts, and ditches to prevent entry into waterways, sewers or confined areas.
- Contain spill with absorbent materials (*from spill kits*), earth, sand, or other non-combustible materials.

Notify the Authorities

- Contact your Supervisor immediately.
- Report the spill to EGD Management.
- For spills greater than 100L on land, or any spill of any size that enters the marine environment, contact: Emergency Management (*EMBC*) Reporting Line: 1-800-663-3456.
- Additional reporting requirements may be required depending on the spilled material.

Recovery and Clean Up

- Use appropriate materials to recover spilled product (*e.g. loose absorbent, pads, booms, socks*).
- Place waste in labelled 6mm plastic bags or leak proof containers.
- Store waste in secure, dry, well-ventilated location, away from heat and ignition sources.
- Consult with authorities before removing waste from site.
- Arrange for waste disposal at an approved facility by a qualified contractor.

Investigation & Reporting

- Investigate the spill or incident and complete and submit required reports to the authority having jurisdiction.

Contain the spill.

Environmental Emergency Contacts (24 Hours):

EGD Commissionaires
250-363-3784

Emergency Management (*BC*) Reporting Line
1-800-663-3456

DND QHM
250-363-2160
or
VHF Channel 10

Recovery and clean up.

EBMP #15:
In-Water Hull Cleaning and Maintenance

The cleaning, maintenance and repair of the underwater hull and associated appendages in water has the potential to release harmful contaminants into the marine environment.

In-water Hull Cleaning

- In-water hull cleaning of vessel hulls, that are coated with antifouling paint, is **prohibited** at the Esquimalt Graving Dock.
- In-water hull cleaning of vessels coated in non-biocide containing paints (*such as silicone based*), **may be considered** on a case-by-case basis and must be approved by EGD Management prior to the commencement of work. This applies to in-water hull cleaning to remove organic growth only, NOT to coating removal.

In-water Maintenance

- In-water maintenance may be considered on a case by case basis and must be approved by EGD Management prior to the commencement of work. In-water maintenance may include but is not limited to:
    - Cleaning of anodes, inlets, props, and transducers for operational and inspection purposes only.

All vessels approved for in-water hull cleaning or maintenance must have a containment boom in place prior to work starting.

Additional requirements may be required on a case by case basis depending on the scope of work involved.

NOTE: Cleaning of the above water hull while berthed alongside the dock is PROHIBITED.

Did You Know?

Antifouling paints and their residues contain heavy metals, such as copper, which are toxic to aquatic organisms, including salmon and shellfish.

Wash water and solid residues from the washing, scraping, sanding and blasting of antifouling paints from boat hulls are considered "*deleterious substances*" under the *Fisheries Act*. Releasing these wastes to fish bearing waters is a violation of the Act.

Environmental Best Management Practices

EBMP #16: Housekeeping

An organized, clean facility provides an environment that reduces the potential for pollutants to enter surface and ground water through spills and accidents. General cleanliness will lead to more organized and consistent handling of hazardous materials and waste products. Good housekeeping programs will identify and assign responsibilities for shift clean up, day-to-day cleanup, proper waste disposal, removal of unused material, and regular inspection.

Clean-Up

- Clean debris from work areas immediately after any maintenance activity. Dispose of collected material appropriately.
- Ensure garbage and recycling containers are available in all leased areas and are emptied regularly.
- Do not use running water to clean the work areas where potentially contaminated water could enter the stormwater system.
- Ensure trench and storm drains within designated leased areas are kept clean and free of debris.
- Sweep and/or clean active working areas on a regular basis.

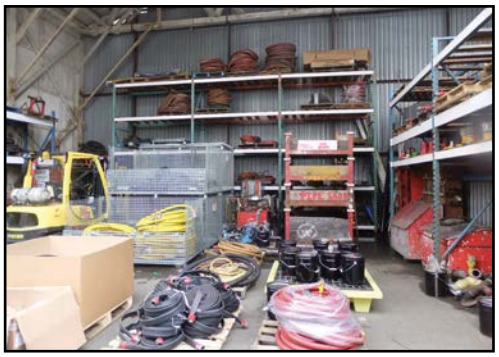
Storage

- Do not store materials or equipment outside of leased areas.
- Regularly inspect lease areas for unidentified or improperly stored materials.
- Ensure all stored products and wastes are clearly labelled and identifiable.
- Place a drip pan underneath vehicles and equipment when performing maintenance. Promptly transfer used fluids to the proper waste or recycling drums.
- Ensure all containers (*e.g. drums, totes, pails*) are in good condition and have a clean exterior at all times. Ensure containers are not left open; secure lids or cover containers when not in use.

INADEQUATE: Keep work areas neat & orderly.

INADEQUATE:
Keep trench and storm drains free of debris.

INADEQUATE:
Ensure storage containers are not left open.



ADEQUATE: Keep work spaces organized and clear of debris to prevent accidents.

EBMP #17: Stormwater Management

Stormwater has been identified as one of the primary pathways of contaminant loading to the local harbour associated with Esquimalt Graving Dock (*EGD*) operations. Common contaminants found in stormwater samples include metals, extractable petroleum hydrocarbons (*LEPH/HEPH)*, and total suspended solids (*TSS*). Five upland stormwater catchment areas terminate into the Esquimalt Harbour from the EGD property. The drydock floor tunnel drainage system leads directly to the Esquimalt Harbour. Any material entering the tunnel drainage system, either through tunnel grate drains or open sump well valves, will end up in the harbour. Deleterious materials must not be allowed to enter the storm or tunnel drain system.

Uplands Stormwater Management

- Store hazardous materials away from storm drains and trenches on the dock floor and in upland areas.
- Ensure totes, drums, pails and skips containing hazardous materials are protected from the weather (*e.g. lids secure, tarps in place*).
- Place filter cloth over storm and trench drains when working with deleterious substances that are in close proximity to, and that could pose a hazard to the marine environment.
- Divert and contain stormwater runoff containing contaminants and sediment with proper materials and filtration, prior to entering the drains (*e.g. use filter cloth, hay bales, sand bags*).
- During heavy stormwater events, ensure storm drains and trenches are kept clear of debris to prevent flooding.
- Conduct regular inspections of storm and trench drains in lease areas to ensure they are kept clear of debris.
- When using trench drains for secondary containment, ensure the containment system is monitored and removed in a stormwater event. A blocked trench drain may cause flooding of the area.

Prevent deleterious substances entering marine environment by placing filter cloth in the trench drains.

Sand bags used on dock bottom to divert and filter excess water.

Do not allow trench drains to build up with debris. This helps to prevent flooding during heavy stormwater events.

Drydock Floor Stormwater Management

- Stormwater has the potential to mix with washwater and other contaminants on the drydock floor during normal operations. Users of the drydock must plan in advance for stormwater management during their work period.
- To reduce the amount of washwater requiring treatment, stop power washing operations until stormwater can be controlled.
- To prevent contamination of stormwater with washwater, waste sandblast grit and other hazardous materials and wastes, cleanup work areas as soon as possible.
- Sump well valves may be opened to allow stormwater to drain into the tunnel drains when the trench drains, sump wells and dock floor area is clear of contaminants and debris. In the case where washwater collection is completed, but the trench drains, sump wells and dock floor have not been cleaned, a filter cloth may be secured over an open sump well valve to allow stormwater flow. This procedure prevents contaminants and debris from entering the drainage system. This method requires dedicated personnel management of the process and regular filter cloth replacement. Do not poke holes in the filter cloth.
- Tunnel grate drains on the drydock floor in Section 2 and 3 may be uncovered enough to allow stormwater to flow into the drains. Ensure the area is clear of contaminants and debris.
- Sump well valves must be closed in sumps containing visibly contaminated material. Sump wells must be pumped out and cleaned prior to opening the valves.
- Ensure there is capacity in the trench drain/sump well collection system to manage expected stormwater volume. This will allow for continued collection and will prevent flooding of the dock floor.
- Prior to flooding and dewatering of the drydock, ensure all sump well valves are open.

Uplands storm drain with filter cloth. Avoid storing hazardous materials near storm drains, which are directly linked to the marine environment.

Filter cloth secured over sump well valve to allow stormwater flow.

EBMP #18:
Property and Infrastructure Maintenance, Modifications and Construction

Significant environmental issues and potential impacts are known to be related to the management of Esquimalt Graving Dock (*EGD*) property and infrastructure. Any new property and infrastructure construction or modification projects at the EGD must consider environmental issues in project planning and implementation. Common environmental aspects that require consideration and management when planning and implementing projects include: dust emissions, hazardous materials and wastes, storm water runoff, noise, and prevention and response to accidental spills and releases. Requirements for the operational aspects are identified in specific sections of the EGD EBMPs.

Infrastructure Maintenance & Repair

Maintenance and repair of existing facility property and infrastructure often results in waste generation and other environmental aspect considerations to be addressed.

Minor Concrete Work

- Contain dust emissions from cutting and drilling.
- Prevent concrete slurry runoff from entering storm drains.
- Prevent debris from mixing concrete from entering storm drains or the marine environment.
- Prevent concrete slurry runoff from entering the trench and tunnel drains and the "moonpool" on the drydock floor.

Use of Preserved Wood

- Avoid use of creosote preserved wood products where possible.
- Follow applicable guideline for use of preserved wood products.
- Creosote wood waste may be considered a hazardous, restricted or controlled waste, and must be handled and disposed of accordingly.

Demolition/Renovation

- Ensure structures are assessed for the presence of hazardous materials prior to demolition or renovation (*e.g. asbestos, lead based paint, PCB and mercury containing ballasts, mould*).
- Hazardous materials and waste must be handled and disposed of according to applicable regulatory requirements.
- Halocarbon containing equipment must be managed in accordance with the Federal Halocarbon Regulations.

Land Use Application

The EGD Land Use Application (*EGD LUA*) contains sections specific to potential environmental aspects related to the project. These sections must be completed with all relevant information.

EGD Management will respond with additional environmental protection and mitigation measures if required.

Infrastructure Modification & Construction

All modification and construction projects at the EGD must be assessed for environmental impacts, and plans put in place to mitigate the identified impacts. Projects managed by the EGD will be completed in accordance with the national project management system and site specific requirements.

For projects managed by Users:

- Any changes to infrastructure, changes to an existing lease or application for a new lease, must be approved by EGD Management.
- Prior to the approval of a property or infrastructure project, the EGD Land Use Application must be completed in full and submitted to EGD Management for review.

Green Space and Vegetation

The EGD property includes areas of vegetation that provides many benefits, including important habitat for wildlife and sensitive native plant species, and act as a buffer between the industrial operations of the facility and the neighbouring residential area.

All projects which have the potential to impact green space, vegetation and wildlife habitat must be reviewed and approved by EGD Management.

Tree and Vegetation Compensation Policy

To facilitate the EGD wildlife management plan and reduce the likelihood of habitat loss at the facility, property and infrastructure projects that require the removal of vegetation must provide compensation in the form of appropriate vegetation replacement. Additional supplies are also required when compensation vegetation is purchased to ensure that new plantings will be successful (*e.g. soil, mulch, tree protection, and water bags*). Consult with EGD Management prior to work to determine what compensation is required.

Soil Management

The EGD has undergone significant capital and operation and maintenance projects in recent years. Extensive investigations into the soil conditions (*e.g. contamination and structure*), utility mapping and identification of archaeological conditions have taken place. The industrial history of the facility has resulted in known contamination of the soil and in-fill material used on site. The primary contaminants commonly found at levels exceeding industrial soil standards include: arsenic, cadmium, copper, lead, mercury, zinc, and polycyclic aromatic hydrocarbons (*PAH*).

Requirements for Excavation

Planning Excavation

1. Consult with EGD Management prior to excavation to identify:

- Project area and excavation boundaries.
- Known utilities, structures, and historical information regarding the proposed excavation area.
- Known contaminated soil locations and the nature and level of contaminants potentially in the soils to be excavated.
- Archaeologically significant areas, requirements for mitigation of archaeological impacts, and dealing with unanticipated archaeological finds.

2. Prepare a plan for soil management: stockpiling and sampling of soils to be excavated. Key issues to be considered include:

- Turnaround times for sample results may take up to 2 weeks.
- Parameters to be sampled may vary depending on the area of excavation. Common parameters include total metals, leachable metals, PAHs, and hydrocarbons (*LEPH, HEPH*).
- EGD Management must approve stockpile areas.
- Soils which exceed the CCME Industrial Levels or BC CSR Industrial Levels: must be disposed of off site at an approved disposal facility.
- Soils which are below industrial standards: may remain on site if geotechnically suitable, if there is an identified use for the soil, and when approved by EGD Management.

3. Ensure contractors and employees are aware of the health and environmental risks associated with the suspected contaminated soils and have procedures in place to mitigate the risks. This includes adequate Personal Protective Equipment (PPE) and hygiene practices (e.g. no smoking, wear gloves).

ADEQUATE soil stockpile management. Soils placed on poly and covered.

INADEQUATE stockpile of contaminated soil. Soil should be covered to prevent exposure to elements, runoff and people.

Conducting Excavation

- Ensure appropriate PPE and hygienic precautions are in place to prevent exposure to contaminants in the soils.
- Monitor all excavations for visible soil contamination or archaeologically significant material.
- Ensure soil is stockpiled, sampled and analyzed in accordance with the Environmental Management Act and Contaminated Sites Regulation, and BC Ministry of Environment Technical Guidance Document 1, Site Characterization BC Government Technical Guidance on Contaminated Sites (*January 2009*).
- Ensure soils suspected of contamination are stockpiled on an impervious surface (*e.g. 6 mil PVC or plastic poly liner*) and adequately covered to prevent exposure to wind, storm water runoff or people. Stockpiles must not exceed 50m^3 in size.
- Imported fill material used for surfacing, backfilling or any other use must meet CCME Residential/Parkland (*RL/PL)* Land Usage Soil Quality Guidelines. Fill material information must be provided to and approved by EGD Management before being used on site.

After Excavation

- Ensure all soil is disposed of at a facility that is permitted to accept that material.
- Obtain all disposal records, including: waste manifests, weigh bills and disposal certificates from the receiver.
- Report the volume, analysis results, excavation details and dimensions and disposal records to EGD Management.
- Provide all as-builts and project drawings to EGD Management in the format compatible with the EGD drawing standards.

Archaeological Considerations

The EGD property and surrounding area has a rich First Nations history. There are Provincially Registered Archaeological Sites listed within the property boundaries of the EGD.

- All excavation projects must be reviewed and approved by EGD Management prior to work beginning.
- Depending on the scope of the project a detailed Archaeological Impact Assessment may be required.
- All Users, including contractors and employees working on excavation projects, must be made aware of the potential for archaeological chance finds. In the case where suspect archaeological material is discovered during excavation, work must stop in that area and EGD Management must be notified immediately.

Archaeological Overview Assessment

An Archaeological Overview Assessment was conducted for the EGD which outlines the archaeologically sensitive areas on the property and identifies areas of high archaeological potential.

Archaeological significant materials found during excavation projects at the facility include shell midden, artifacts, faunal and human remains.

Many archaeologically sensitive areas exist on the EGD Property.

First Nations archaeologists examine materials unearthed during excavations at EGD.

E

ESQUIMALT GRAVING DOCK

DOCKING SCHEDULE

Number of Pages: 9

Public Services and Procurement Canada | Services publics et Approvisionnement Canada

Calendar of All Bookings

Company	Length	Width	Vessel	Sections	Date In	Date Out	Booking Date	Booking Time
Dry Dock - Confirmed								
VSL	134.20 m	16.80 m	HMCS Ottawa 341	2 and 3	12-May-20	18-Oct-20	10-May-17	11:22:00
PHM	42.50 m	7.00 m	EGD Caisson 2	1	12-May-20	30-Nov-20	07-Jan-19	14:32:00
PHM	107.00 m	24.00 m	Salish Orca	3	19-Oct-20	05-Nov-20	17-Mar-17	13:50:00
VSL	255.73 m	35.97 m	North Star	1, 2, and 3	01-Dec-20	30-Dec-20	11-Dec-18	14:16:59
BCF	167.50 m	26.60 m	Spirit of British Columbia	2 and 3	05-Jan-21	19-Jan-21	02-Dec-16	17:23:00
BCF	139.35 m	27.29 m	Queen of Surrey	2 and 3	29-Jan-21	26-Feb-21	16-May-16	16:26:00
PHM	124.00 m	19.60 m	FRPD 309	2 and 3	01-Mar-21	31-Mar-21	28-Jul-17	19:20:00
BCF	150.75 m	23.90 m	Northern Expedition	2 and 3	02-Apr-21	21-Apr-21	10-Nov-16	09:56:00
VSL	220.00 m	30.94 m	Maasdam	1, 2, and 3	21-Apr-21	05-May-21	06-Apr-18	13:33:00
VSL	134.20 m	16.80 m	HMCS Ottawa 341	2 and 3	06-May-21	14-Jul-21	10-May-17	13:08:00
VSL	294.00 m	32.29 m	Disney Wonder	1	09-Sep-21	15-Sep-21	29-Apr-20	08:36:39
VSL	294.00 m	32.29 m	Disney Wonder	1, 2, and 3	16-Sep-21	22-Sep-21	18-Feb-18	10:39:00
VSL	285.24 m	32.25 m	Oosterdam	1, 2, and 3	23-Sep-21	11-Oct-21	29-Oct-18	11:43:00
BCF	160.00 m	28.20 m	Coastal Renaissance	2 and 3	12-Oct-21	08-Nov-21	16-May-16	15:49:00
BCF	139.35 m	27.08 m	Queen of Alberni	2 and 3	08-Nov-21	02-Dec-21	06-Dec-16	15:22:00
VSL	255.73 m	35.97 m	Midnight Sun	1	01-Dec-21	09-Dec-21	05-Mar-19	14:47:04
VSL	255.73 m	35.97 m	Midnight Sun	1, 2, and 3	10-Dec-21	30-Dec-21	11-Dec-18	14:27:00
EGD			Maintenance Block	3	01-Jan-22	31-Dec-22	23-Jul-19	10:29:35
BCF	107.00 m	24.00 m	Salish Eagle	1	05-Jan-22	22-Jan-22	17-Mar-17	14:26:00
BCF	167.50 m	32.90 m	Spirit of Vancouver Island	1 and 2	08-Feb-22	24-Feb-22	30-Nov-16	17:53:00
BCF	107.00 m	24.00 m	Salish Raven	1	25-Feb-22	10-Mar-22	17-Mar-17	14:30:00
PHM	60.96 m	18.29 m	Peter D. Anderson	1	11-Mar-22	08-Apr-22	23-Aug-19	13:41:00
PHM	124.00 m	19.60 m	FRPD 309	1 and 2	11-Mar-22	08-Apr-22	28-Jul-17	19:16:00
BCF	160.00 m	28.20 m	Coastal Inspiration	1 and 2	18-Apr-22	16-May-22	04-Oct-16	13:44:00
VSL	134.20 m	16.80 m	HMCS Regina 334	1 and 2	16-May-22	05-Sep-22	12-Jan-18	09:36:00
BCF	139.35 m	27.13 m	Queen of Coquitlam	1 and 2	05-Sep-22	29-Sep-22	03-Oct-16	14:30:00
BCF	167.50 m	26.60 m	Spirit of British Columbia	2 and 3	03-Jan-23	28-Jan-23	02-Dec-16	17:19:00

Prepard by Nicola Greeley, 2020 August 17 @ 0800

BCF	102.45 m	27.00 m	Malaspina Sky	3	09-Feb-23	12-Mar-23	29-Jan-19	15:10:24
BCF	160.00 m	27.80 m	Coastal Celebration	2 and 3	17-Mar-23	25-Apr-23	03-Oct-16	16:38:00
VSL	134.20 m	16.80 m	HMCS Calgary 335	2 and 3	01-May-23	08-Sep-23	23-May-19	09:13:00
BCF	117.00 m	20.62 m	Northern Adventure	3	29-Sep-23	30-Oct-23	04-Oct-16	14:50:00
VSL	134.20 m	16.80 m	HMCS Winnipeg 338	2 and 3	12-Apr-24	07-Sep-24	23-May-19	11:25:00
BCF	160.00 m	28.20 m	Coastal Inspiration	1 and 2	20-May-25	09-Jun-25	04-Oct-16	14:00:00
VSL	134.20 m	16.80 m	HMCS Vancouver 331	3	06-Jun-25	08-Jun-25	06-May-20	10:52:00
VSL	134.20 m	16.80 m	HMCS Vancouver 331	2 and 3	09-Jun-25	20-Oct-25	23-May-19	11:38:00
BCF	150.75 m	23.90 m	Northern Expedition	2 and 3	10-Apr-26	22-Apr-26	07-Dec-16	17:12:00
VSL	134.20 m	16.80 m	HMCS Ottawa 341	2 and 3	22-Apr-26	10-Sep-26	23-May-19	11:46:00
BCF	160.00 m	28.20 m	Coastal Inspiration	2 and 3	12-May-27	06-Jun-27	01-Feb-18	14:12:26
VSL	134.20 m	16.80 m	HMCS Regina 334	2 and 3	06-Jun-27	12-Oct-27	24-May-19	06:32:00
BCF	150.75 m	23.90 m	Northern Expedition	1 and 2	03-Apr-28	27-Apr-28	07-Dec-16	17:12:00
BCF	160.00 m	27.80 m	Coastal Celebration	2 and 3	03-Apr-28	27-Apr-28	03-Oct-16	16:48:00
VSL	134.20 m	16.80 m	HMCS Calgary 335	2 and 3	27-Apr-28	20-Sep-28	24-May-19	09:49:00
VSL	134.20 m	16.80 m	HMCS Winnipeg 338	2 and 3	13-Apr-29	08-Sep-29	24-May-19	08:46:00

North Landing Wharf - Confirmed								
VSL	60.96 m	15.24 m	Seaspan Barge 483	NLW	14-Feb-20	12-Dec-20	28-Jan-20	11:45:00
VSL	63.40 m	16.00 m	OFSV 3: John Cabot	NLW	19-Aug-20	10-Oct-20	25-Nov-20	14:22:00
VSL	134.20 m	16.80 m	HMCS Vancouver 331	NLW	12-Oct-20	01-Dec-20	12-Aug-20	08:25:07
VSL	70.40 m	7.62 m	HMCS Chicoutimi	NLW	07-Nov-20	12-Dec-20	23-Jun-20	09:28:00
VSL	255.73 m	35.97 m	Midnight Sun	NLW	13-Dec-20	28-Feb-21	18-Jun-18	10:17:00
VSL	50.00 m	30.00 m	Maasdam Lifeboats	NLW	23-Apr-21	03-May-21	30-May-19	09:17:41
VSL	60.00 m	10.00 m	Disney Wonder Lifeboats	NLW	13-Sep-21	27-Sep-21	18-Feb-18	10:50:00
VSL	30.00 m	3.00 m	Oosterdam Lifeboats	NLW	28-Sep-21	10-Oct-21	10-Apr-19	13:13:00
VSL	255.73 m	35.97 m	Midnight Sun	NLW	13-Dec-21	28-Feb-22	11-Dec-18	14:31:09
BCF	107.00 m	24.00 m	Salish Raven	NLW	11-Mar-22	07-Apr-22	26-Aug-19	11:51:21
VSL	134.20 m	16.80 m	HMCS Calgary 335	NLW	31-Mar-23	08-May-23	06-May-20	09:50:00
VSL	134.20 m	16.80 m	HMCS Winnipeg 338	NLW	10-Mar-25	30-Apr-25	06-Jul-20	13:42:27

South Jetty - Confirmed								
VSL	118.00 m	16.50 m	HMNZS Te Mana	SJ	09-Dec-19	30-Nov-20	22-Mar-19	09:11:00
VSL	134.20 m	16.80 m	HMCS Vancouver 331	SJ	15-May-20	12-Oct-20	24-Mar-20	10:24:00
VSL	134.20 m	16.80 m	HMCS Ottawa 341	SJ	12-Oct-20	12-May-21	23-May-19	08:40:00
PHM	42.50 m	7.00 m	EGD Caisson 2	SJ	27-Nov-20	31-Mar-21	31-Jul-20	14:26:00
VSL	60.96 m	15.24 m	Seaspan Barge 483	SJ	12-Dec-20	30-Mar-21	28-Jan-20	12:30:00
VSL	70.40 m	7.62 m	HMCS Chicoutimi	SJ	12-Dec-20	30-Mar-21	23-Jun-20	09:37:14
VSL	134.20 m	16.80 m	HMCS Ottawa 341	SJ	07-Jul-21	30-Sep-21	06-Jul-20	13:59:22
VSL	134.20 m	16.80 m	HMCS Regina 334	SJ	20-Oct-21	23-May-22	06-Jul-20	14:17:00
BCF	107.00 m	24.00 m	Salish Eagle	SJ	22-Jan-22	16-Feb-22	26-Aug-19	11:12:57
VSL	134.20 m	16.80 m	HMCS Regina 334	SJ	31-Aug-22	31-Mar-23	21-Aug-19	10:17:00
VSL	134.20 m	16.80 m	HMCS Vancouver 331	SJ	19-Oct-22	23-Dec-22	23-May-19	11:43:00
VSL	134.20 m	16.80 m	HMCS Calgary 335	SJ	31-Dec-22	31-Mar-23	06-Jul-20	14:46:30
VSL	134.20 m	16.80 m	HMCS Ottawa 341	SJ	16-Jan-23	09-Jun-23	23-May-19	11:52:00
VSL	134.20 m	16.80 m	HMCS Calgary 335	SJ	05-Sep-23	16-Mar-24	23-May-19	10:34:00
VSL	134.20 m	16.80 m	HMCS Winnipeg 338	SJ	28-Feb-24	19-Apr-24	07-Jul-20	07:15:07
VSL	134.20 m	16.80 m	HMCS Regina 334	SJ	01-Apr-24	22-Jul-24	23-May-19	12:12:00
VSL	134.20 m	16.80 m	HMCS Winnipeg 338	SJ	31-Aug-24	10-Mar-25	23-May-19	12:39:00
VSL	134.20 m	16.80 m	HMCS Vancouver 331	SJ	01-Apr-25	09-Jun-25	23-May-19	07:29:00
VSL	134.20 m	16.80 m	HMCS Calgary 335	SJ	15-Apr-25	01-Sep-25	23-Aug-19	06:53:00
VSL	134.20 m	16.80 m	HMCS Vancouver 331	SJ	13-Oct-25	31-Mar-26	23-May-19	12:40:00
VSL	134.20 m	16.80 m	HMCS Ottawa 341	SJ	01-Apr-26	30-Apr-26	23-May-19	12:42:00
VSL	134.20 m	16.80 m	HMCS Ottawa 341	SJ	07-Sep-26	31-Mar-27	23-May-19	07:59:00
VSL	134.20 m	16.80 m	HMCS Regina 334	SJ	01-Apr-27	11-Jun-27	29-May-19	07:19:00
VSL	134.20 m	16.80 m	HMCS Regina 334	SJ	07-Oct-27	31-Mar-28	29-May-19	07:19:00
VSL	134.20 m	16.80 m	HMCS Calgary 335	SJ	03-Apr-28	05-May-28	19-May-19	07:19:00
VSL	134.20 m	16.80 m	HMCS Calgary 335	SJ	15-Sep-28	31-Mar-29	29-May-19	07:19:00
VSL	134.20 m	16.80 m	HMCS Winnipeg 338	SJ	02-Apr-29	20-Apr-29	29-May-20	07:12:00
VSL	134.20 m	16.80 m	HMCS Winnipeg 338	SJ	01-Sep-29	06-Mar-30	29-May-19	07:12:00

Dry Dock - Tentative								
BCF	84.99 m	18.62 m	Powell River Queen	DD TBD	09-Sep-20	19-Sep-20	05-Jun-19	10:01:00
BCF	139.35 m	27.13 m	Queen of Coquitlam	DD TBD	08-Oct-20	23-Oct-20	03-Oct-16	14:01:22
VSL	134.20 m	16.80 m	HMCS Ottawa 341	DD TBD	18-Oct-20	30-Nov-20	24-Mar-20	12:51:18
BCF	160.00 m	28.20 m	Coastal Renaissance	DD TBD	19-Oct-20	05-Nov-20	15-Apr-20	08:48:00
BCF	84.99 m	18.62 m	Powell River Queen	DD TBD	26-Oct-20	07-Nov-20	16-Sep-19	12:05:00
VSL	255.73 m	35.97 m	North Star	DD TBD	20-Nov-20	30-Nov-20	24-Jul-20	14:25:02
BCF	96.00 m	21.20 m	Queen of Cumberland	DD TBD	05-Jan-21	19-Jan-21	13-Jun-17	11:53:00
VSL	258.47 m	37.52 m	Norwegian Sun	DD TBD	01-Mar-21	31-Mar-21	26-Sep-19	10:32:27
BCF	139.35 m	27.29 m	Queen of Surrey	DD TBD	25-Mar-21	02-Apr-21	08-Oct-19	15:09:34
BCF	75.40 m	15.00 m	Northern Sea Wolf	DD TBD	01-Apr-21	23-Apr-21	31-Jan-19	09:27:00
BCF	160.00 m	27.80 m	Coastal Celebration	DD TBD	05-Apr-21	23-Apr-21	03-Oct-16	16:27:24
BCF	75.40 m	15.00 m	Northern Sea Wolf	DD TBD	24-Apr-21	01-May-21	31-Jan-19	09:15:00
VSL	89.92 m	13.52 m	Katie Ann	DD TBD	27-May-21	30-Jun-21	30-Nov-16	09:43:31
BCF	75.00 m	19.50 m	Quinitsa	DD TBD	22-Aug-21	14-Sep-21	01-Jun-20	16:49:20
VSL	294.00 m	38.00 m	Coral Princess	DD TBD	16-Sep-21	11-Oct-21	11-Apr-18	10:38:00
VSL	203.82 m	27.50 m	Ocean Phoenix	DD TBD	16-Sep-21	15-Oct-21	07-Apr-17	10:10:09
BCF	117.00 m	20.62 m	Northern Adventure	DD TBD	02-Oct-21	25-Oct-21	04-Jun-19	10:50:25
BCF	130.00 m	24.00 m	Queen of New Westminster	DD TBD	12-Oct-21	30-Oct-21	06-Dec-16	15:22:00
VSL	203.82 m	27.50 m	Ocean Phoenix	DD TBD	12-Oct-21	08-Nov-21	15-Apr-20	11:32:38
VSL	112.00 m	17.00 m	Excellence	DD TBD	12-Oct-21	10-Nov-21	15-Apr-20	10:42:36
BCF	84.97 m	18.65 m	Bowen Queen	DD TBD	13-Oct-21	29-Oct-21	07-Oct-19	09:43:00
BCF	139.29 m	27.08 m	Queen of Cowichan	DD TBD	15-Oct-21	04-Nov-21	04-Oct-16	13:21:00
BCF	110.00 m	24.00 m	Skeena Queen	DD TBD	01-Nov-21	16-Nov-21	06-Feb-19	14:43:56
BCF	139.29 m	27.08 m	Queen of Cowichan	DD TBD	08-Nov-21	14-Nov-21	02-Apr-18	17:06:08
BCF	110.00 m	24.00 m	Skeena Queen	DD TBD	14-Nov-21	30-Nov-21	06-Feb-19	14:55:38
VSL	112.00 m	17.00 m	Excellence	DD TBD	15-Nov-21	10-Dec-21	07-Apr-17	10:14:09
BCF	117.00 m	20.62 m	Northern Adventure	DD TBD	02-Jan-22	20-Jan-22	04-Oct-16	14:11:53
VSL	255.73 m	35.97 m	Midnight Sun	DD TBD	28-Jan-22	28-Feb-22	18-Jun-18	09:35:23
VSL	294.00 m	32.30 m	NCL Norwegian Pearl	DD TBD	28-Feb-22	15-Mar-22	10-Oct-19	11:30:33
VSL	294.00 m	32.30 m	NCL Norwegian Pearl	DD TBD	01-Mar-22	21-Mar-22	26-Sep-19	10:38:00
VSL	253.60 m	36.00 m	NCL Norwegian Sky	DD TBD	16-Mar-22	31-Mar-22	10-Oct-19	11:32:40
VSL	253.60 m	36.00 m	NCL Norwegian Sky	DD TBD	22-Mar-22	14-Apr-22	26-Sep-19	10:40:01
CCG	83.00 m	16.20 m	Sir Wilfrid Laurier	DD TBD	22-Mar-22	19-Apr-22	07-Aug-15	13:30:00

VSL	297.00 m	35.00 m	Koningsdam	DD TBD	28-Mar-22	13-Apr-22	30-May-19	09:35:00
VSL	288.61 m	36.05 m	Emerald Princess	DD TBD	01-Apr-22	25-Apr-22	26-Sep-18	11:17:54
VSL	181.00 m	25.46 m	Pacific Princess	DD TBD	25-Apr-22	14-May-22	20-Jun-18	09:29:17
VSL	112.00 m	17.00 m	Excellence	DD TBD	11-May-22	07-Jun-22	07-Apr-17	10:15:29
BCF	52.21 m	16.76 m	Kuper	DD TBD	11-Oct-22	08-Nov-22	28-Dec-16	16:24:00
VSL	288.61 m	36.05 m	Emerald Princess	DD TBD	11-Oct-22	09-Nov-22	26-Apr-19	09:16:31
BCF	89.84 m	21.25 m	Quinsam	DD TBD	31-Oct-22	22-Nov-22	17-Jun-19	14:15:00
CCG	69.00 m	14.00 m	John P Tully	DD TBD	01-Nov-22	13-Dec-22	07-Aug-15	13:38:00
BCF	102.45 m	27.00 m	Malaspina Sky	DD TBD	17-Jan-23	08-Feb-23	16-Jan-18	15:17:00
VSL	255.73 m	35.97 m	Midnight Sun	DD TBD	23-Jan-23	19-Feb-23	10-Mar-20	12:46:51
VSL	289.00 m	37.00 m	Crown Princess	DD TBD	20-Mar-23	04-Apr-23	20-Jun-18	09:37:43
VSL	289.51 m	40.20 m	Golden Princess	DD TBD	24-Mar-23	14-Apr-23	20-Jun-18	09:40:15
VSL	114.60 m	18.30 m	Alaska Ocean	DD TBD	29-Mar-23	28-Apr-23	30-Apr-18	10:00:59
BCF	75.40 m	15.00 m	Northern Sea Wolf	DD TBD	02-Apr-23	26-Apr-23	14-May-20	13:36:11
BCF	150.75 m	23.90 m	Northern Expedition	DD TBD	02-Apr-23	01-May-23	07-Dec-16	17:12:00
BCF	47.55 m	12.25 m	Klitsa	DD TBD	16-Apr-23	16-May-23	23-Dec-16	15:17:16
BCF	48.62 m	13.21 m	Quadra Queen II	DD TBD	16-Apr-23	20-May-23	03-Nov-16	14:34:57
BCF	150.75 m	23.90 m	Northern Expedition	DD TBD	27-Apr-23	21-May-23	06-Jun-19	17:29:19
VSL	223.60 m	31.00 m	Seven Seas Explorer	DD TBD	01-May-23	25-May-23	23-Jun-20	07:44:27
BCF	49.54 m	14.69 m	Tachek	DD TBD	20-Jun-23	15-Jul-23	14-Oct-16	08:34:02
VSL	294.06 m	32.29 m	Disney Magic	DD TBD	06-Sep-23	14-Oct-23	18-Feb-18	10:59:12
VSL	294.13 m	37.88 m	Norwegian Jewel	DD TBD	09-Oct-23	10-Nov-23	27-Nov-19	08:42:19
BCF	160.00 m	28.20 m	Coastal Renaissance	DD TBD	10-Oct-23	06-Nov-23	14-Apr-20	11:37:05
BCF	130.00 m	24.00 m	Queen of New Westminster	DD TBD	11-Oct-23	05-Nov-23	22-May-19	09:56:39
BCF	107.00 m	24.00 m	Salish Orca	DD TBD	16-Oct-23	25-Oct-23	30-Jan-19	12:38:00
BCF	139.29 m	27.08 m	Queen of Cowichan	DD TBD	06-Nov-23	01-Dec-23	14-Oct-16	08:19:00
VSL	289.51 m	36.03 m	Star Princess	DD TBD	28-Nov-23	18-Dec-23	20-Jun-18	09:35:03
BCF	96.00 m	21.20 m	Queen of Cumberland	DD TBD	08-Jan-24	16-Jan-24	08-Dec-16	11:45:00
BCF	139.35 m	27.29 m	Queen of Surrey	DD TBD	29-Jan-24	16-Feb-24	14-Oct-16	08:24:00
BCF	167.50 m	32.90 m	Spirit of Vancouver Island	DD TBD	01-Feb-24	25-Feb-24	30-Nov-16	17:53:00
BCF	107.00 m	24.00 m	Salish Eagle	DD TBD	13-Feb-24	25-Feb-24	04-Jun-19	09:37:58
BCF	107.00 m	24.00 m	Salish Eagle	DD TBD	26-Feb-24	11-Mar-24	04-Jun-19	09:35:47
VSL	288.61 m	36.05 m	Emerald Princess	DD TBD	23-Mar-24	16-Apr-24	26-Sep-18	11:20:16
BCF	54.72 m	14.18 m	Kahloke	DD TBD	07-Apr-24	07-May-24	23-Dec-16	15:27:21

VSL	297.00 m	35.00 m	Koningsdam	DD TBD	08-Apr-24	01-May-24	26-Sep-18	12:01:18
VSL	285.30 m	32.20 m	Westerdam	DD TBD	15-Apr-24	09-May-24	26-Sep-18	11:23:34
VSL	293.80 m	32.30 m	MSC Magnifica	DD TBD	08-Sep-24	14-Oct-24	05-Jul-19	14:11:00
VSL	294.00 m	32.29 m	Disney Wonder	DD TBD	08-Sep-24	14-Oct-24	18-Feb-18	10:53:00
VSL	293.80 m	32.30 m	MSC Magnifica	DD TBD	30-Sep-24	30-Oct-24	05-Jul-19	14:08:21
BCF	75.00 m	19.50 m	Quinitsa	DD TBD	14-Oct-24	05-Nov-24	23-Dec-16	15:28:00
BCF	160.00 m	28.20 m	Coastal Renaissance	DD TBD	15-Oct-24	01-Nov-24	14-Oct-16	08:13:13
BCF	139.35 m	27.59 m	Queen of Oak Bay	DD TBD	06-Jan-25	30-Jan-25	04-Jun-19	09:32:42
BCF	95.74 m	21.23 m	Queen of Capilano	DD TBD	06-Jan-25	30-Jan-25	04-Jun-19	09:30:21
BCF	107.00 m	24.00 m	Salish Raven	DD TBD	03-Mar-25	15-Mar-25	03-Jun-19	13:31:02
BCF	75.40 m	15.00 m	Northern Sea Wolf	DD TBD	23-Mar-25	22-Apr-25	14-May-20	12:28:21
BCF	139.35 m	27.13 m	Queen of Coquitlam	DD TBD	02-Sep-25	21-Sep-25	14-May-20	11:54:28
BCF	71.63 m	14.18 m	Kwuna	DD TBD	30-Sep-25	25-Oct-25	23-Dec-16	15:25:07
BCF	107.00 m	24.00 m	Salish Orca	DD TBD	21-Oct-25	12-Nov-25	17-Mar-17	13:49:26
BCF	89.84 m	21.25 m	Quinsam	DD TBD	23-Oct-25	14-Nov-25	22-Dec-16	11:30:26
BCF	139.29 m	27.08 m	Queen of Cowichan	DD TBD	10-Nov-25	23-Nov-25	04-Jun-19	09:47:31
BCF	167.50 m	26.60 m	Spirit of British Columbia	DD TBD	04-Jan-26	18-Jan-26	02-Dec-16	17:23:00
BCF	96.00 m	21.20 m	Queen of Cumberland	DD TBD	06-Jan-26	30-Jan-26	31-Jan-18	11:41:03
BCF	139.35 m	27.29 m	Queen of Surrey	DD TBD	02-Feb-26	27-Feb-26	09-Feb-18	11:39:00
BCF	75.40 m	15.00 m	Northern Sea Wolf	DD TBD	16-Mar-26	22-Apr-26	04-Jun-19	10:01:19
BCF	150.75 m	23.90 m	Northern Expedition	DD TBD	30-Mar-26	09-Apr-26	06-Jun-19	16:42:13
BCF	160.00 m	27.80 m	Coastal Celebration	DD TBD	07-Apr-26	27-Apr-26	03-Oct-16	16:45:03
BCF	160.00 m	27.80 m	Coastal Celebration	DD TBD	23-Apr-26	10-May-26	06-Jun-19	16:47:51
BCF	48.62 m	13.21 m	Quadra Queen II	DD TBD	11-May-26	20-May-26	03-Nov-16	14:36:09
BCF	49.54 m	14.69 m	Tachek	DD TBD	09-Jul-26	24-Jul-26	14-Oct-16	08:30:00
BCF	117.00 m	20.62 m	Northern Adventure	DD TBD	04-Oct-26	25-Oct-26	09-Aug-19	08:16:49
BCF	160.00 m	28.20 m	Coastal Renaissance	DD TBD	13-Oct-26	08-Nov-26	14-Oct-16	10:02:00
BCF	52.21 m	16.76 m	Kuper	DD TBD	13-Oct-26	10-Nov-26	28-Dec-16	16:26:04
BCF	110.00 m	24.00 m	Skeena Queen	DD TBD	02-Nov-26	19-Nov-26	04-Jun-19	10:11:21
BCF	110.00 m	24.00 m	Skeena Queen	DD TBD	26-Nov-26	13-Dec-26	04-Jun-19	10:13:55
BCF	117.00 m	20.62 m	Northern Adventure	DD TBD	02-Jan-27	17-Jan-27	04-Oct-16	14:56:24
BCF	107.00 m	24.00 m	Salish Eagle	DD TBD	06-Jan-27	29-Jan-27	17-Mar-17	14:27:26
BCF	167.50 m	32.90 m	Spirit of Vancouver Island	DD TBD	09-Feb-27	25-Feb-27	30-Nov-16	17:53:00
BCF	107.00 m	24.00 m	Salish Raven	DD TBD	15-Feb-27	05-Mar-27	17-Mar-17	14:31:00

BCF	139.35 m	27.08 m	Queen of Alberni	DD TBD	13-Oct-27	30-Oct-27	01-Feb-18	14:53:31
BCF	95.74 m	21.23 m	Queen of Capilano	DD TBD	04-Jan-28	13-Jan-28	01-Feb-18	15:54:21
BCF	167.50 m	26.60 m	Spirit of British Columbia	DD TBD	04-Jan-28	31-Jan-28	02-Dec-16	17:18:00
BCF	139.35 m	27.59 m	Queen of Oak Bay	DD TBD	09-Jan-28	27-Jan-28	04-Oct-16	16:23:13
BCF	102.45 m	27.00 m	Malaspina Sky	DD TBD	11-Jan-28	05-Feb-28	16-Jan-18	15:08:39
BCF	102.45 m	27.00 m	Malaspina Sky	DD TBD	10-Feb-28	04-Mar-28	29-Jan-19	15:14:44
BCF	75.40 m	15.00 m	Northern Sea Wolf	DD TBD	19-Mar-28	20-Apr-28	04-Jun-19	10:26:06
BCF	48.62 m	13.21 m	Quadra Queen II	DD TBD	19-Apr-28	22-May-28	03-Nov-16	14:37:25
BCF	150.75 m	23.90 m	Northern Expedition	DD TBD	03-May-28	21-May-28	06-Jun-19	16:54:48
BCF	49.54 m	14.69 m	Tachek	DD TBD	21-Jun-28	15-Jul-28	14-Oct-16	08:35:00
BCF	117.00 m	20.62 m	Northern Adventure	DD TBD	28-Sep-28	10-Oct-28	04-Oct-16	15:04:06
BCF	107.00 m	24.00 m	Salish Orca	DD TBD	18-Oct-28	01-Nov-28	30-Jan-19	12:53:34
BCF	96.00 m	21.20 m	Queen of Cumberland	DD TBD	08-Jan-29	16-Jan-29	08-Dec-16	11:52:00
BCF	139.35 m	27.29 m	Queen of Surrey	DD TBD	28-Jan-29	15-Feb-29	14-Oct-16	08:21:27
BCF	167.50 m	32.90 m	Spirit of Vancouver Island	DD TBD	31-Jan-29	25-Feb-29	30-Nov-16	17:53:00
BCF	95.74 m	21.23 m	Queen of Capilano	DD TBD	06-Jan-30	30-Jan-30	08-Dec-16	18:26:00
BCF	107.00 m	24.00 m	Salish Orca	DD TBD	15-Oct-30	05-Nov-30	17-Mar-17	13:48:00
BCF	96.00 m	21.20 m	Queen of Cumberland	DD TBD	06-Jan-31	24-Jan-31	03-Jun-19	13:01:01
BCF	150.75 m	23.90 m	Northern Expedition	DD TBD	01-Apr-31	17-Apr-31	04-Jun-19	16:06:30
BCF	75.40 m	15.00 m	Northern Sea Wolf	DD TBD	01-Apr-31	24-Apr-31	04-Jun-19	16:09:38
BCF	117.00 m	20.62 m	Northern Adventure	DD TBD	28-Sep-31	20-Oct-31	04-Jun-19	16:27:39
BCF	110.00 m	24.00 m	Skeena Queen	DD TBD	03-Nov-31	20-Nov-31	04-Jun-19	16:23:53
BCF	107.00 m	24.00 m	Salish Eagle	DD TBD	05-Jan-32	29-Jan-32	17-Mar-17	14:28:30
BCF	107.00 m	24.00 m	Salish Raven	DD TBD	16-Feb-32	10-Mar-32	17-Mar-17	14:32:59

North Landing Wharf - Tentative								
EGD	305.00 m	10.00 m	EGD NLW Project	NLW	01-Feb-20	01-Nov-20	04-Sep-19	14:29:00
VSL	131.09 m	48.77 m	Seaspan Careen	NLW	29-Oct-20	08-Nov-20	30-Jul-20	08:54:04
VSL	255.73 m	35.97 m	North Star	NLW	13-Dec-20	28-Feb-21	11-Dec-18	14:19:57
VSL	131.09 m	48.77 m	Seaspan Careen	NLW	19-Mar-21	02-Apr-21	30-Jul-20	09:02:42
VSL	297.00 m	35.00 m	Koningsdam	NLW	25-Apr-21	01-May-21	22-Oct-18	09:54:06
VSL	50.00 m	0.00 m	Pacific Princess Lifeboats	NLW	28-Apr-22	12-May-22	20-Jun-18	09:53:58
VSL	173.00 m	24.00 m	HMCS JSS 194	NLW	01-Aug-22	31-Jul-23	06-Mar-20	09:41:57
VSL	50.00 m	10.00 m	Emerald Princess Lifeboats	NLW	19-Oct-22	04-Nov-22	26-Apr-19	09:25:39
VSL	50.00 m	0.00 m	Crown Princess Lifeboats	NLW	23-Mar-23	02-Apr-23	20-Jun-18	09:58:33
VSL	50.00 m	0.00 m	Golden Princess Lifeboats	NLW	29-Mar-23	12-Apr-23	20-Jun-18	10:00:45
VSL	60.00 m	20.00 m	Disney Magic Lifeboats	NLW	14-Sep-23	10-Oct-23	18-Feb-18	11:06:02
VSL	50.00 m	5.00 m	Star Princess Lifeboats	NLW	01-Dec-23	15-Dec-23	20-Jun-18	09:55:59
VSL	60.00 m	10.00 m	Disney Wonder Lifeboats	NLW	15-Sep-24	08-Oct-24	18-Feb-18	10:55:29
VSL	173.00 m	24.00 m	HMCS JSS 195	NLW	01-Oct-24	30-Sep-25	06-Mar-20	09:32:38
South Jetty - Tentative								
VSL	173.00 m	24.00 m	HMCS JSS 194	SJ	01-Aug-22	31-Jul-23	04-Jun-19	14:06:45
VSL	173.00 m	24.00 m	HMCS JSS 195	SJ	01-Oct-24	30-Sep-25	06-Mar-20	17:25:00

F

ESQUIMALT GRAVING DOCK

REFERENCE DRAWINGS

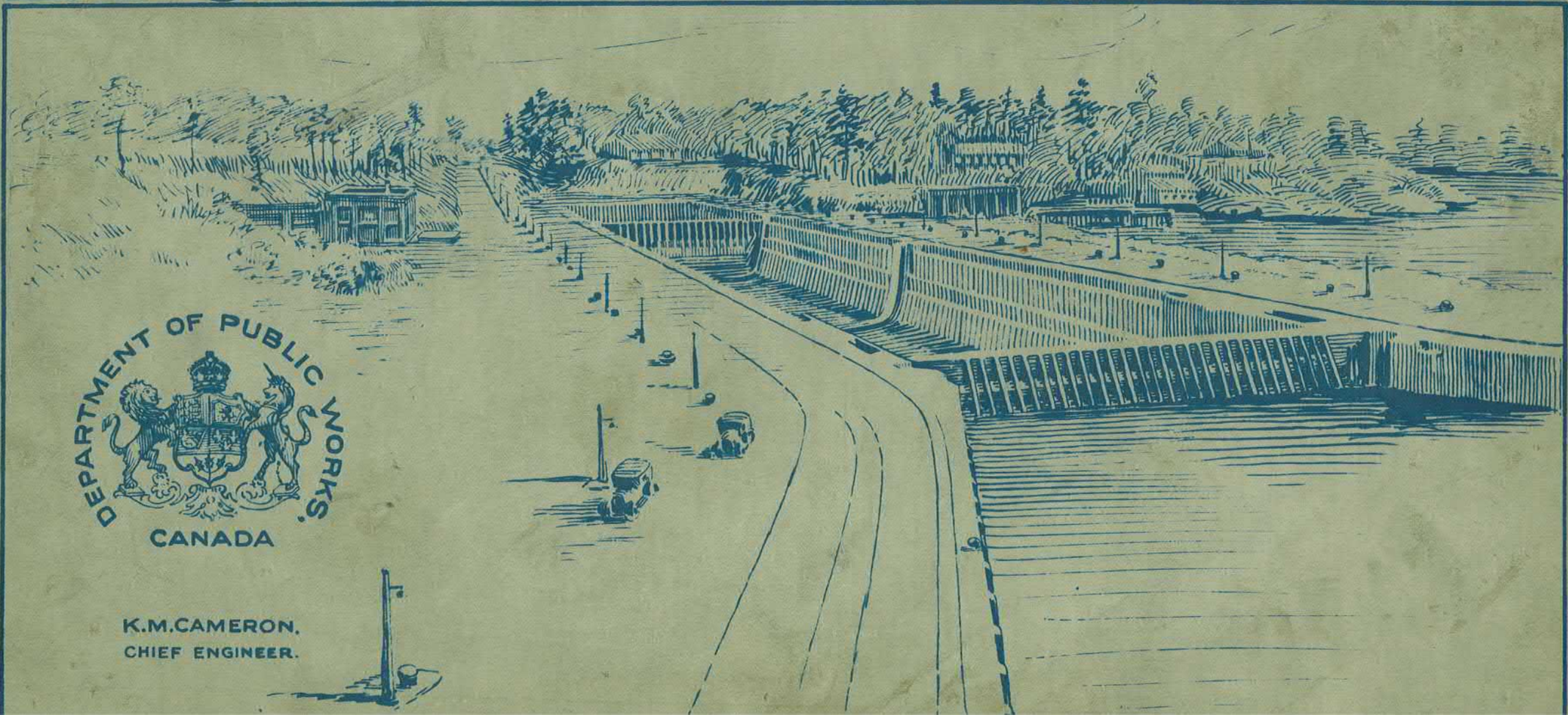
EGD General Plans - ca 1925, (51 sheets)

EGD East End Retaining Wall - Record Drawings, Mar 8th 2012 (26 Sheets)

EGD Retaining Wall Steel Stairs - Record Drawings, Feb 20th 2012 (4 Sheets)

GENERAL PLANS

ESQUIMALT GRAVING DOCK



DEPARTMENT OF PUBLIC WORKS
CANADA

K.M.CAMERON.
CHIEF ENGINEER.

ESQUIMALT GRAVING DOCK

LENGTH 1186 FEET **WIDTH 149 FEET** **DEPTH 49.5 FEET**

COMMENCED 1921 COMPLETED 1927

EXECUTIVE

THE HONOURABLE F. B. McCURDY,	MINISTER	1921
THE HONOURABLE J. H. KING, M.D.	MINISTER	1922
THE HONOURABLE J. C. ELLIOTT, K.C.	MINISTER	1926
JAMES BLAKE HUNTER, B.A.	DEPUTY MINISTER	

ENGINEERS

K.M. CAMERON, M.Sc. M.E.I.C.	CHIEF ENGINEER
J.P. FORDE, M.E.I.C.	DISTRICT ENGINEER
W.A. GOURLAY, B.A.Sc.	RESIDENT ENGINEER
FRED G. SMITH, A.M.E.I.C.	STRUCTURAL ENGINEER
A.R. DECARY, D.Sc. M.E.I.C. E.E. BRYDONE-JACK, D.Sc. M.I.C.E. M.E.I.C. LT. COL. H.J. LAMB, D.S.O. M.E.I.C. ALEXANDER GRAY, M.E.I.C.	BOARD OF ENGINEERS ON DESIGN

GENERAL CONTRACTORS

P. LYALL AND SONS CONSTRUCTION CO. LIMITED.

OFFICIALLY OPENED ON JULY 1ST 1927 BY THE HONOURABLE J. A. MACDONALD, CHIEF JUSTICE OF THE COURT OF APPEAL

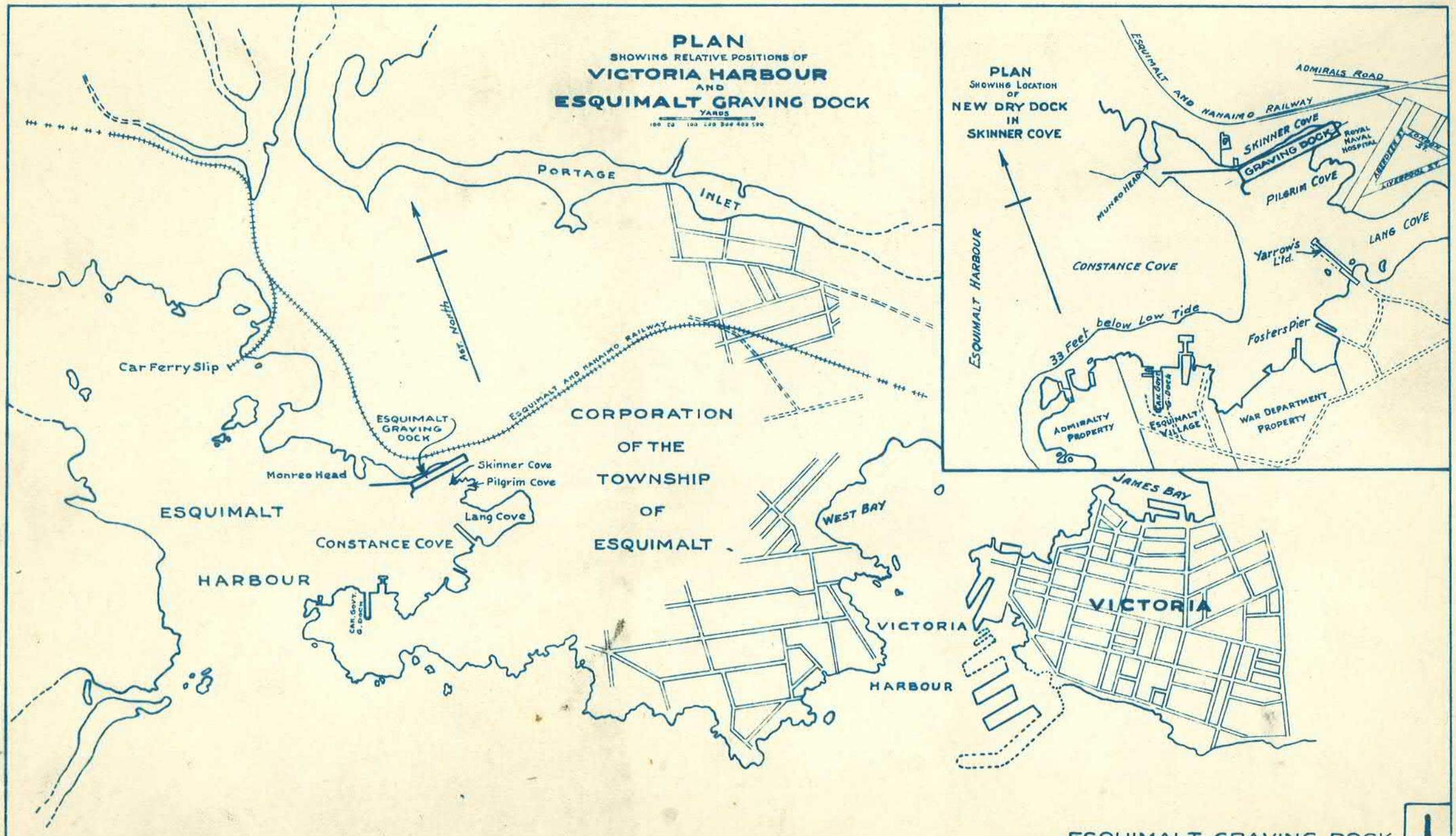
ESQUIMALT GRAVING DOCK

PRINCIPAL DIMENSIONS

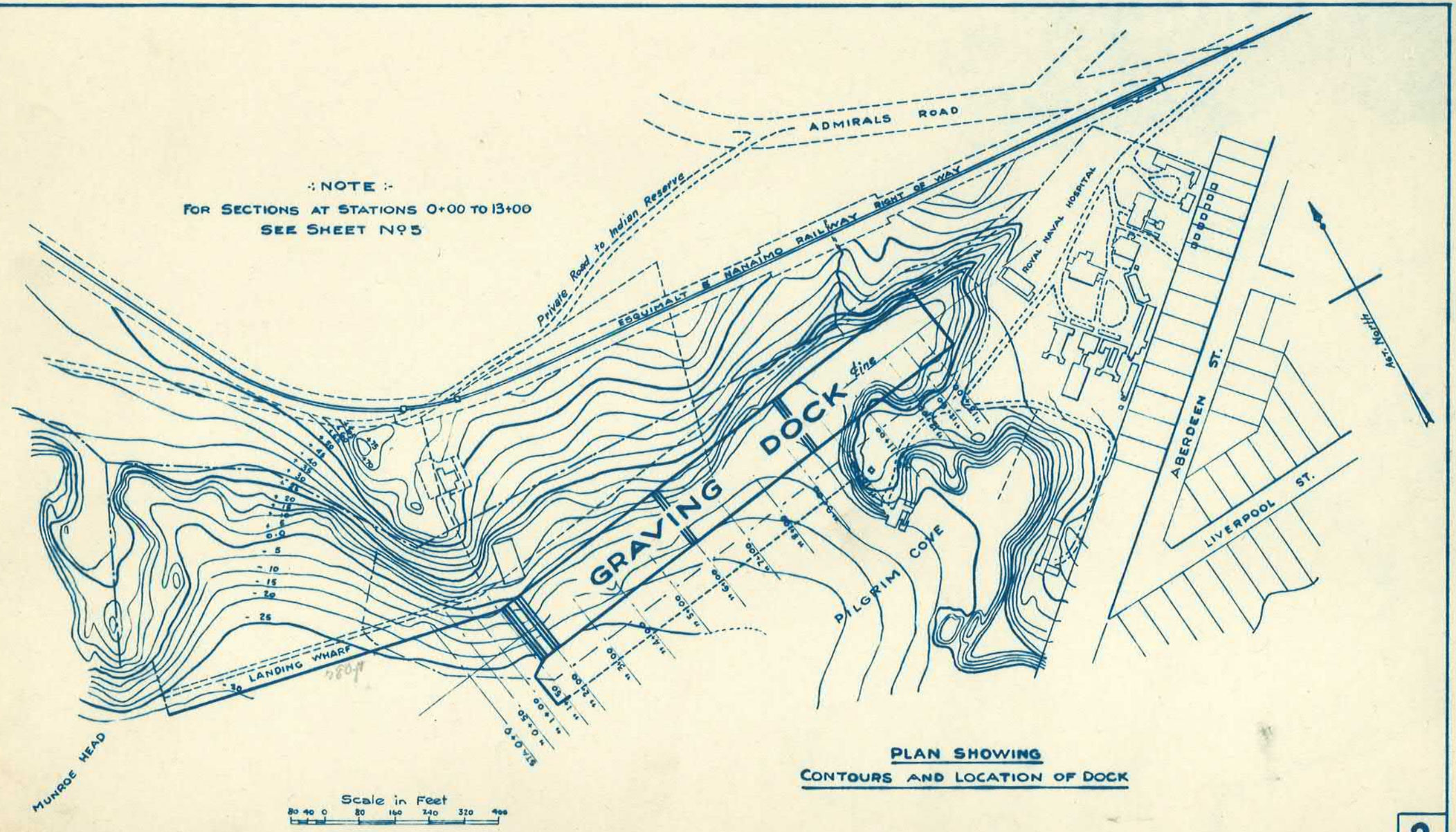
TOTAL LENGTH OF DOCK FROM Nº 1 BERTH	1186'-0"
TOTAL CLEAR INSIDE LENGTH WHEN FLOATING CAISSON IS IN Nº 1 BERTH	1173'-9"
TOTAL LENGTH OF DOCK FROM Nº 2 BERTH	1150'-0"
TOTAL CLEAR INSIDE LENGTH WHEN FLOATING CAISSON IS IN Nº 2 BERTH	1137'-9"
TOTAL CLEAR INSIDE LENGTH BETWEEN Nos 1 AND 3 BERTH	409'-6"
TOTAL CLEAR INSIDE LENGTH BETWEEN Nos 2 AND 3 BERTH	373'-6"
TOTAL CLEAR INSIDE LENGTH BETWEEN Nos 1 AND 4 BERTH	759'-6"
TOTAL CLEAR INSIDE LENGTH BETWEEN Nos 2 AND 4 BERTH	723'-6"
TOTAL CLEAR INSIDE LENGTH BETWEEN Nos 3 AND 4 BERTH	323'-6"
TOTAL CLEAR INSIDE LENGTH BETWEEN Nos 3 AND INNER END OF DOCK	737'-9"
TOTAL CLEAR INSIDE LENGTH BETWEEN Nº 4 BERTH AND INNER END OF DOCK	387'-9"
WIDTH OF DOCK AT ENTRANCE	135'-0"
WIDTH OF DOCK FLOOR AT BOTTOM	126'-0"
DEPTH OF WATER ON SILL AT L.W.O.S.T.	30'-0"
DEPTH OF WATER ON SILL AT H.W.O.S.T.	40'-0"
HEIGHT OF SILL ABOVE DOCK FLOOR	4'-6"
HEIGHT OF KELL ABOVE DOCK FLOOR	4'-5"

INDEX

SHEET Nº	DESCRIPTION	SHEET Nº	DESCRIPTION
1	Plan of Esquimalt Harbour	20	Cross Section 20-20 in front of Berth Nº4
2	Plan showing Contours and Location of Dock	21	Cross Section 21-21 showing Connecting Tunnel
3	Plan showing Borings	22	General Cross Section 22-22 showing 5-25 Ton Crane
4	Plan showing Railway Spur Line	23	Cross Section 23-23 through Entrance to Stairways
5	General Cross Sections	24	Elevation 24-24 showing junction of Landing Pier with Dock
6	Longitudinal Sections at Landing Wharf	25	Elevation 25-25 North Wall at Entrance
7	Key Plan	26	Elevation 26-26 through Berth Nº3
8	Enlarged Plan at Dock Entrance	27	Elevation 27-27 through Berth Nº4
9	Enlarged Plan at Berth Nº 3	28	Elevation 28-28 at Inner End
10	Enlarged Plan at Berth Nº 4	29	Cross Section 29-29 through Landing Wharf showing 100 Ton Derrick
11	Enlarged Plan at Inner End	30	Detail of Power House
12	Cross Section 12-12 at Berth Nº1	31	Power House Section 31-31 (Looking East) (Looking North)
13	Cross Section 13-13 at Berth Nº2	32	Elevation 32-32 Wharf at South side of Entrance
14	Cross Section 14-14, showing Manholes & Capstans	33	Plan and Details of Cribs, for Landing Wharf
15	General Cross Section 15-15	34	Details of Altar Ladders
16	Cross Section 16-16 through Light Openings	35	Details of Bollards
17	Cross Section 17-17 in front of Berth Nº 3	36	Details of Keel Blocks
18	Cross Section 18-18 at back of Berth Nº 3	37	Details of Dolphins
19	Cross Section 19-19 through Dock & Pump House	38	Plan of Caissons with Elevation & Cross Section



ESQUIMALT GRAVING DOCK 1



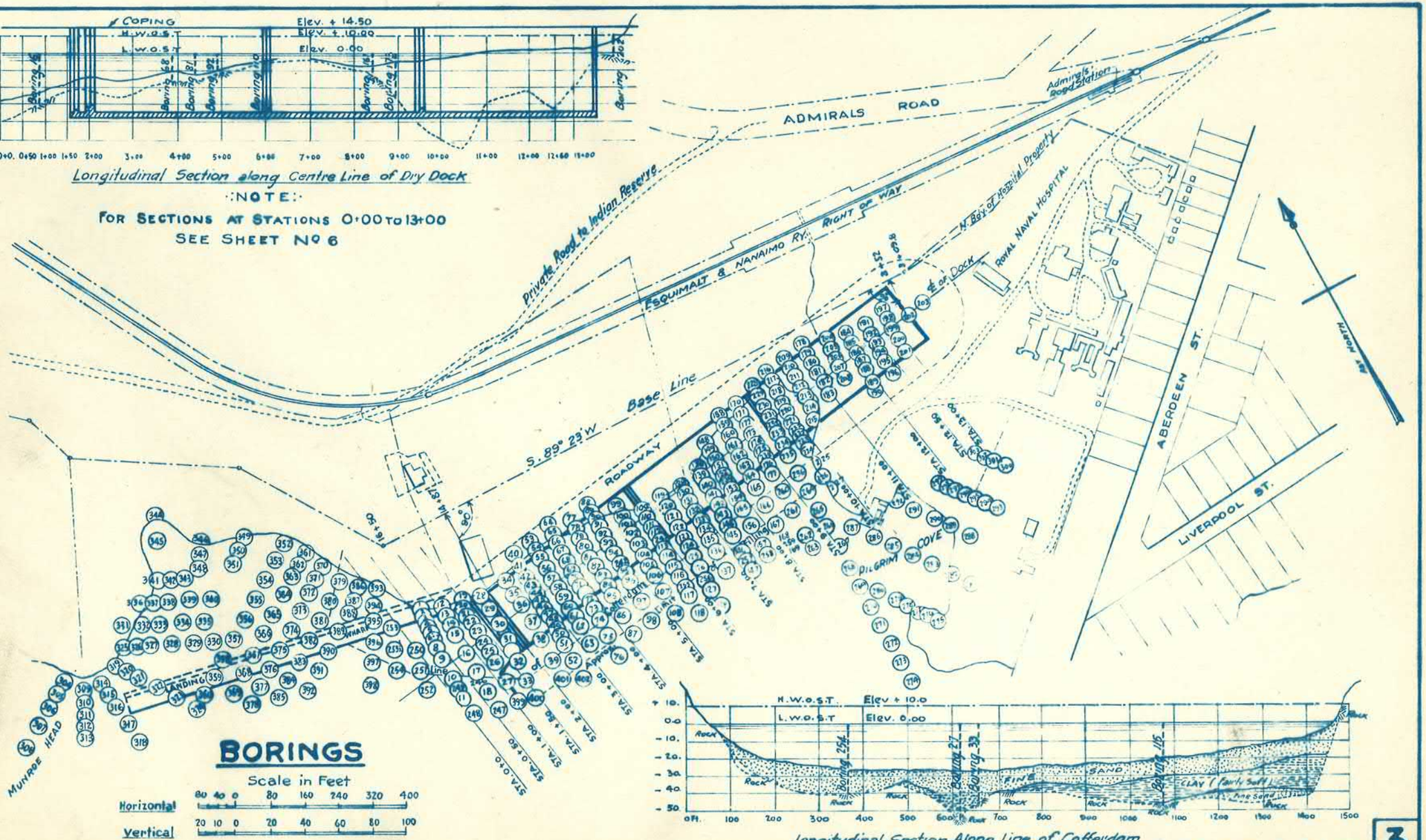
PLAN SHOWING
CONTOURS AND LOCATION OF DOCK

ESQUIMALT GRAVING DOCK 2

Longitudinal Section along Centre Line of Dry Dock

::NOTE::

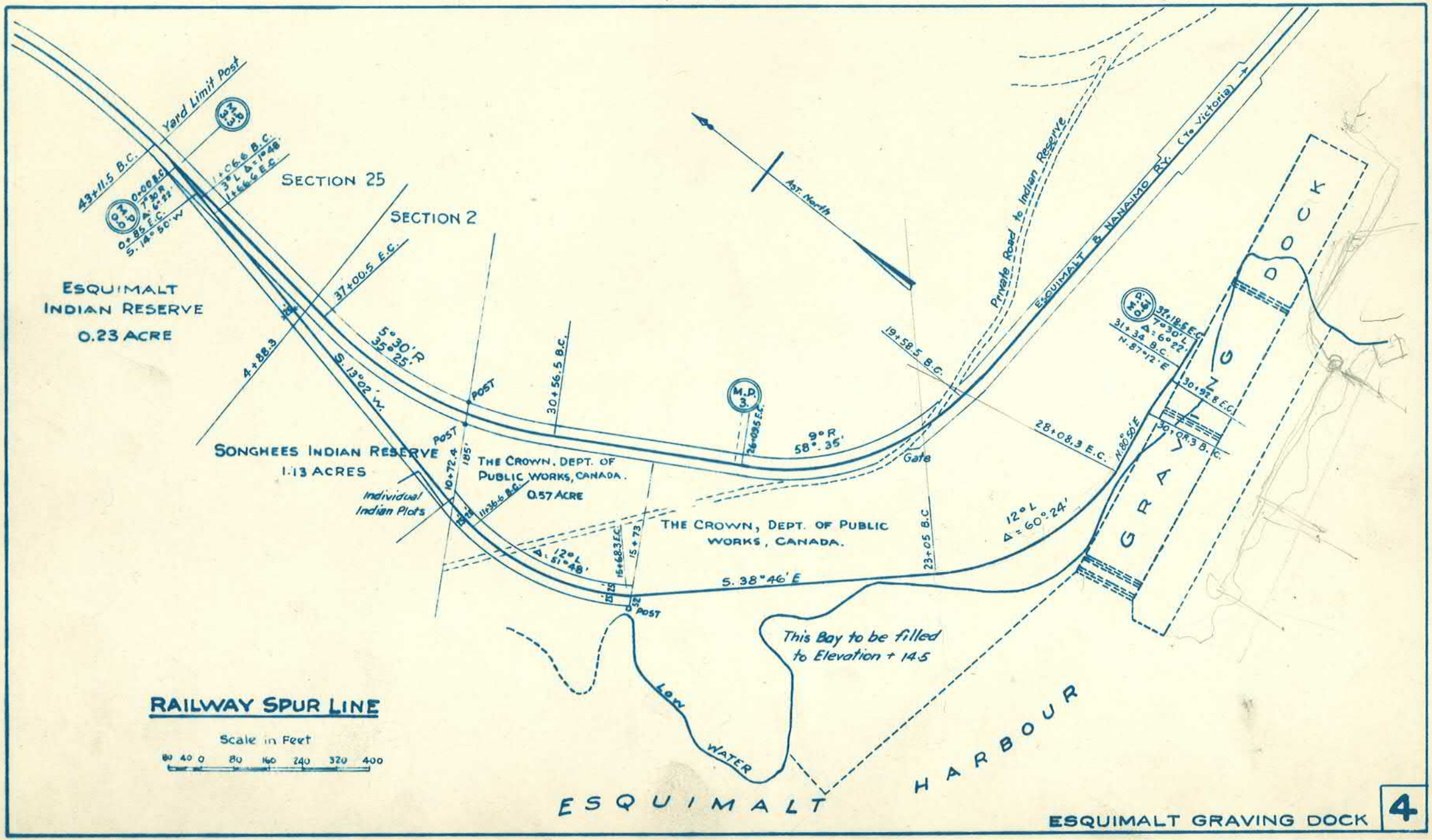
FOR SECTIONS AT STATIONS 0+00 TO 13+00
SEE SHEET No 6



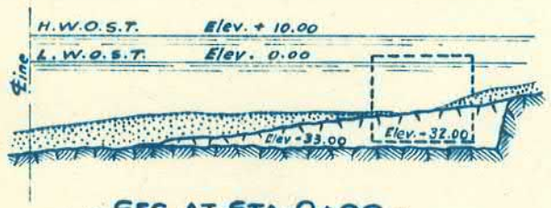
Longitudinal Section Along Line of Cofferdam

ESQUIMALT GRAVING DOCK

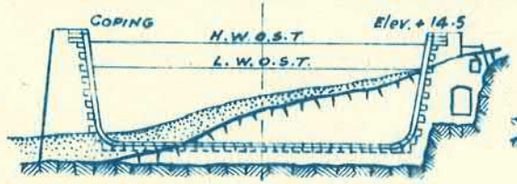
3



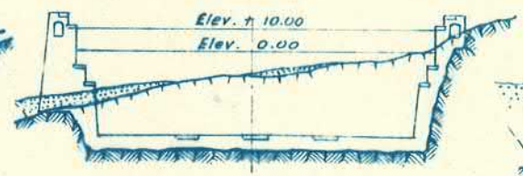
ESQUIMALT GRAVING DOCK 4



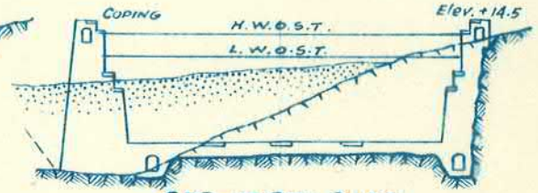
- SEC. AT STA. 0+00 -



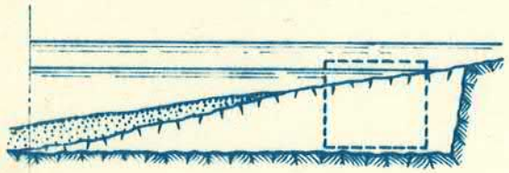
- SEC. AT STA. 2+00 -



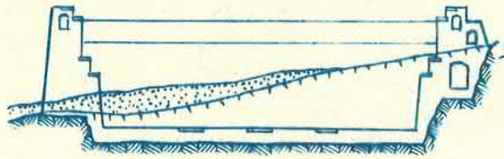
- SEC. AT STA. 5+00 -



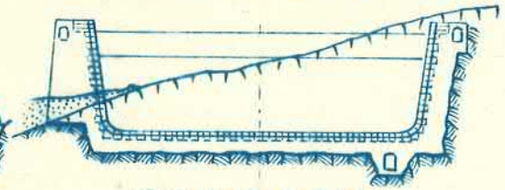
- SEC. AT STA. 9+00 -



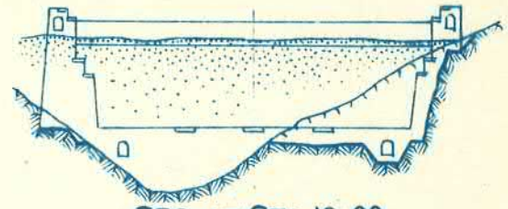
- SEC AT STA 0+50 -



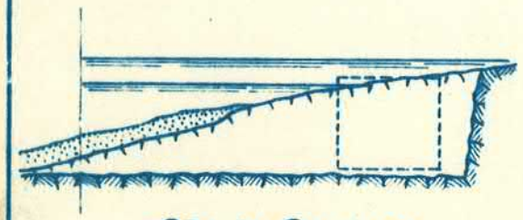
- SEC. AT STA. 3+00 -



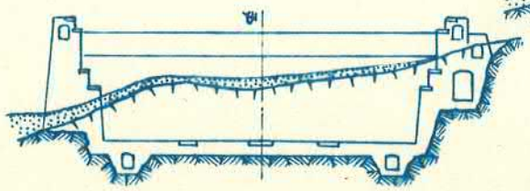
- SEC. AT STA. 6+00 -



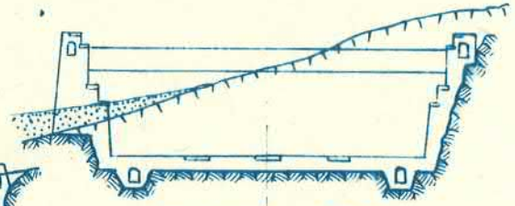
- SEC. AT STA. 10+00 -



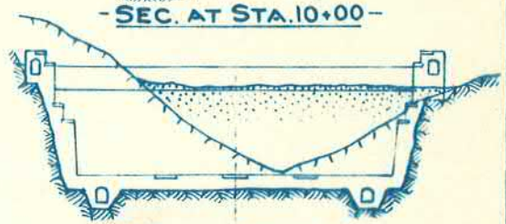
- SEC. AT STA. 1+00 -



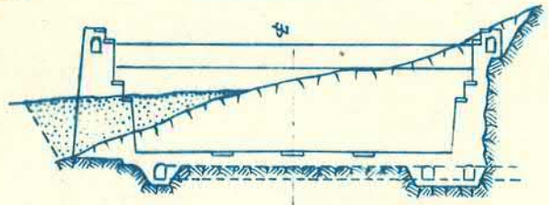
- SEC. AT STA. 4+00 -



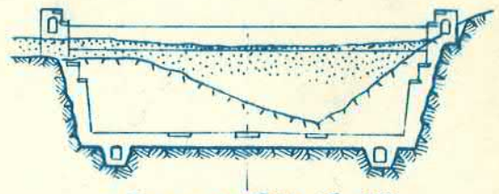
- SEC. AT STA. 7+00 -



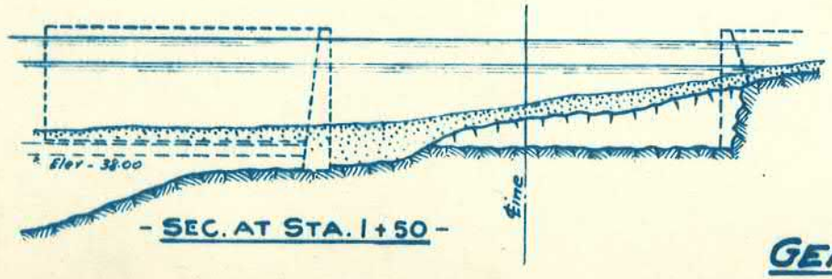
- SEC. AT STA. 11+00 -



- SEC. AT STA. 8+00 -

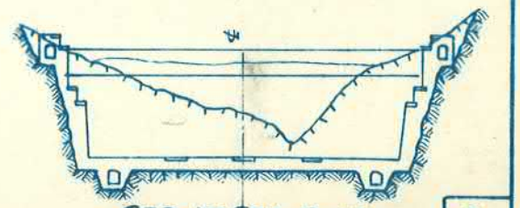


- SEC. AT STA. 12+00 -



- SEC. AT STA. 1+50 -

- NOTE -
For location of these Sections
See Sheet No 2



- SEC. AT STA. 13+00 -

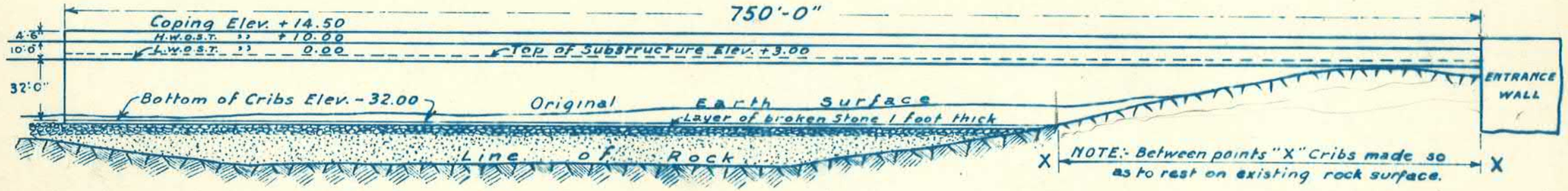
GENERAL CROSS SECTIONS

ESQUIMALT GRAVING DOCK

5

LONGITUDINAL SECTION - REAR OF LANDING WHARF

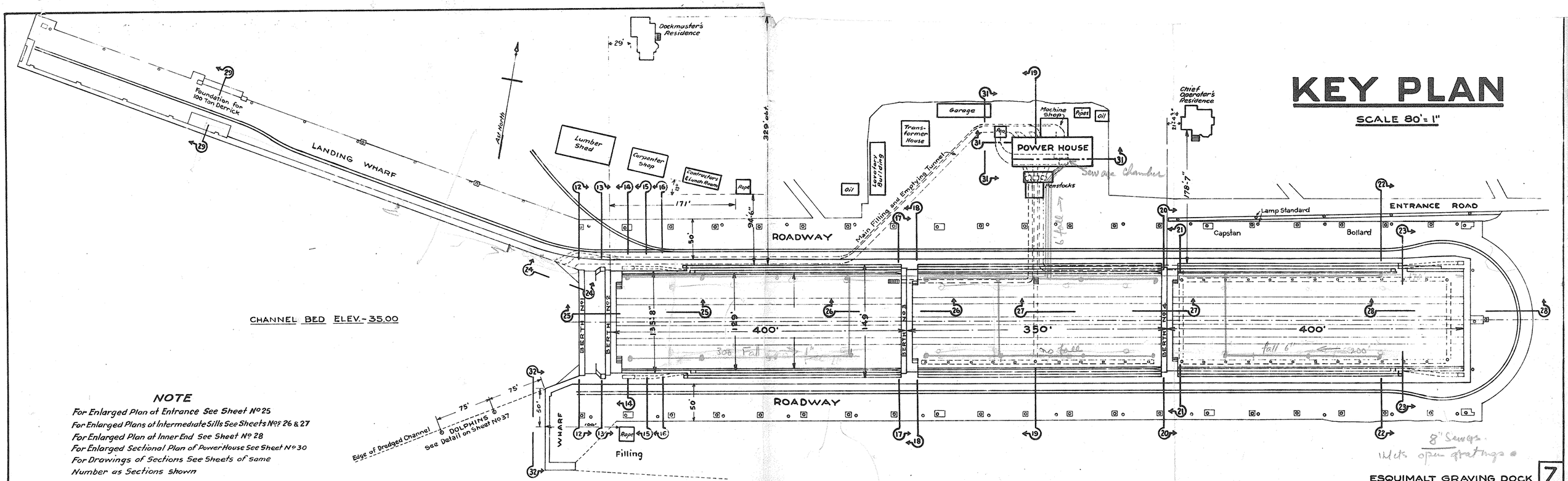
Scale:- 70 feet to One inch



LONGITUDINAL SECTION - FACE OF LANDING WHARF

KEY PLAN

SCALE 80'= 1"



NOTE

For Enlarged Plan at Entrance See Sheet No 25
For Enlarged Plans at Intermediate Sills See Sheets Nos 26 & 27
For Enlarged Plan at Inner End See Sheet No 28
For Enlarged Sectional Plan of Power House See Sheet No 30
For Drawings of Sections See Sheets of same Number as Sections Shown

Thursday May 22nd.

Dear Mr Morton,

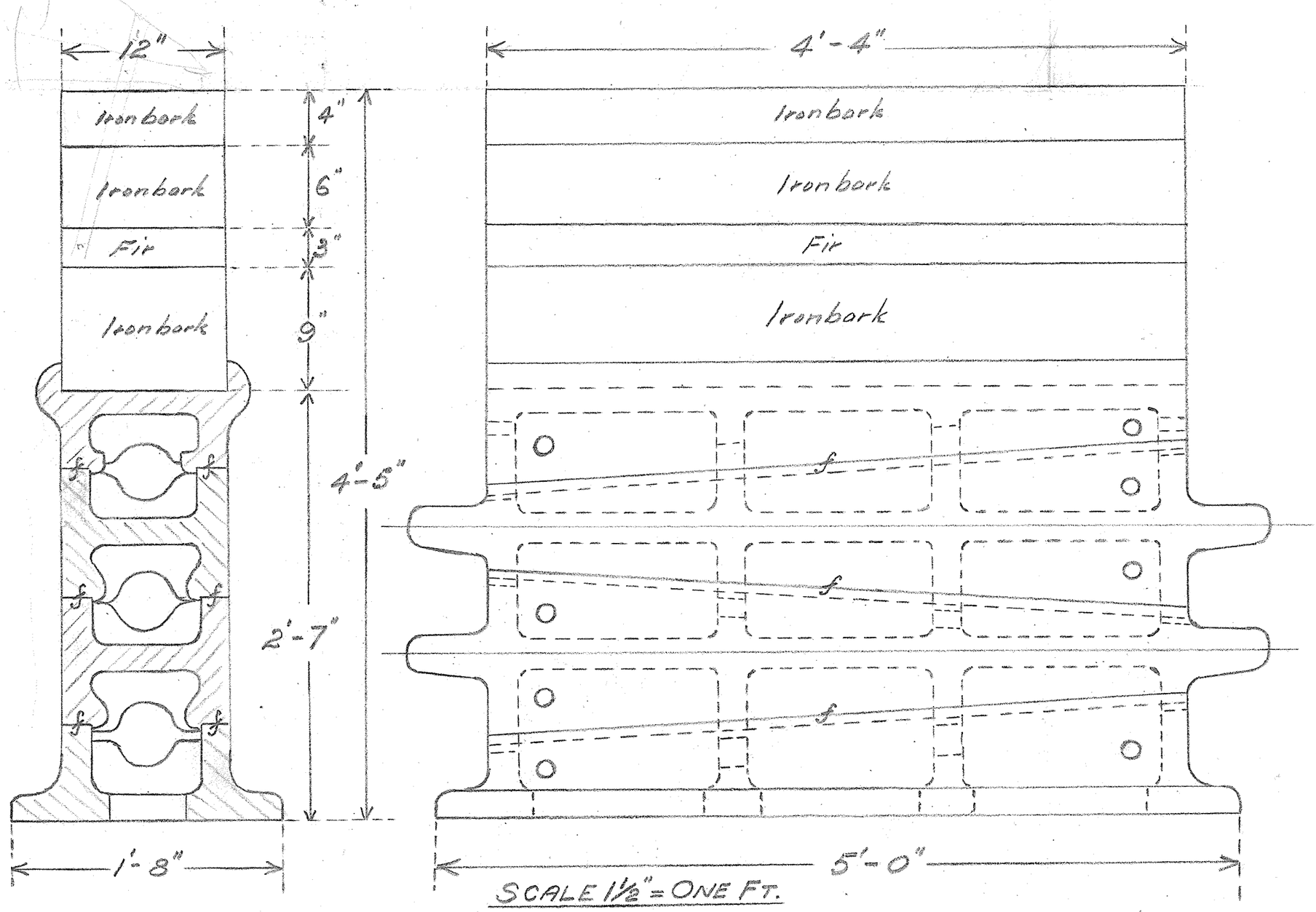
I got this ready for you in case it might be of use, it shows the type of block we should have for it would fit anywhere with our existing blocks, having the same strength and uniform crushability.

O.R.P.

ESQUIMALT DRYDOCK

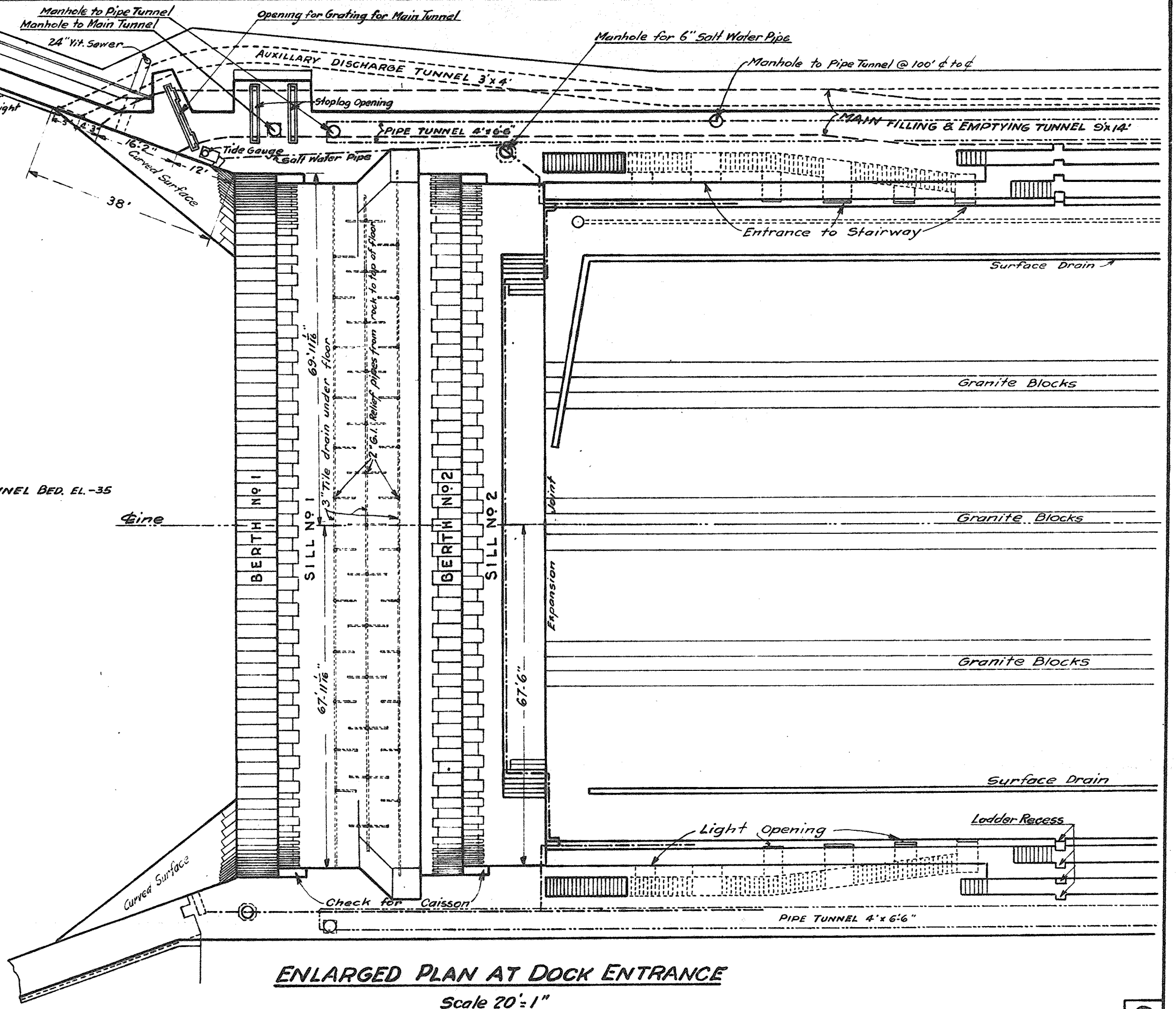
SKETCH

SHOWING PROPOSED DOUBLE WEDGE BLOCK



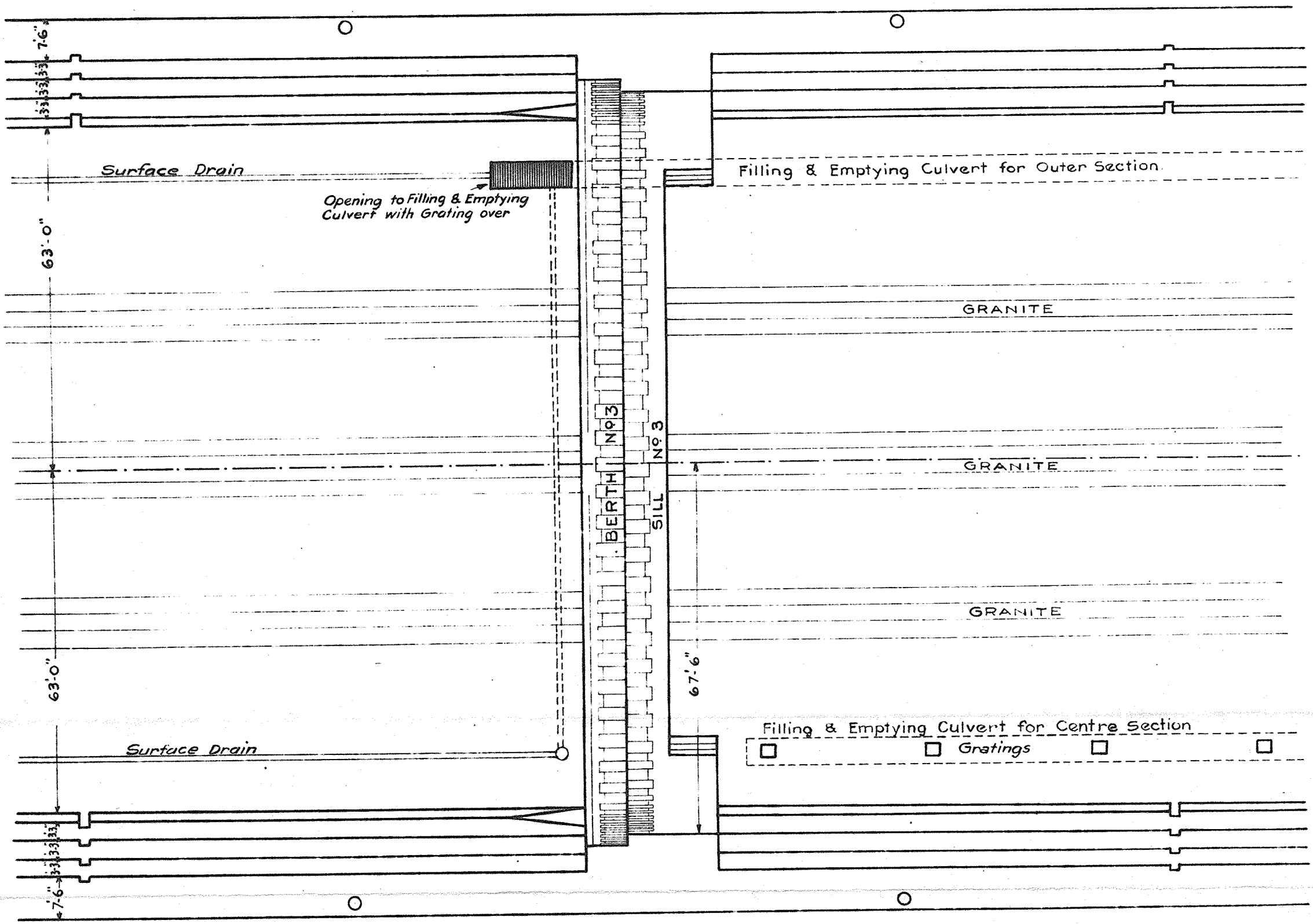
SCALE 1½" = ONE FT.

O.R. Parker.
May 21st 1941.



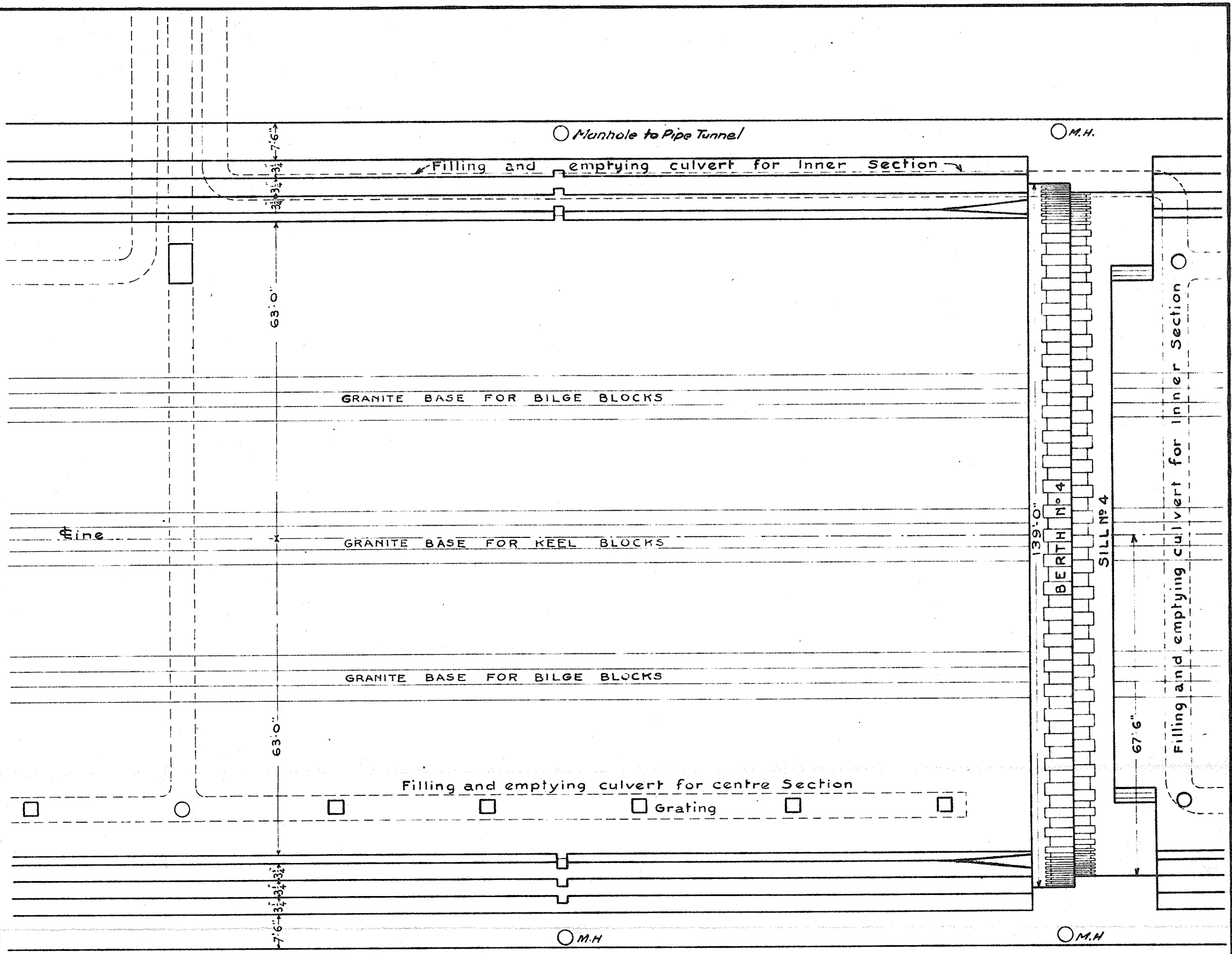
ENLARGED PLAN AT DOCK ENTRANCE

Scale 20'=1"



ENLARGED PLAN AT BERTH No 3

Scale 20'=1"



ENLARGED PLAN AT BERTH Nº 4

Scale 20' = 1"

Bollard

Lamp Standard

Bollard

Lamp Standard

Capstan

Track for 5.25 Ton Crane

Manhole to Pipe Tunnel

Manhole to Pipe Tunnel

Stanchions 3' high

7'-6"

3¼"

3¼"

3¼"

Lamp Standard

Filling and Emptying Culvert for Inner Section

Gratings over Openings to Emptying & Filling Culvert

63'-0"

GRANITE

Line

GRANITE

GRANITE

63'-0"

30'

30'

Manhole to Filling & Emptying Culvert

Lamp Standard

Capstan

Lamp Standard

3¼"

3¼"

3¼"

7'-6"

Manhole to Pipe Tunnel

Manhole to Pipe Tunnel

Toe of Slope

Bollard

Lamp Standard

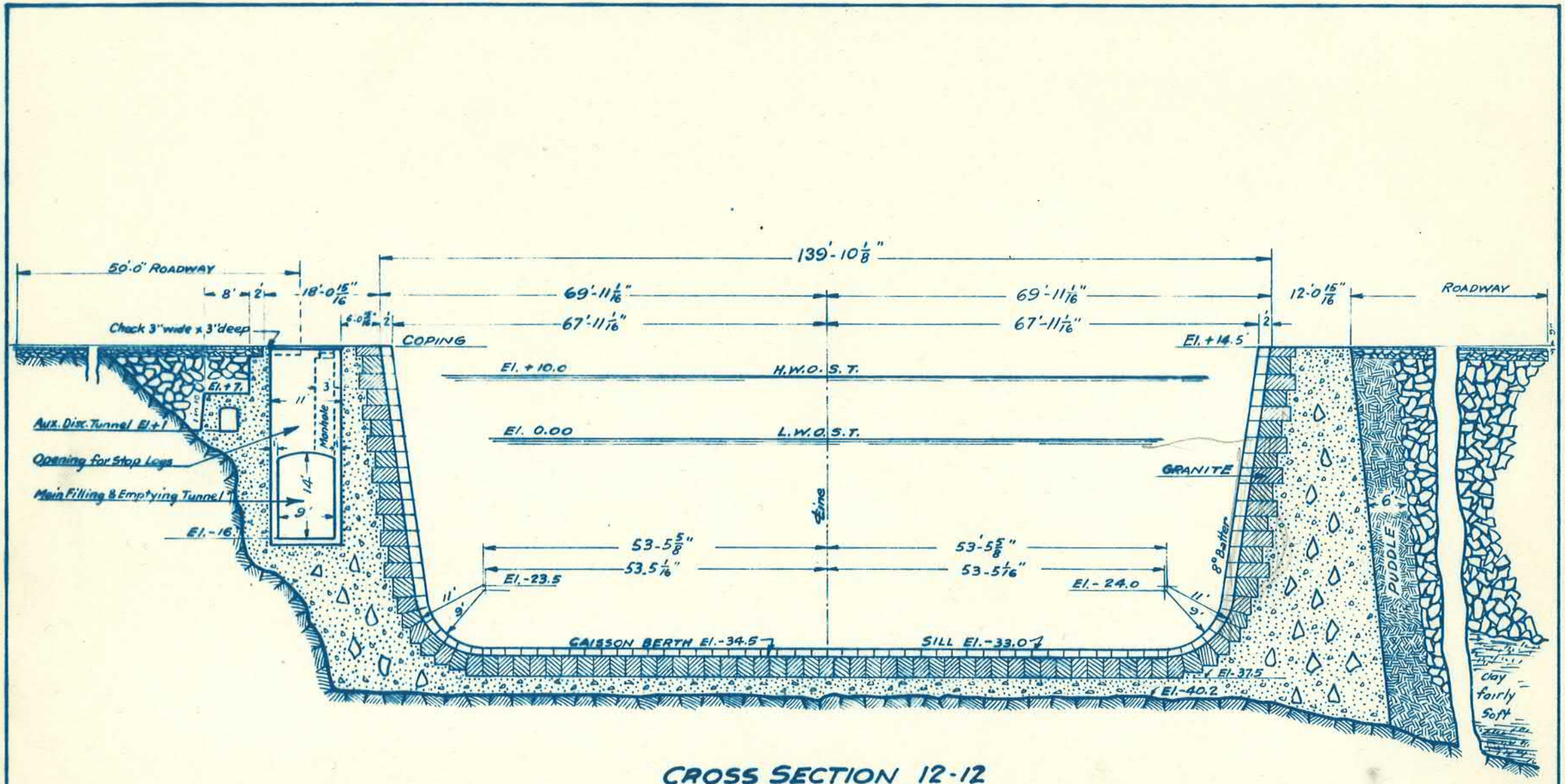
Bollard

Lamp Standard

Capstan

ENLARGED PLAN AT INNER END

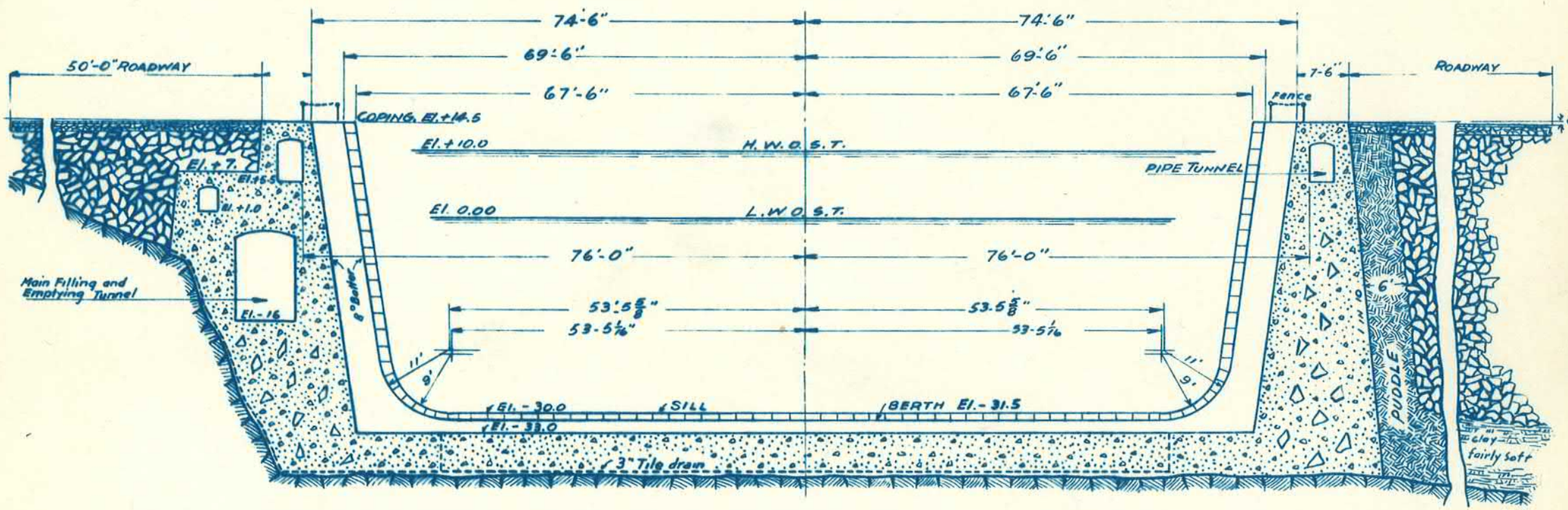
Scale: 20' = 1"



CROSS SECTION 12-12

AT BERTH NO 1

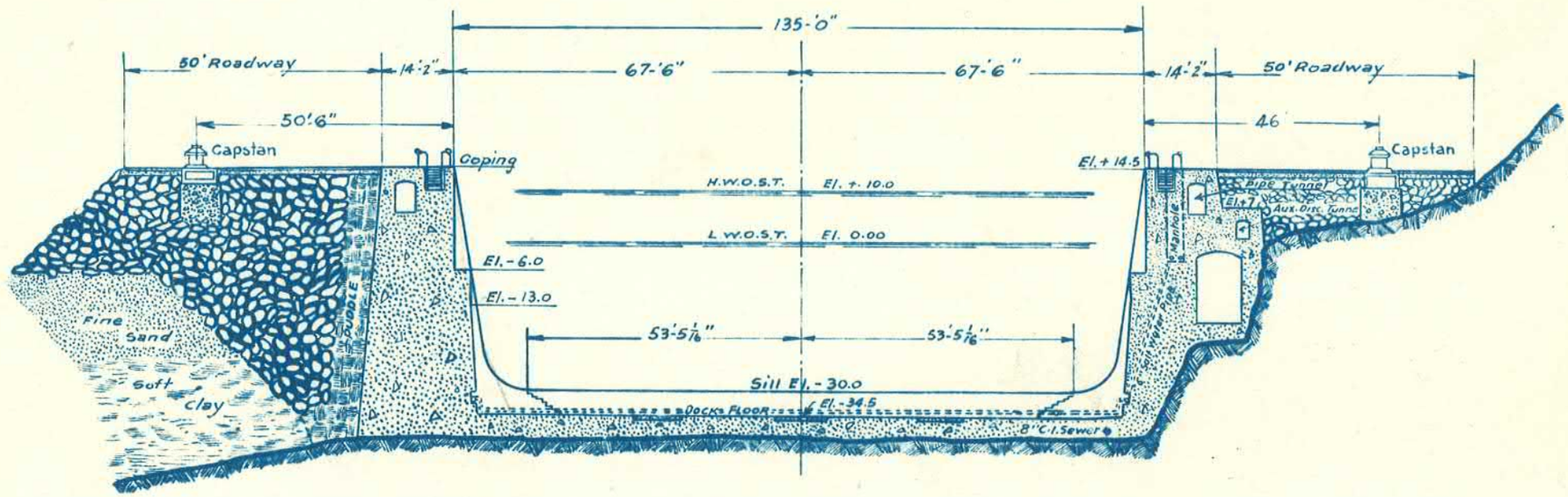
Scale 20=1"



CROSS SECTION 13-13

AT BERTH No 2

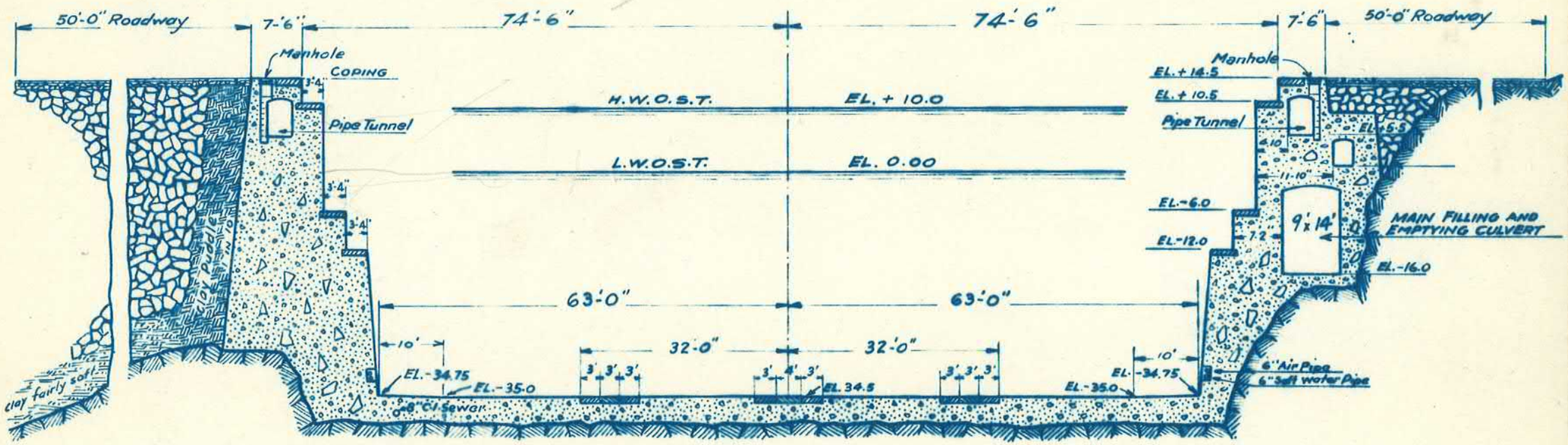
Scale 20'=1"



CROSS SECTION 14-14

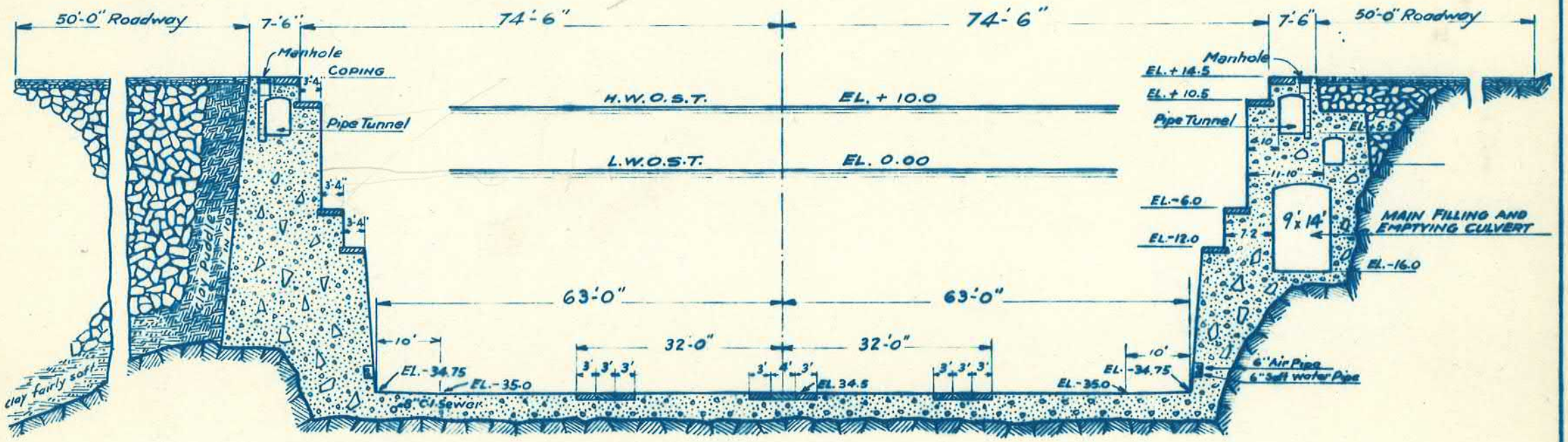
SHOWING MANHOLES AND CAPSTANS

Scale 30'=1"



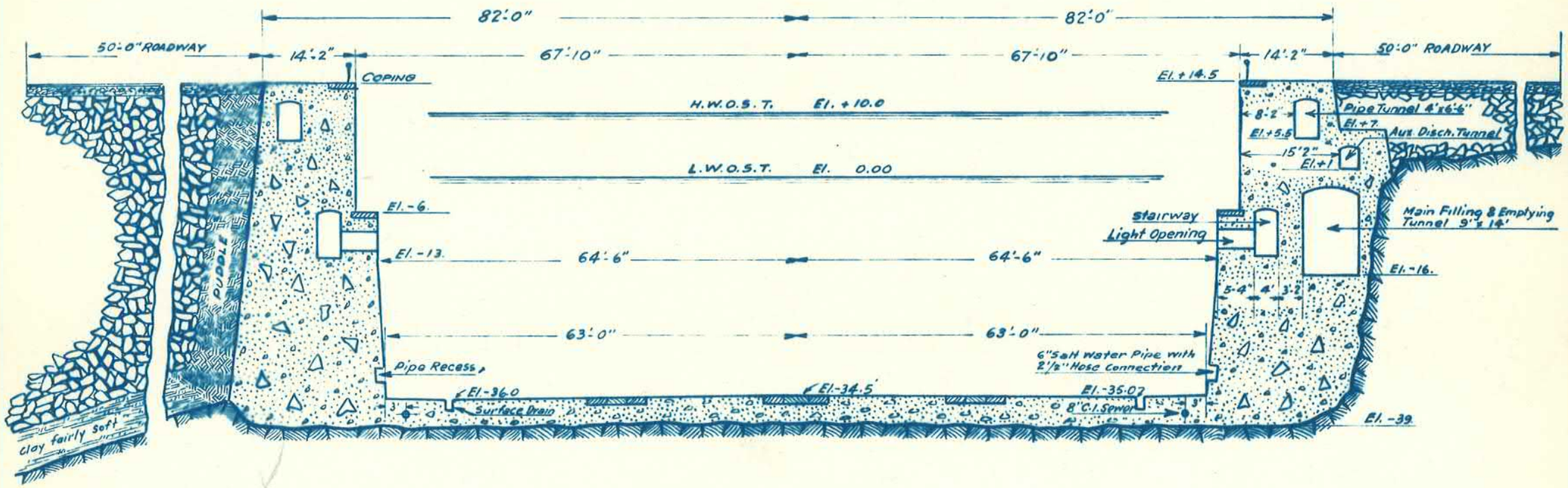
GENERAL CROSS SECTION 15-15

Scale 20' = 1"



GENERAL CROSS SECTION 15-15

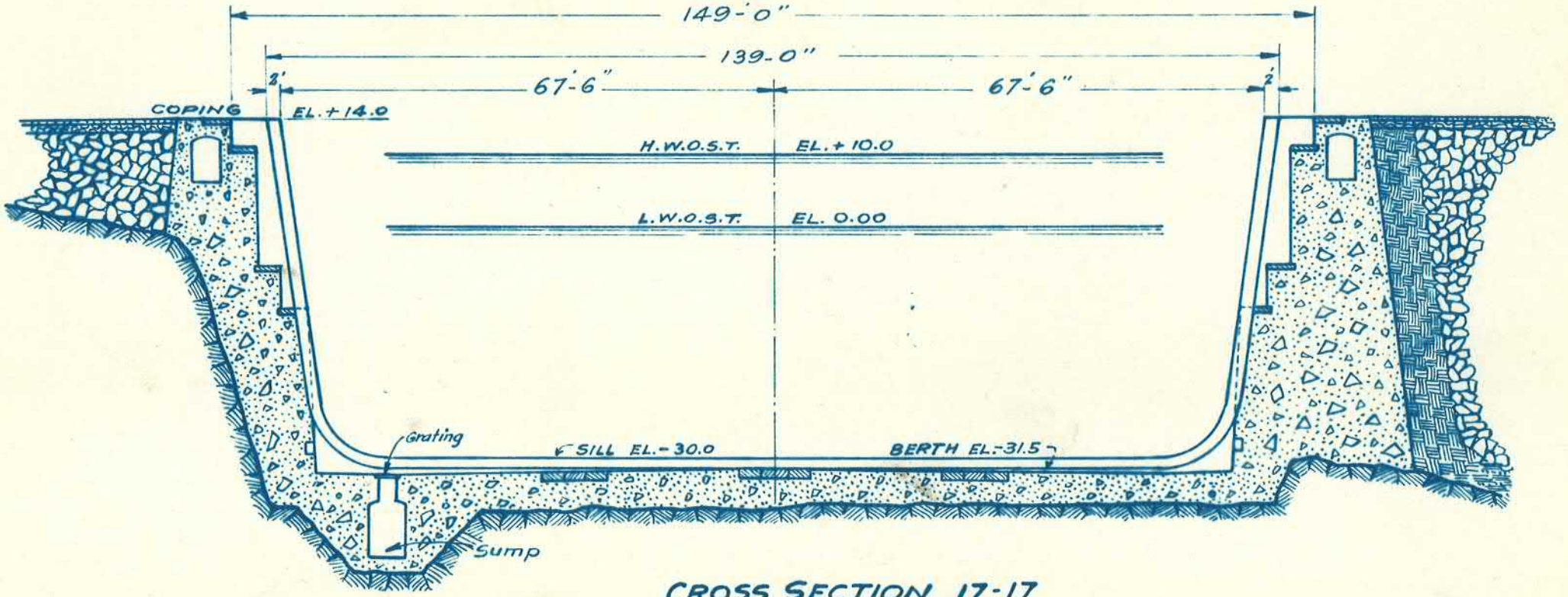
Scale 20'=1"



CROSS SECTION 16-16

THROUGH LIGHT OPENINGS

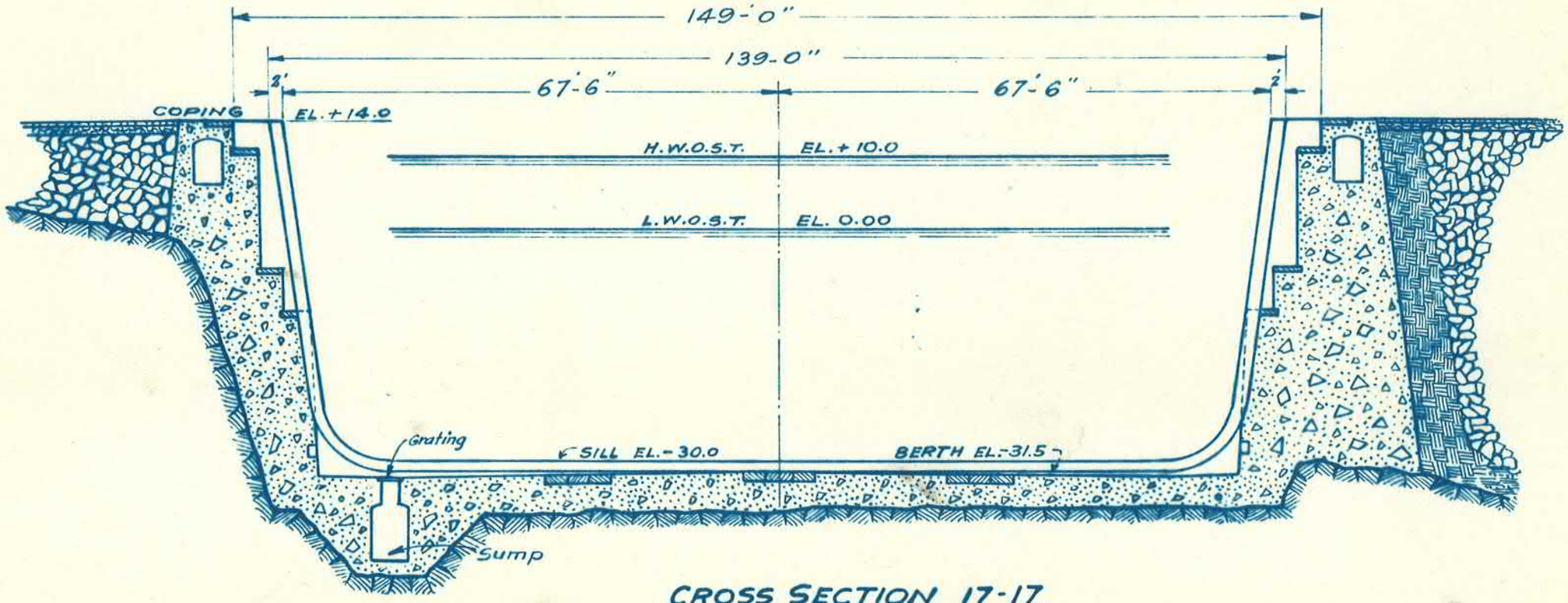
Scale 20'=1"



CROSS SECTION 17-17

IN FRONT OF BERTH No 3

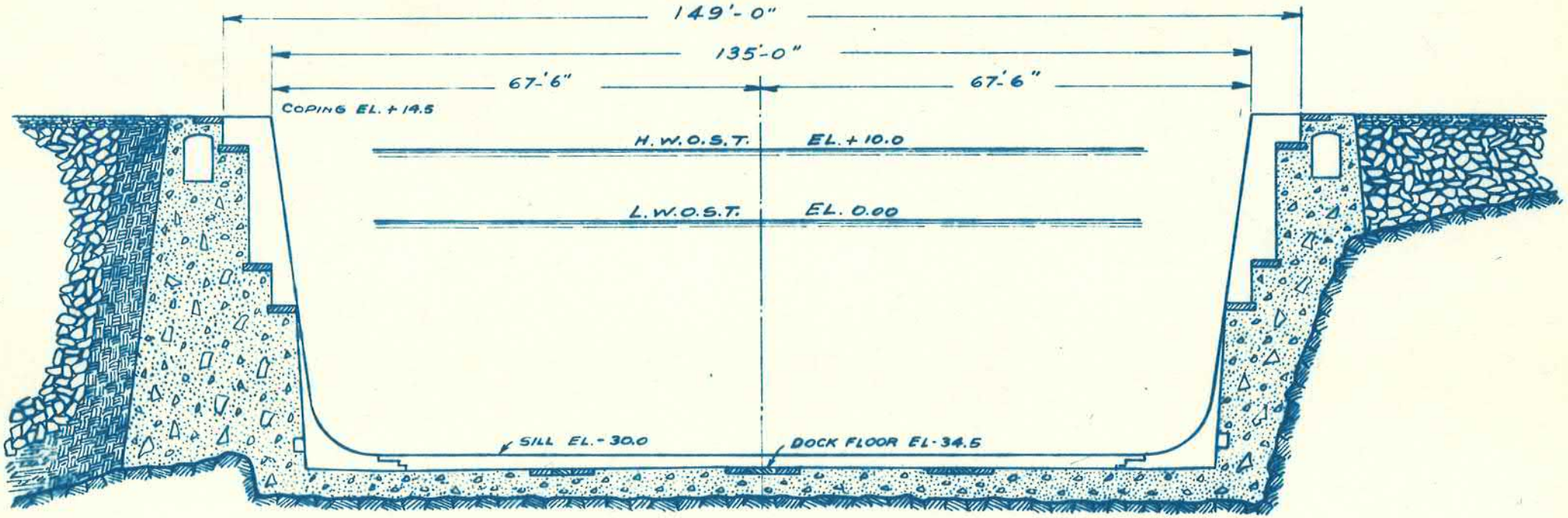
Scale 20' = 1"



CROSS SECTION 17-17

IN FRONT OF BERTH No 3

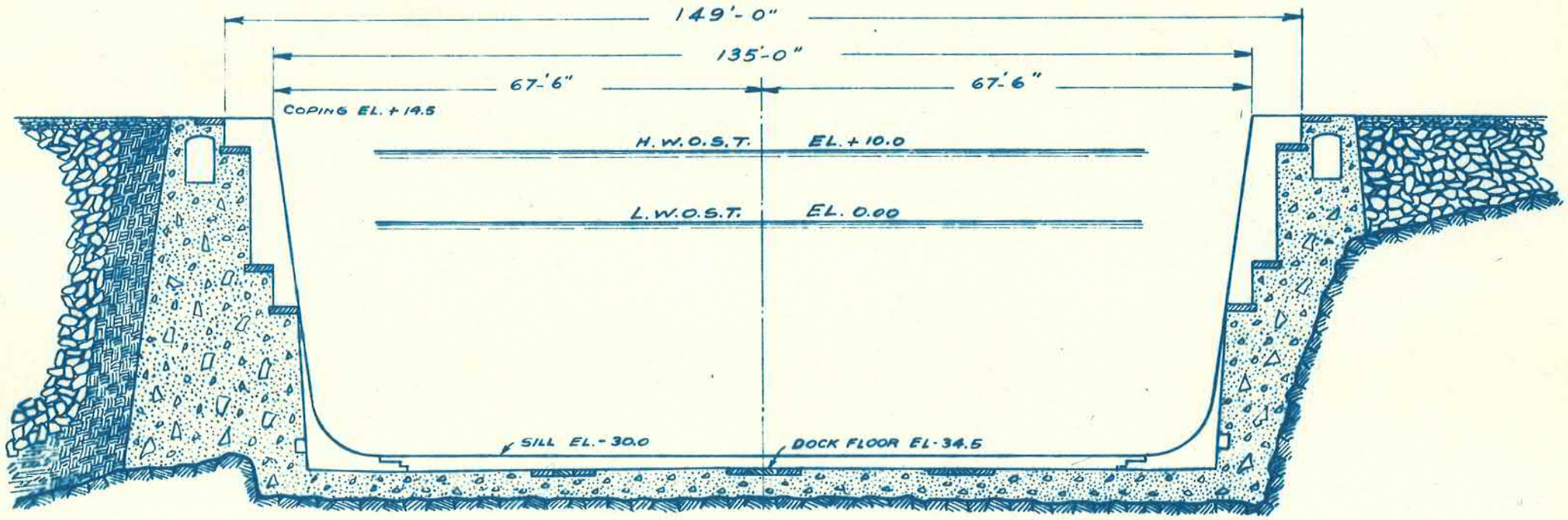
Scale 20'=1"



CROSS SECTION 18-18

AT BACK OF BERTH Nº 3

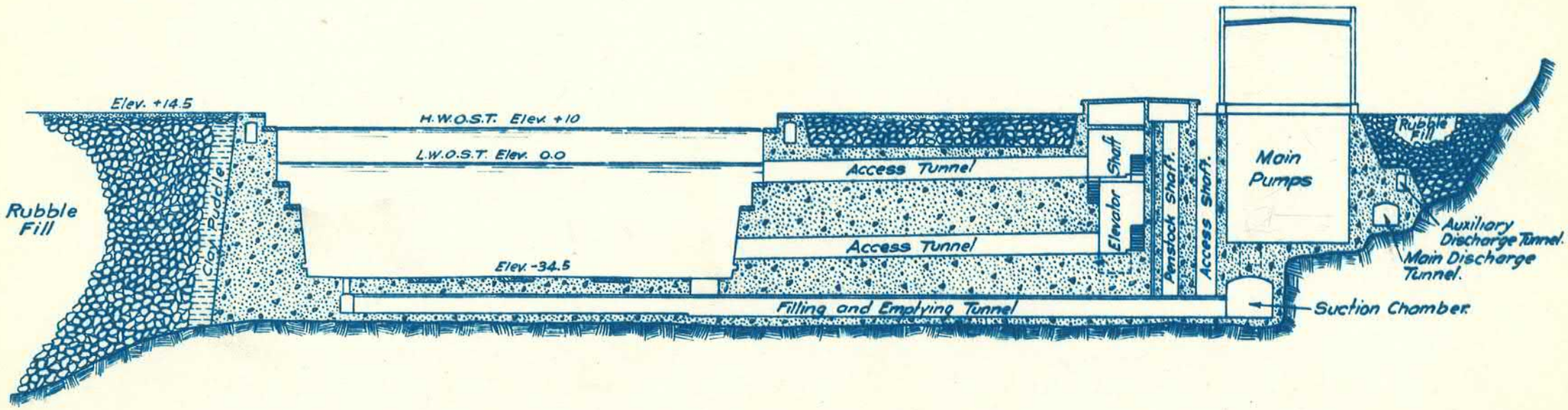
Scale 20'=1"



CROSS SECTION 18-18

AT BACK OF BERTH No 3

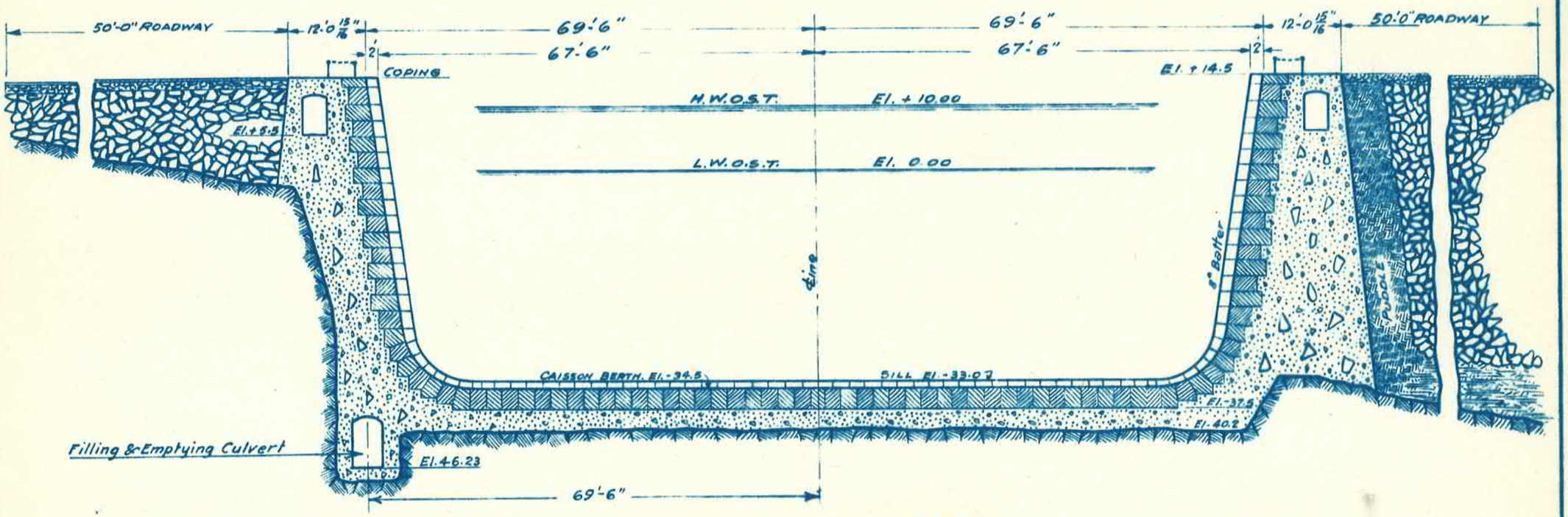
Scale 20'=1"



CROSS SECTION 19-19

THROUGH DOCK AND PUMP HOUSE

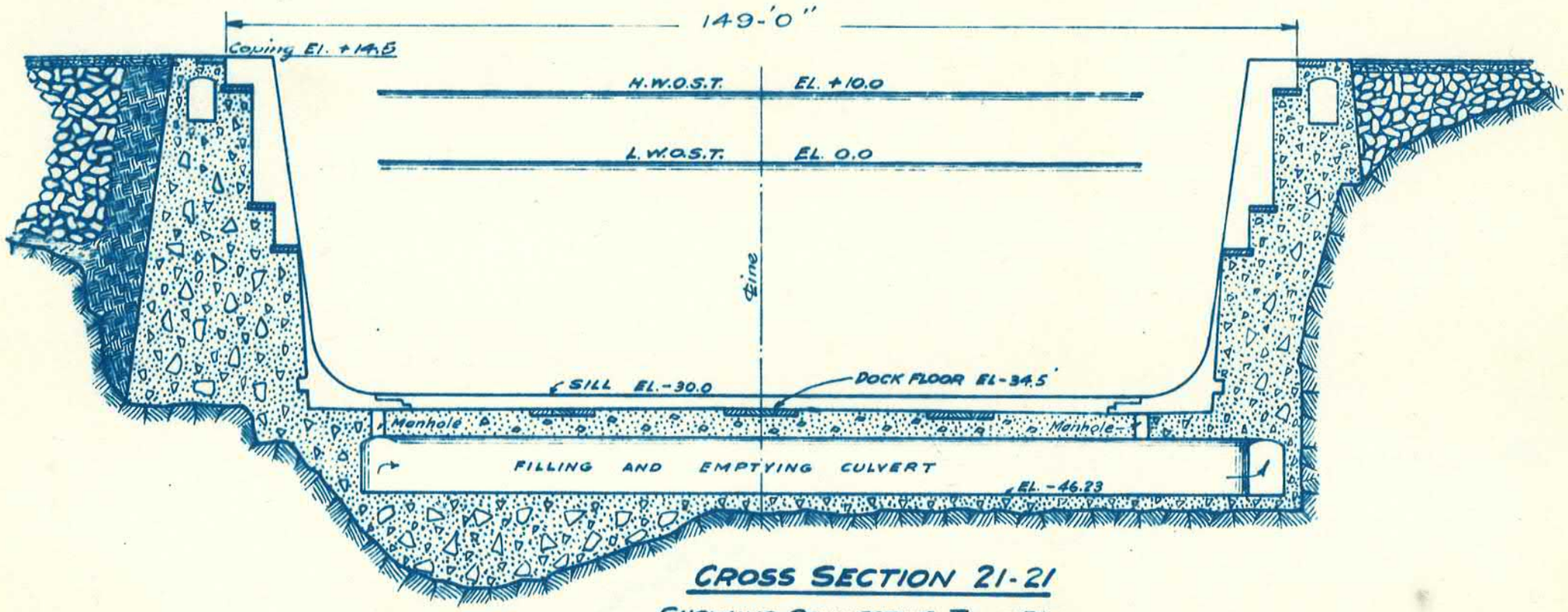
Scale 40' = 1"



CROSS SECTION 20-20

IN FRONT OF BERTH Nº 4

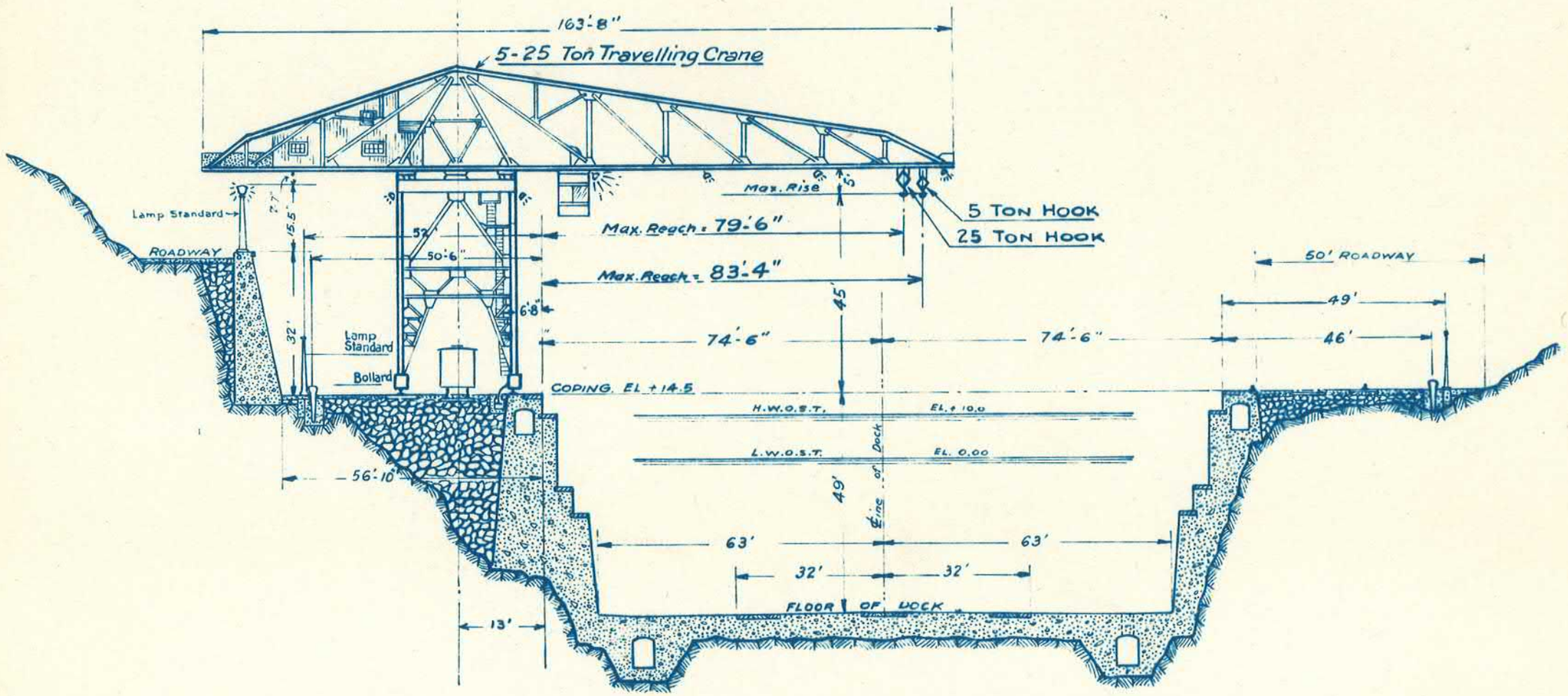
Scale 20' = 1"



CROSS SECTION 21-21

SHOWING CONNECTING TUNNEL

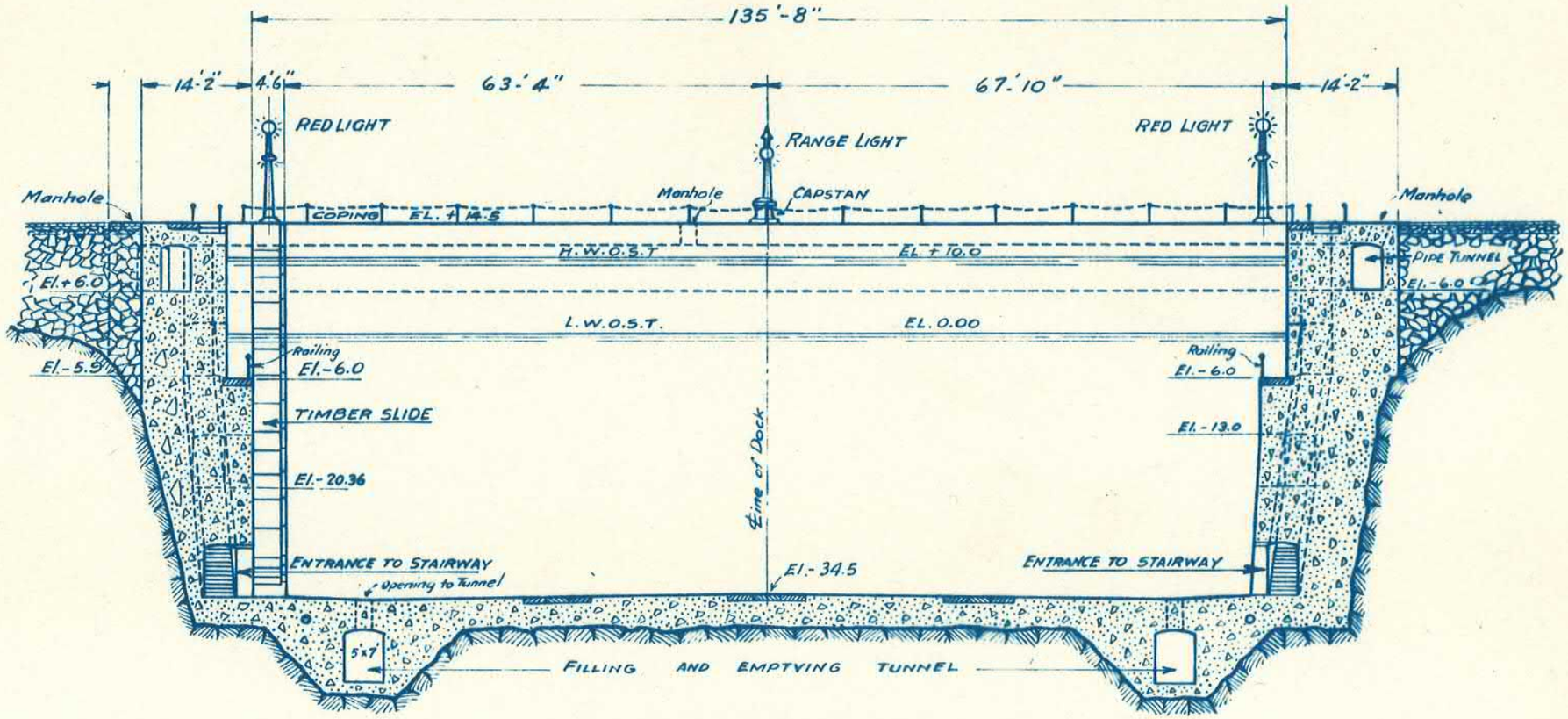
Scale 20' = 1"



GENERAL CROSS SECTION 22-22

SHOWING 5-25 TON CRANE

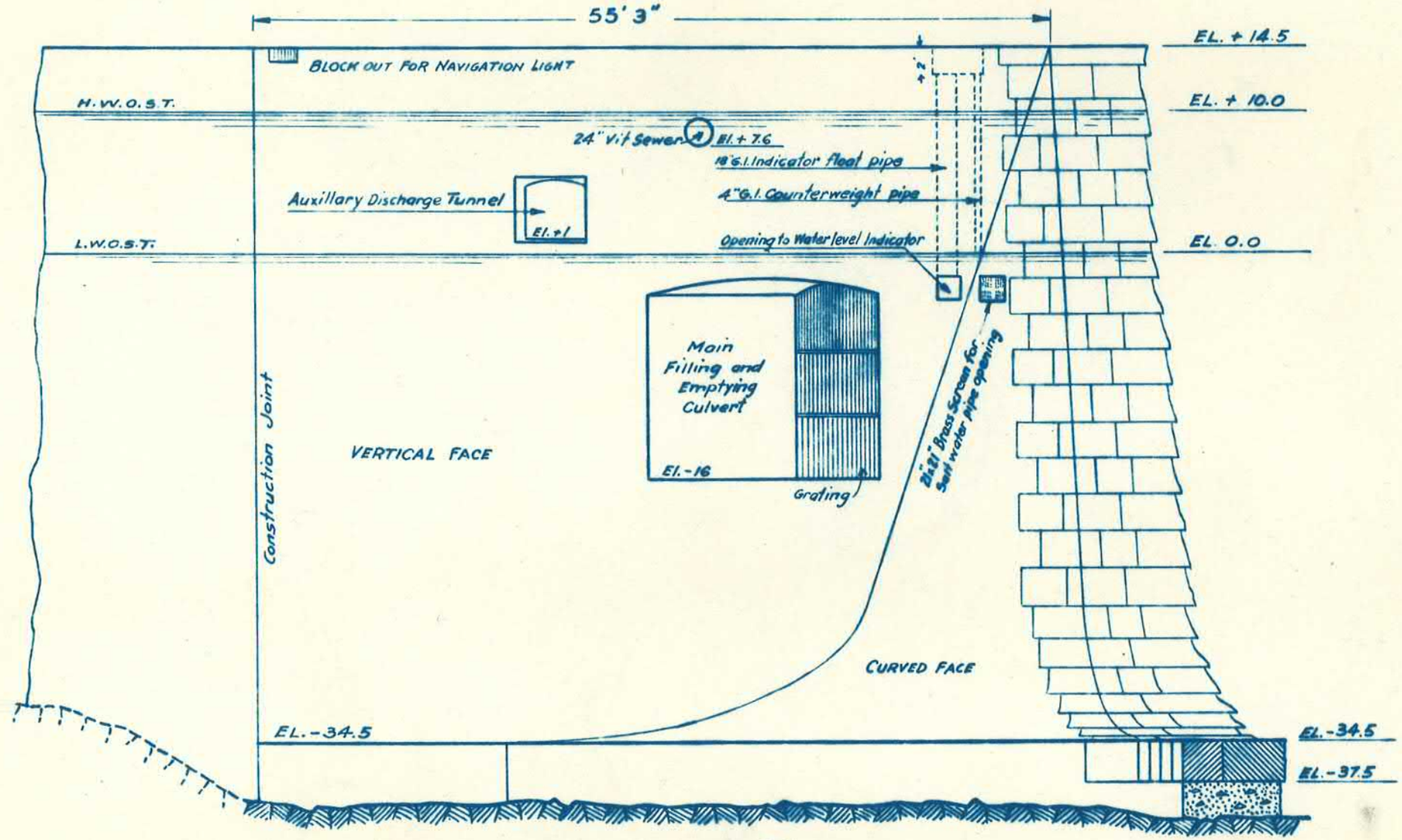
Scale 30'=1"



CROSS SECTION 23-23

THROUGH ENTRANCE TO STAIRWAYS "INNER END"

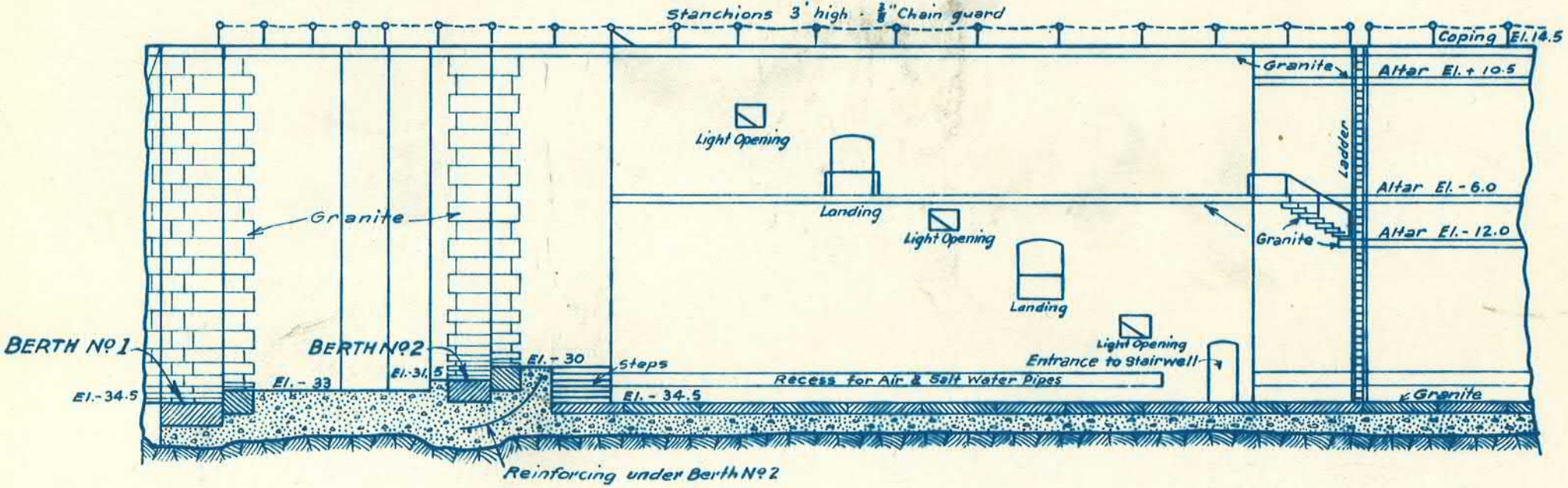
Scale 20' = 1'



ELEVATION 24-24

SHOWING JUNCTION OF LANDING PIER WITH DOCK

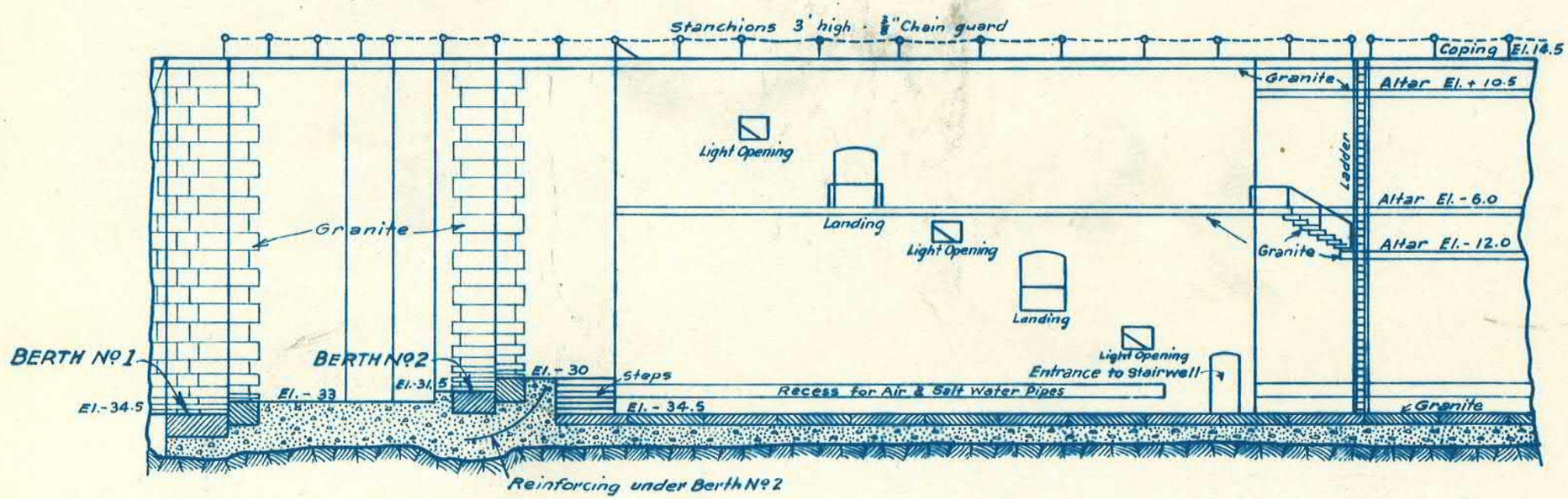
Scale 20'=1"



ELEVATION 25-25

NORTH WALL AT ENTRANCE

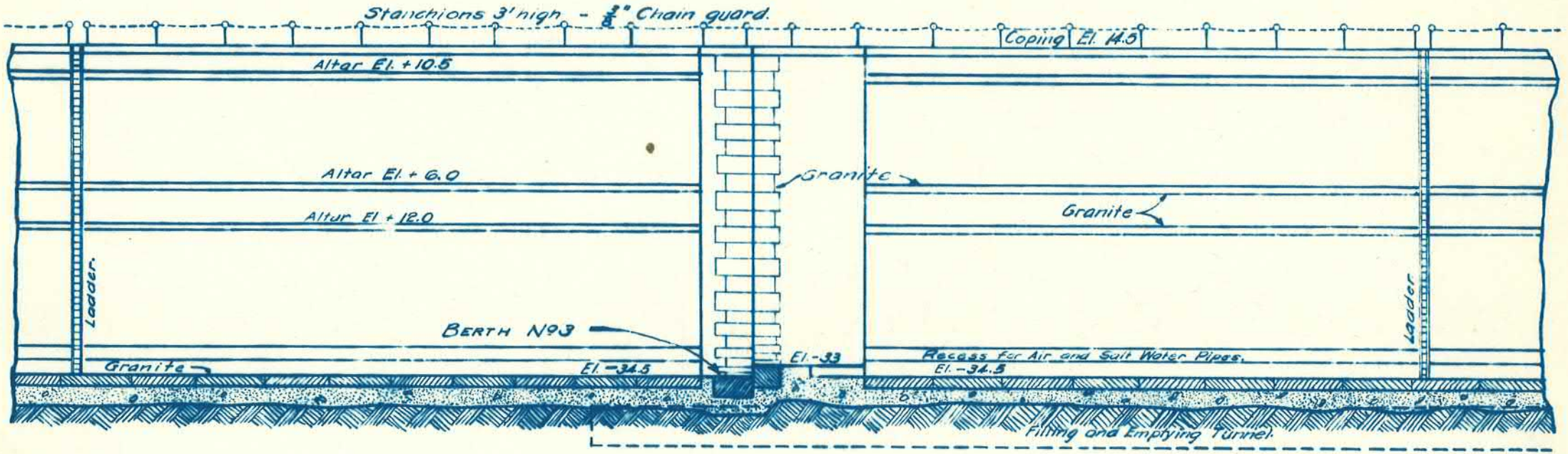
Scale 20' = 1"



ELEVATION 25-25

NORTH WALL AT ENTRANCE

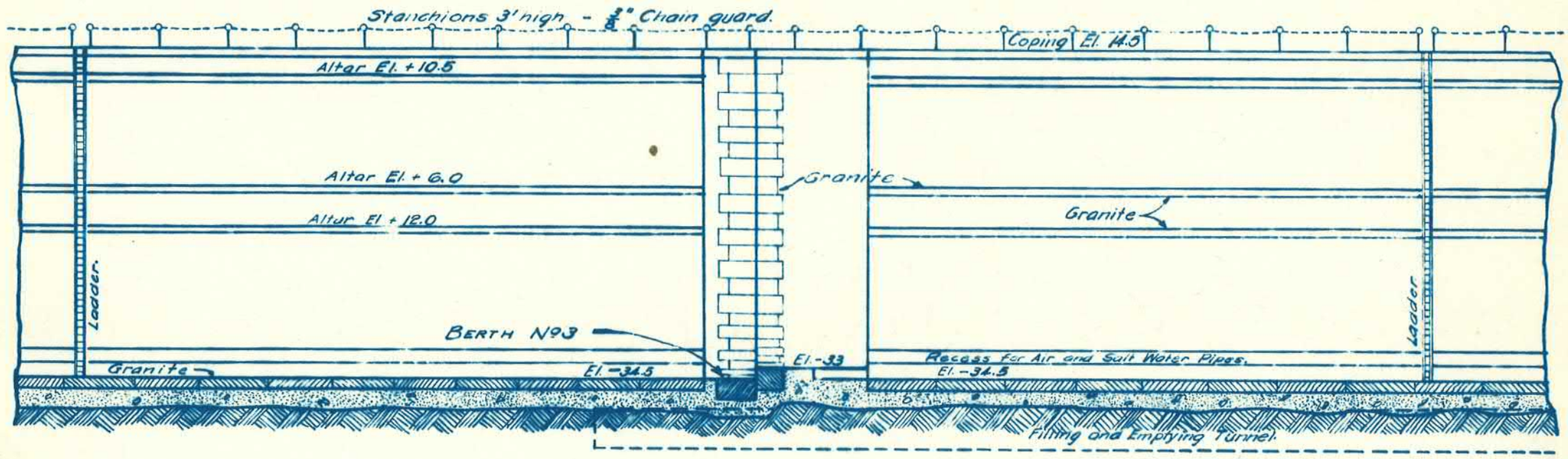
Scale 20' = 1"



ELEVATION 26-26

THROUGH BERTH No 3

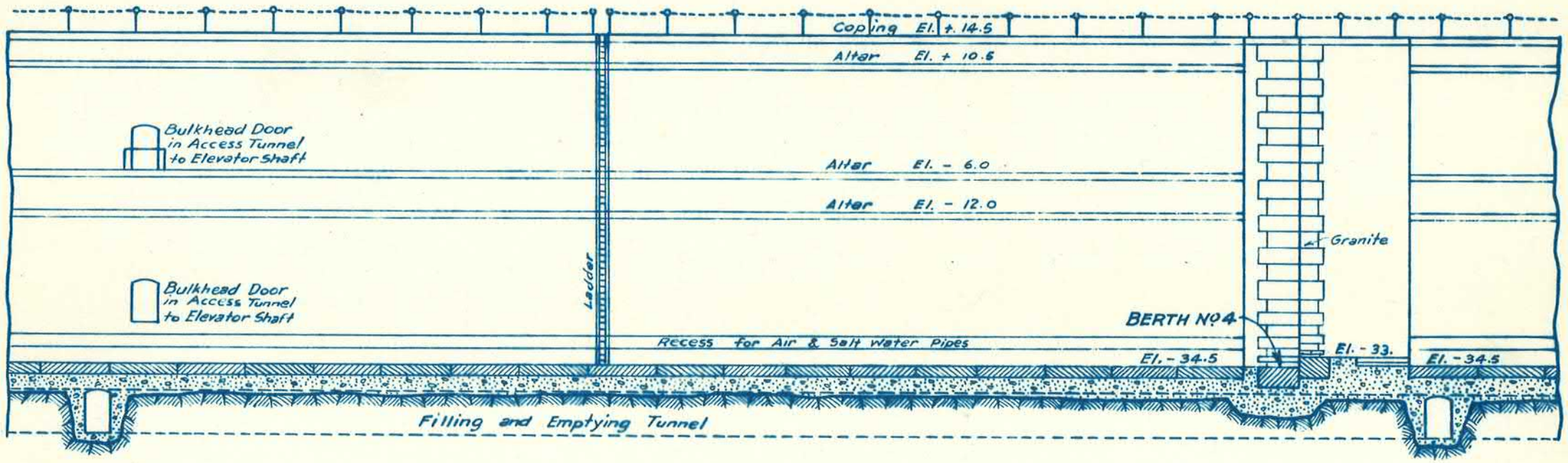
Scale 20'= 1"



ELEVATION 26-26

THROUGH BERTH N° 3

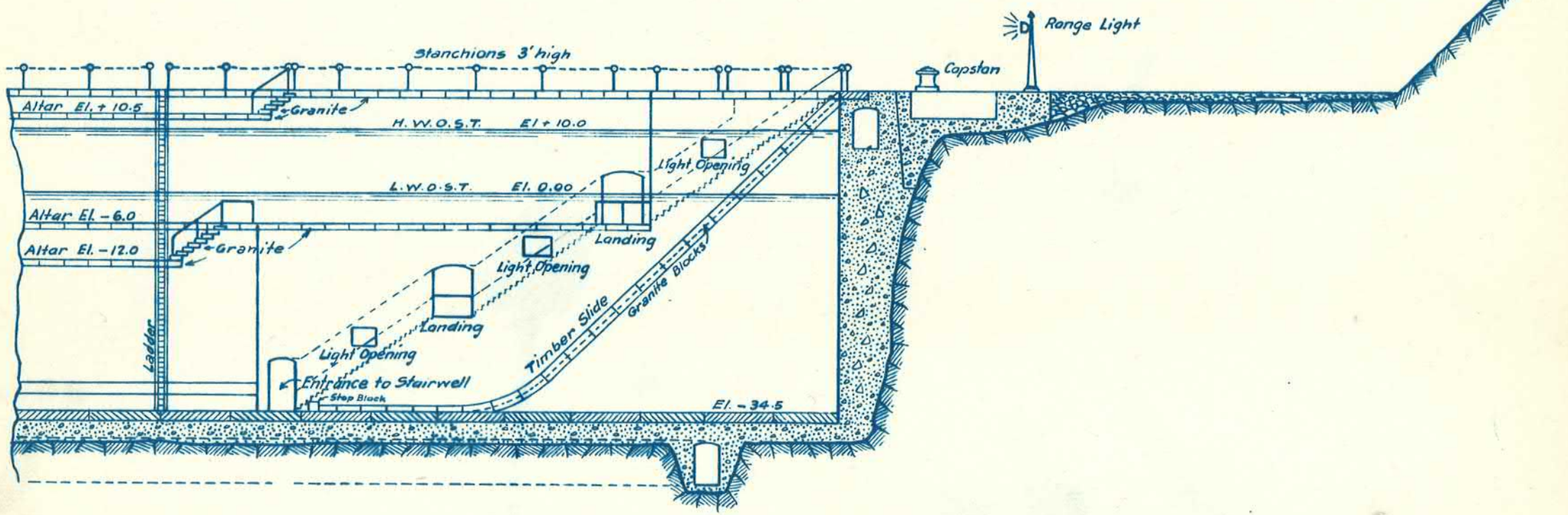
Scale 20'= 1"



ELEVATION 27-27

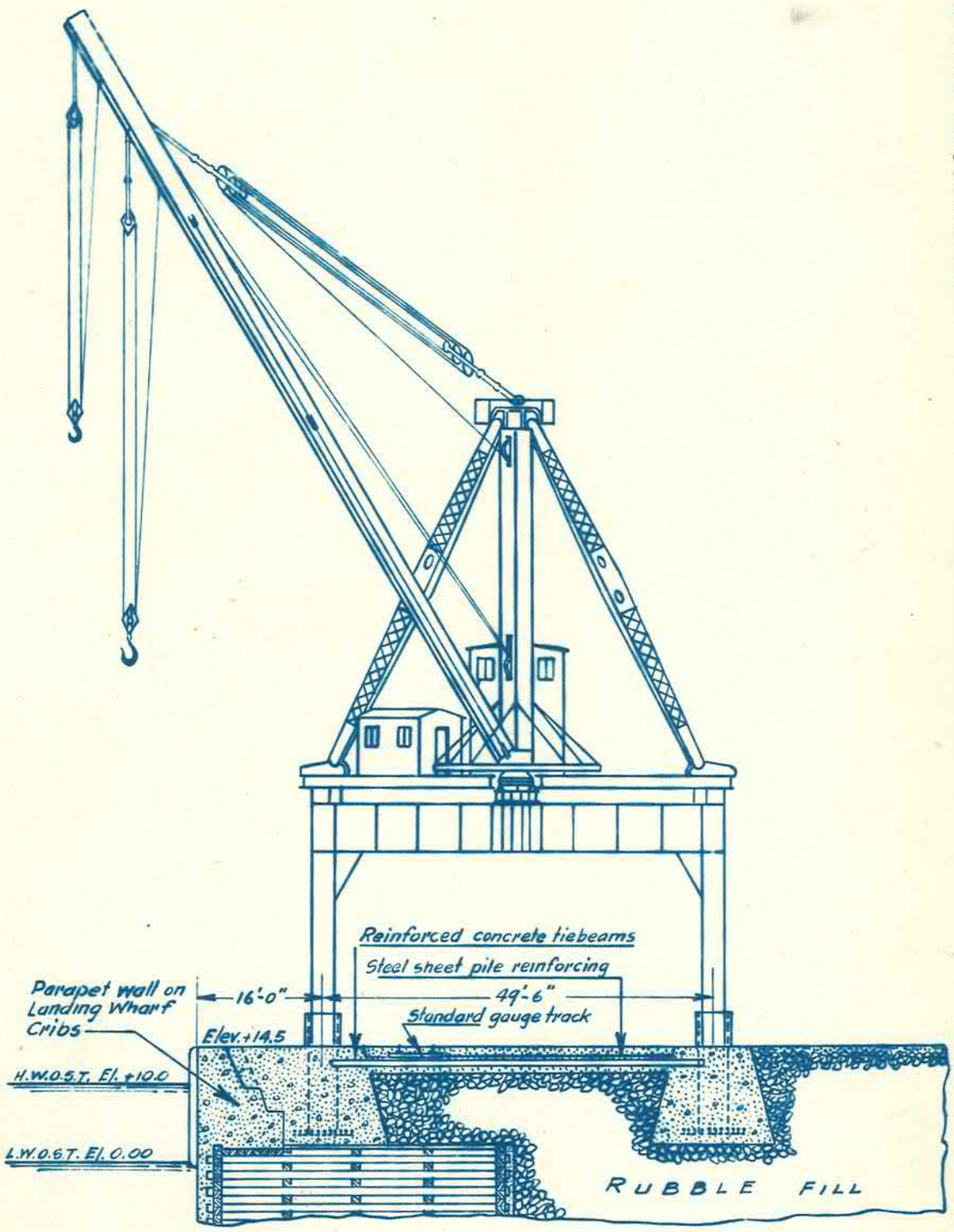
THROUGH BERTH No 4

Scale 20'= 1"



ELEVATION 28-28, AT INNER END

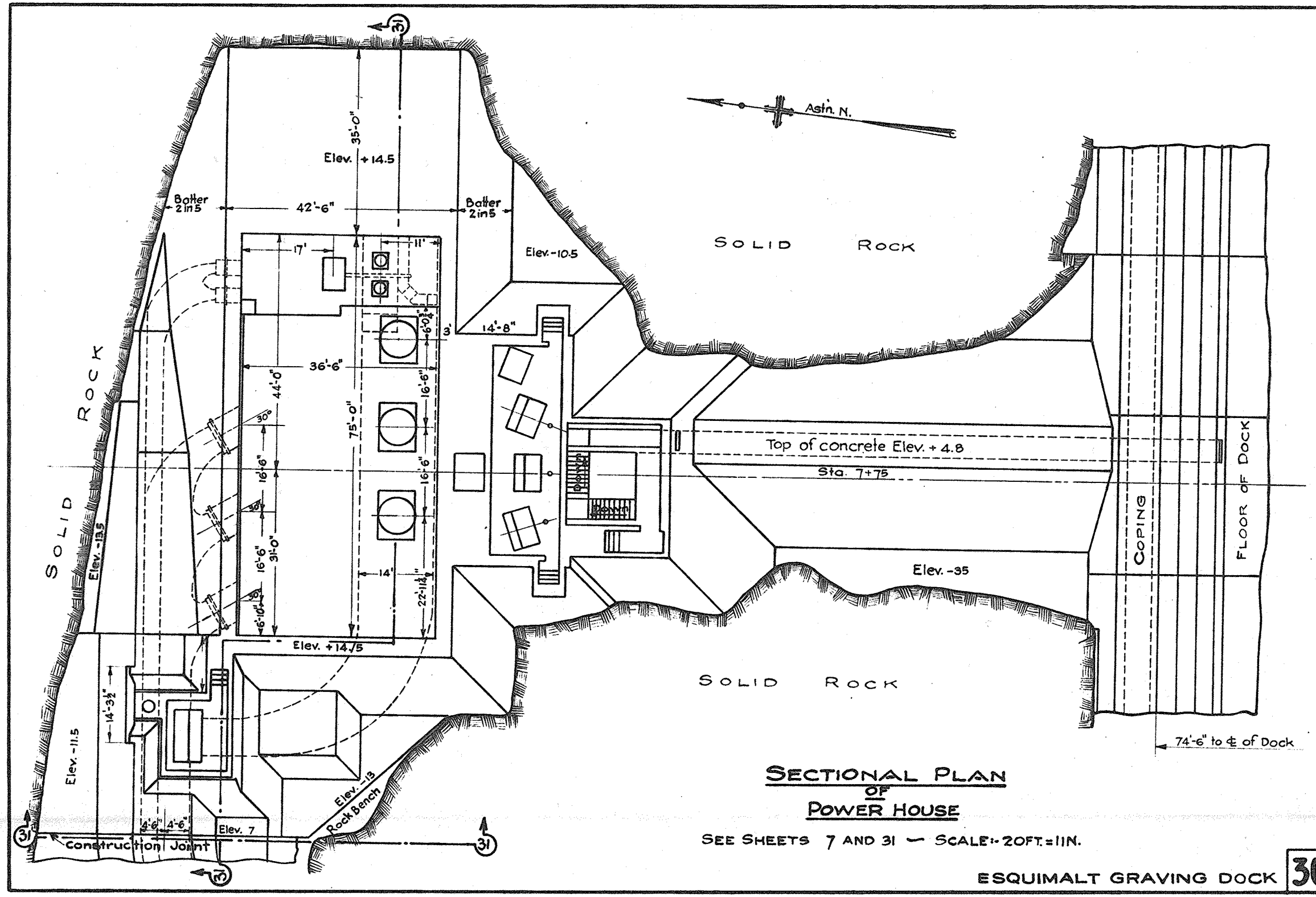
Scale 20' = 1"



CROSS SECTION 29-29

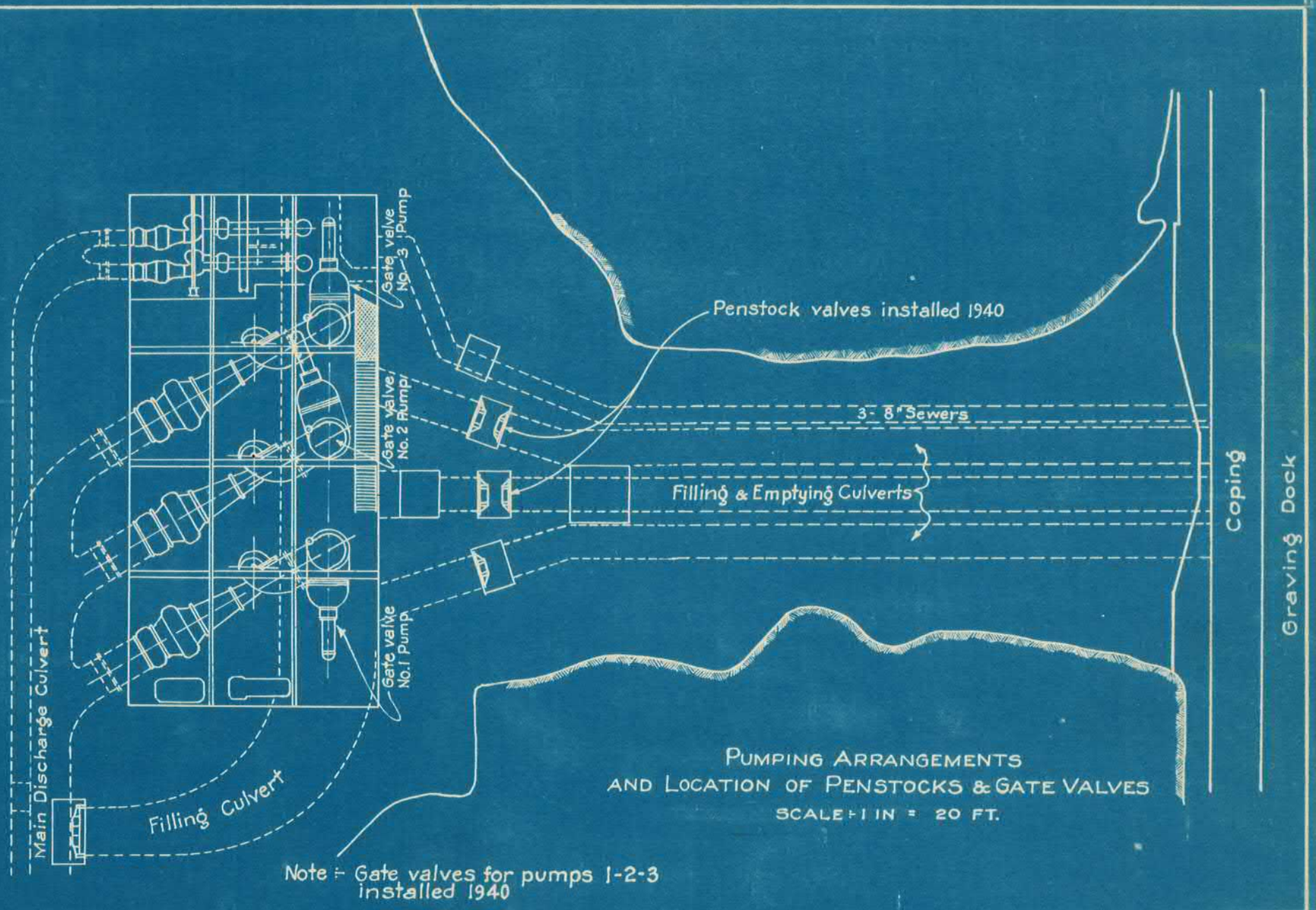
THROUGH LANDING WHARF. SHOWING 100 TON DERRICK

Scale:- 20' = 1"



SECTIONAL PLAN OF POWER HOUSE

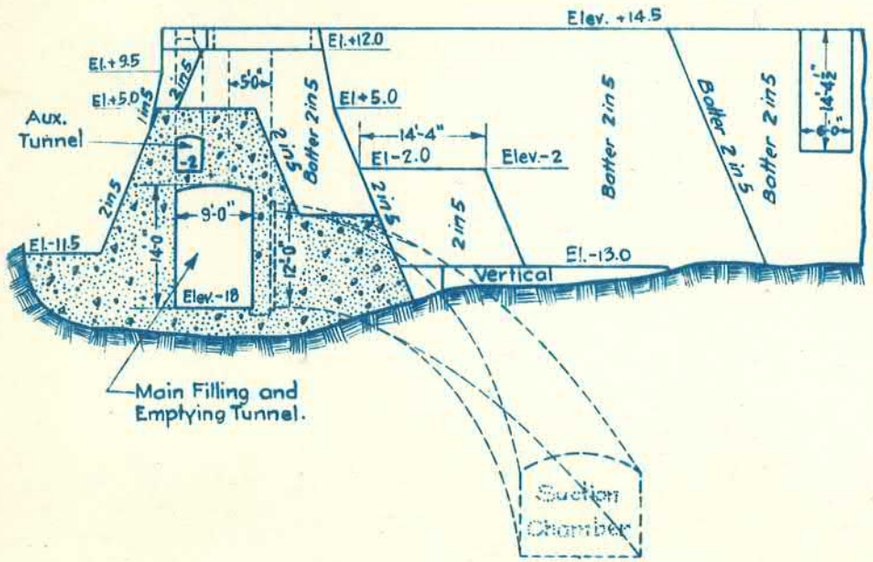
SEE SHEETS 7 AND 31 — SCALE:- 20FT. = 1IN.



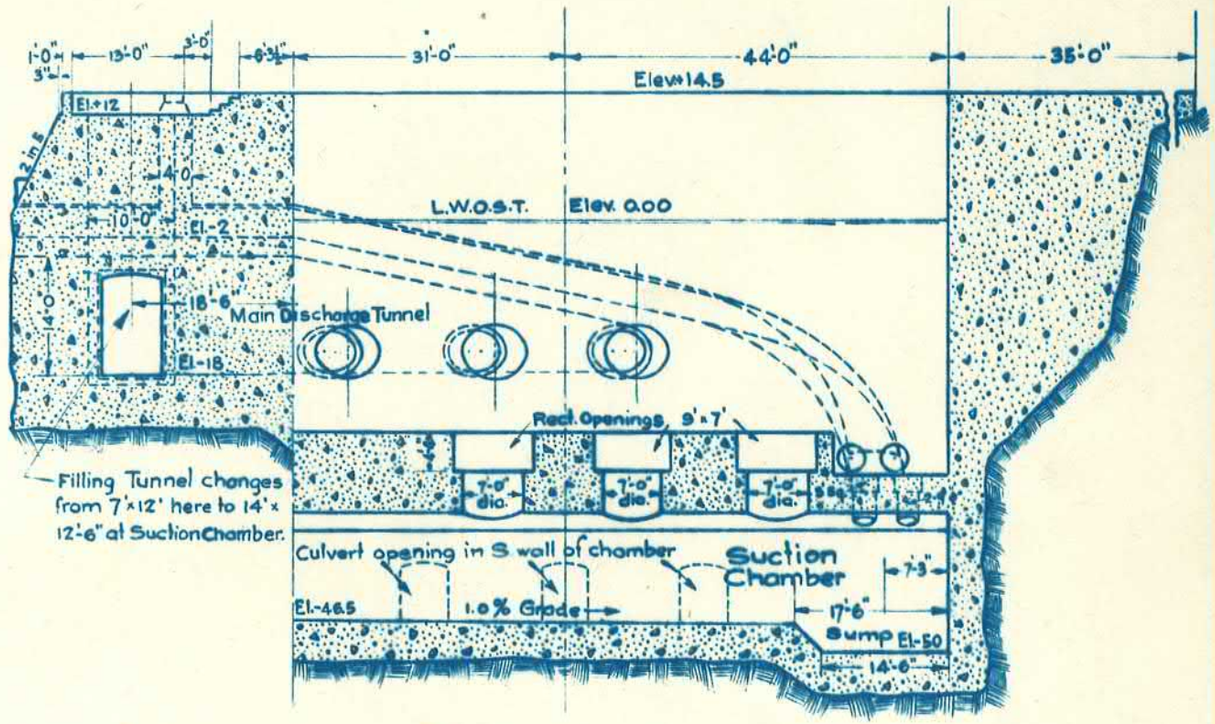
PUMPING ARRANGEMENTS
AND LOCATION OF PENSTOCKS & GATE VALVES
SCALE 1 IN = 20 FT.

ESQUIMALT GRAVING DOCK

30-A



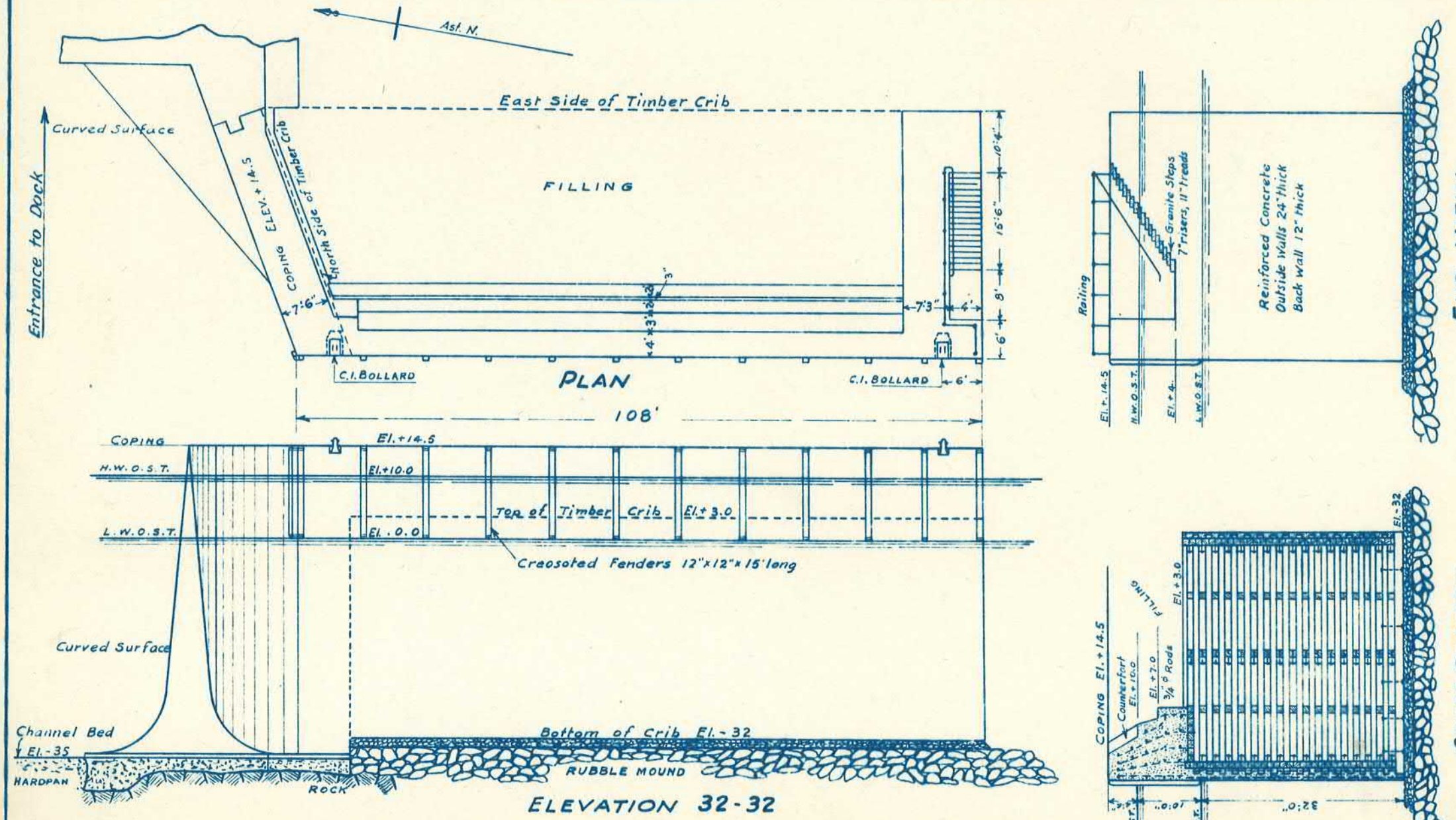
SECTION THROUGH 31-31 LOOKING EAST.



SECTION THROUGH 31-31 LOOKING NORTH

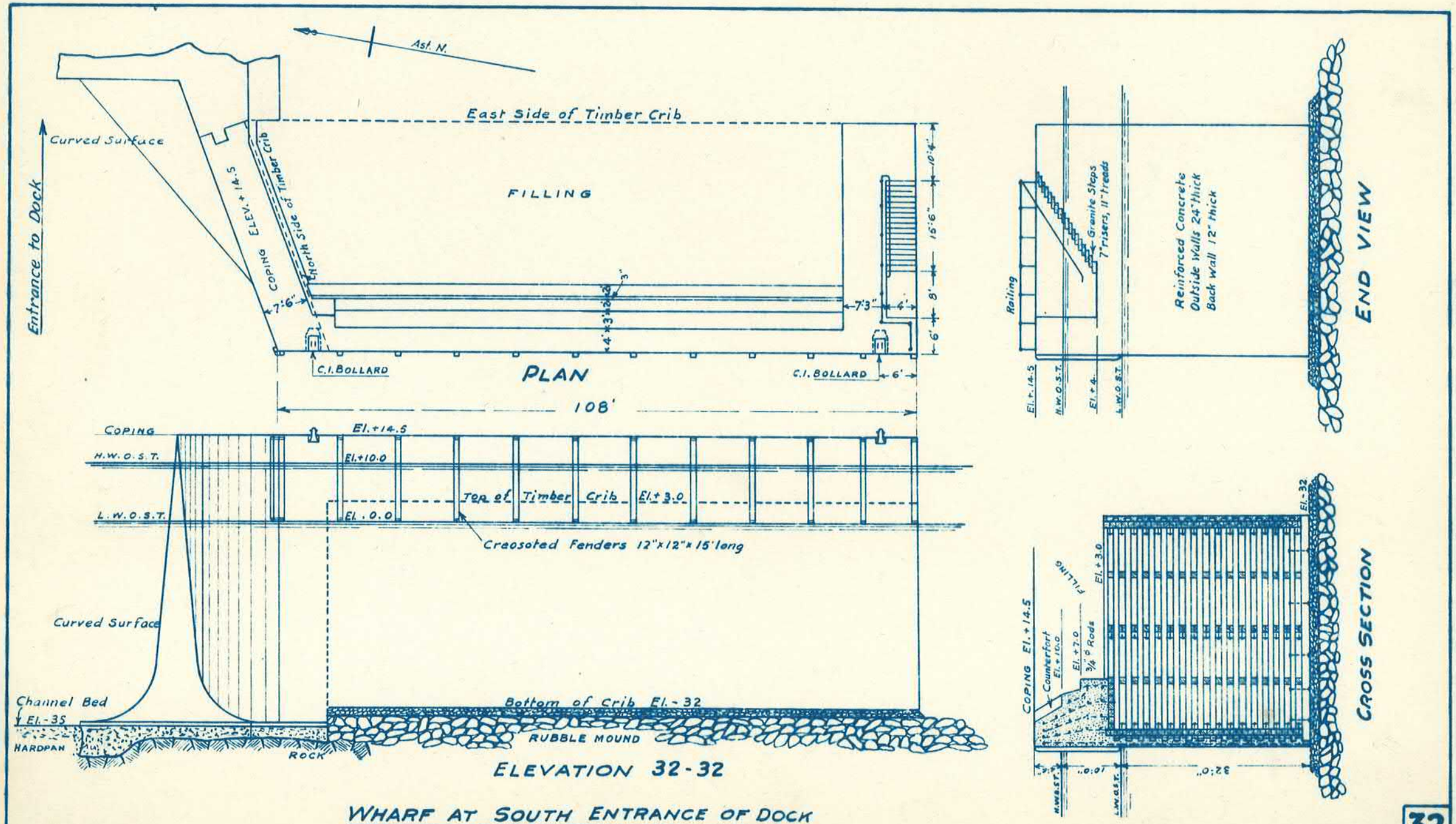
SCALE :- 20FT. = 1 IN.

See Sheets Nos 7 and 30



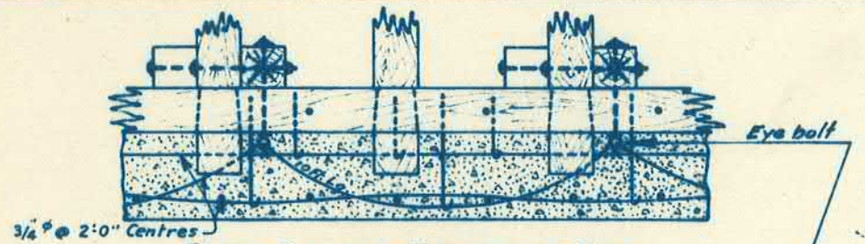
WHARF AT SOUTH ENTRANCE OF DOCK

Scale 20' = 1"

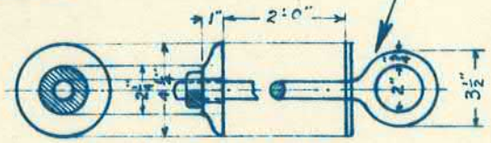


WHARF AT SOUTH ENTRANCE OF DOCK

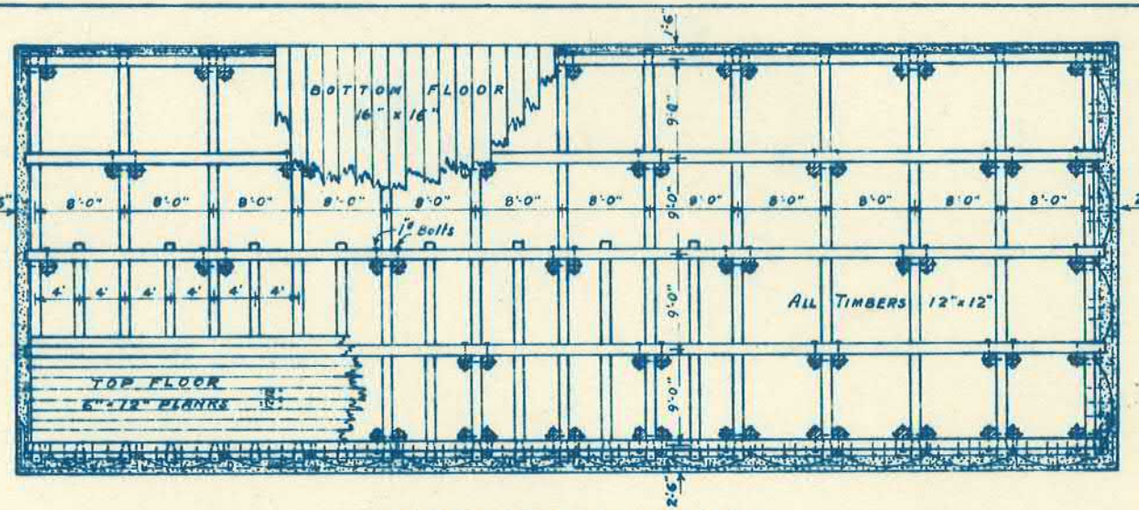
Scale 20' = 1"



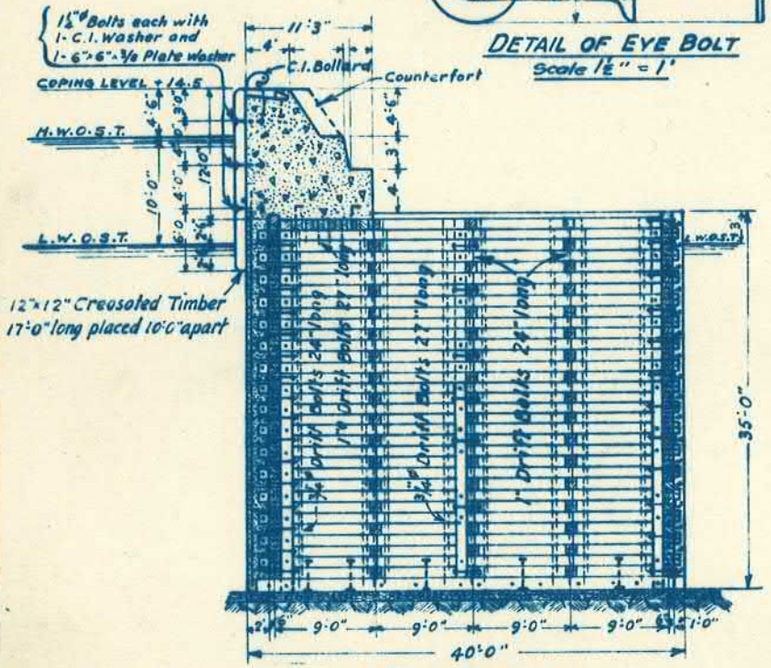
DETAIL SHOWING REINFORCING STEEL
Scale 1/4" = 1'



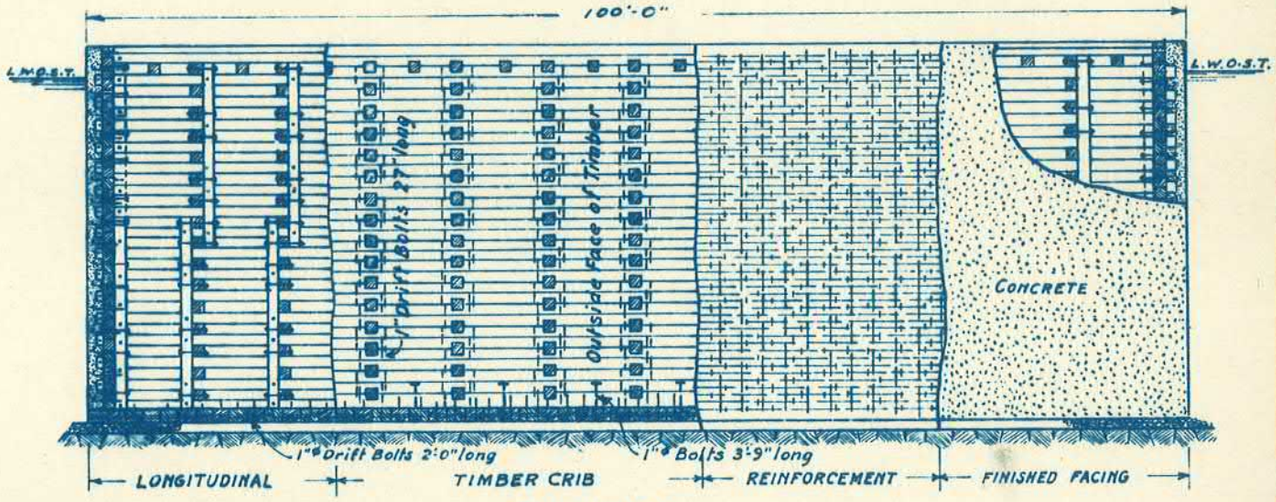
DETAIL OF EYE BOLT
Scale 1/2" = 1'



PLAN OF OUTER END CRIB
Scale 1/16" = 1'

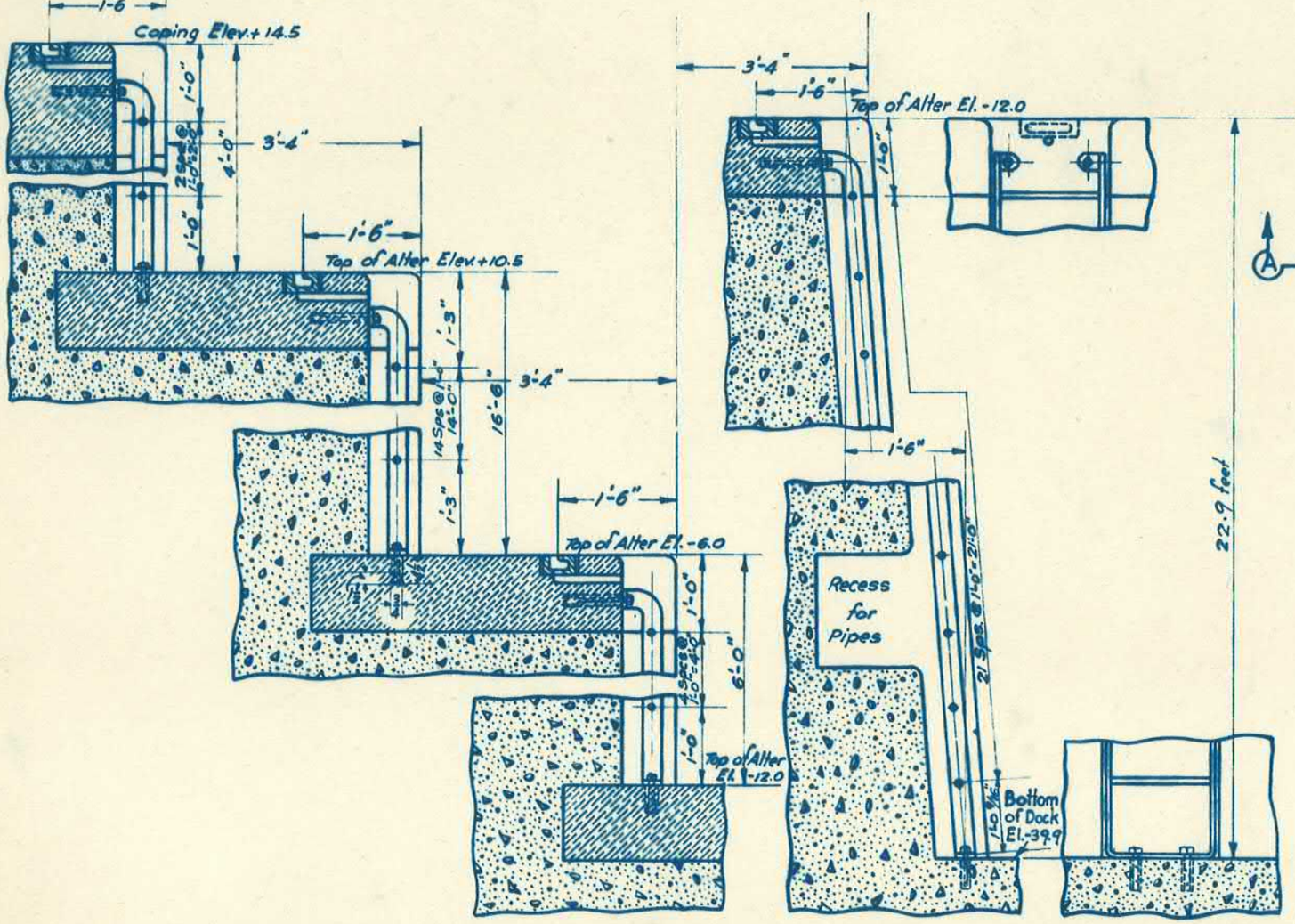


CROSS SECTION
Showing Superstructure

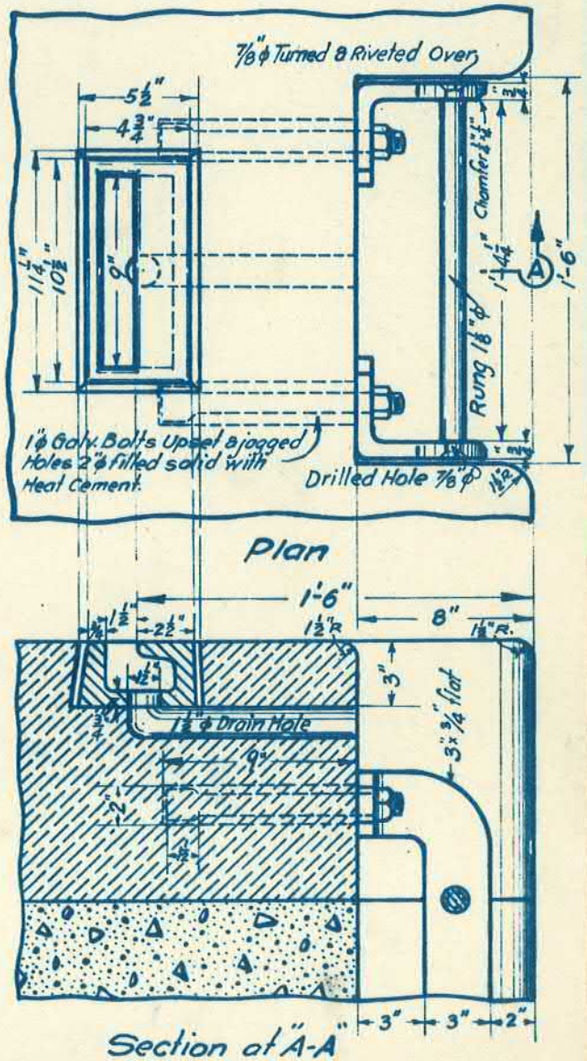


ELEVATION

LANDING WHARF
PLAN AND DETAILS OF CRIBS



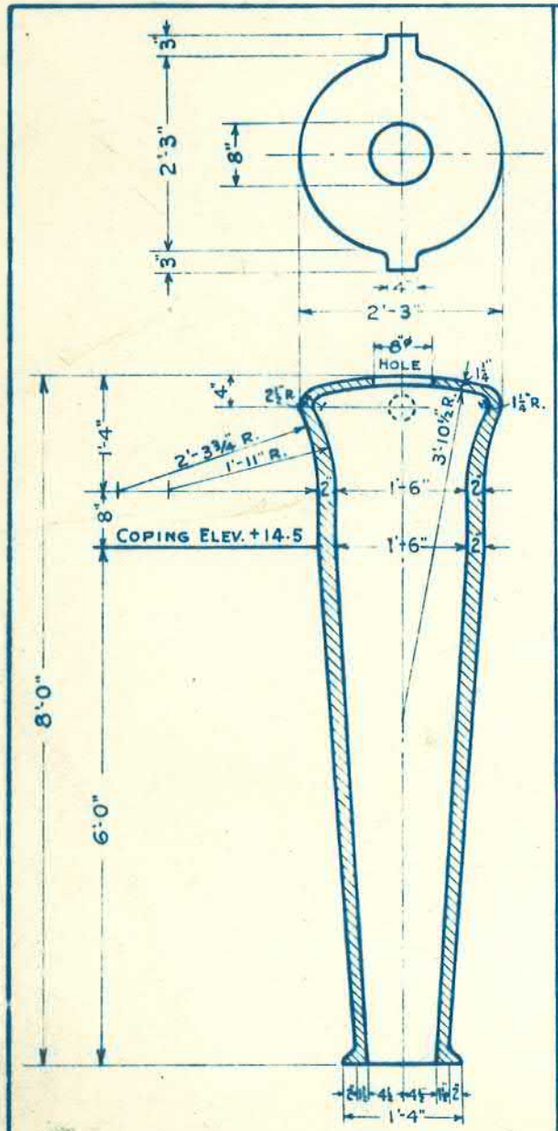
DETAIL OF ALTAR LADDERS
— Scale:- 1/2"=1' —



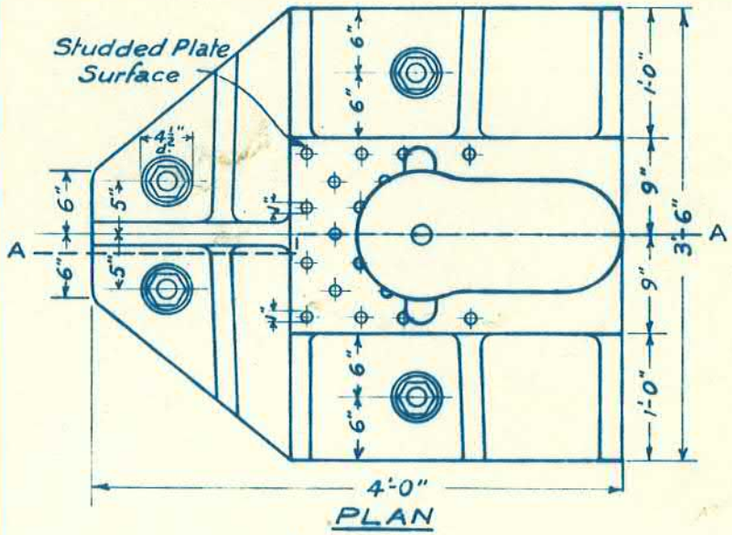
Section at "A-A"

ENLARGED DETAIL OF C.I. HOLDFAST
Scale 1½"=1'

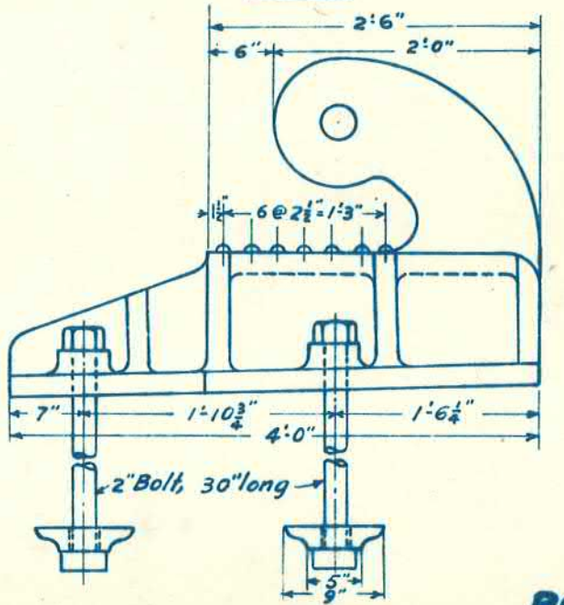
ESQUIMALT GRAVING DOCK



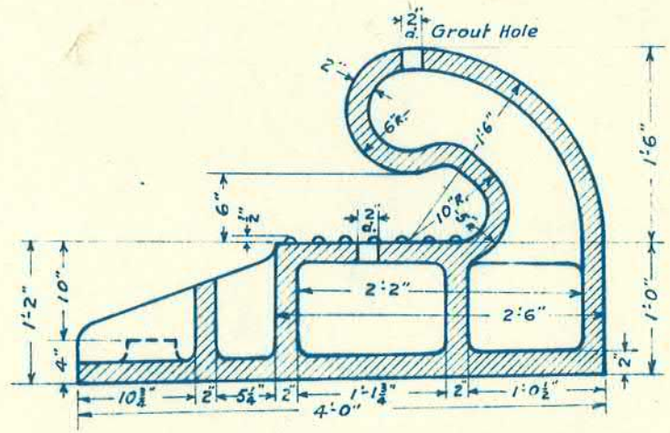
Scale: ½" = 1'



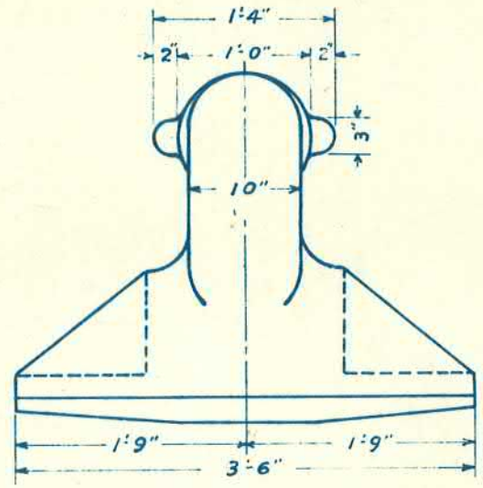
PLAN



SIDE ELEVATION



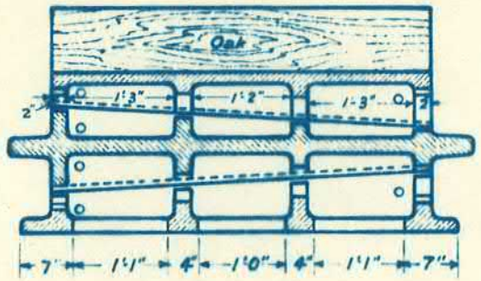
LONGITUDINAL SECTION A-A



FRONT ELEVATION

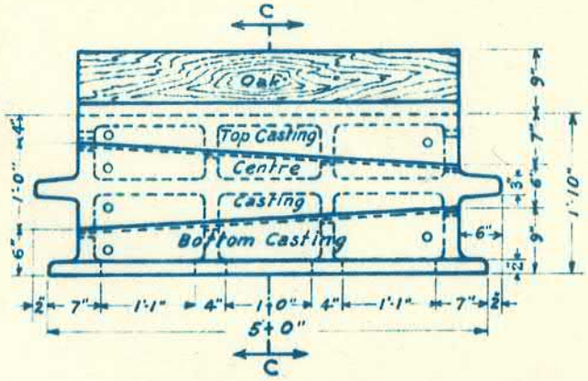
BOLLARDS

Scale: ¾" = 1'



LONGITUDINAL SECTION ON A-A

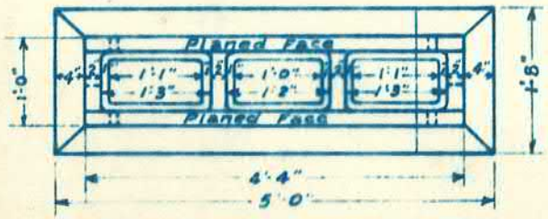
Scale: ½" = 1'



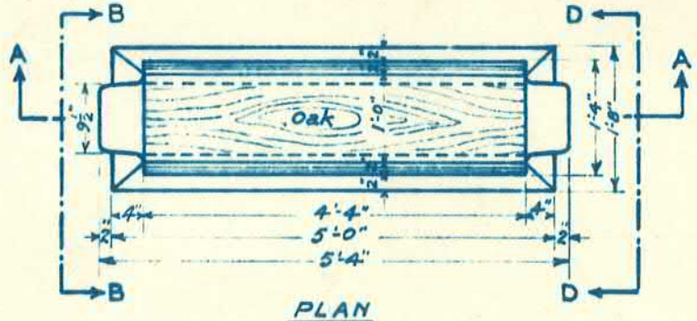
SIDE ELEVATION

INVERTED PLAN OF TOP CASTING

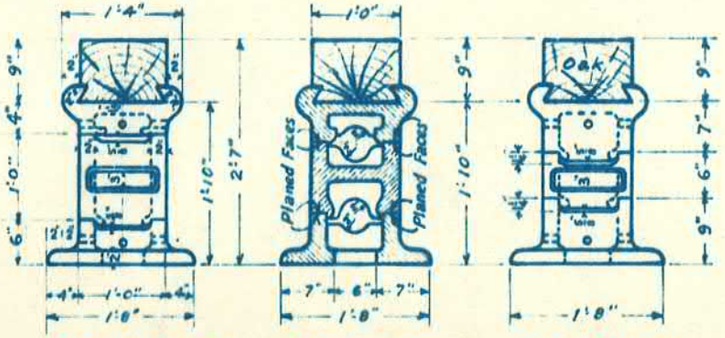
TOP VIEW OF CENTRE CASTING



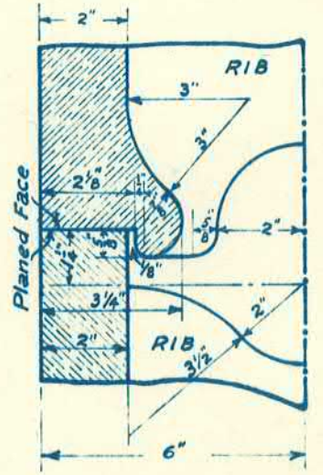
TOP VIEW OF BUTTOM CASTING



PLAN



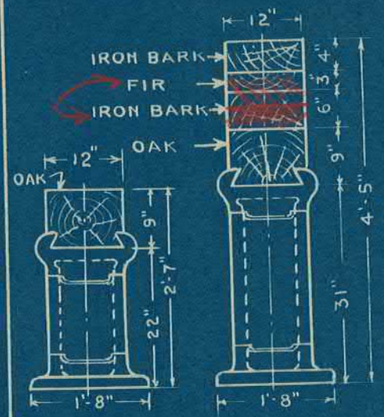
END ELEV. B-B SECTION C-C END ELEV. D-D



DETAIL AT PLANED FACES

Scale: ¼ Full Size

KEEL BLOCKS

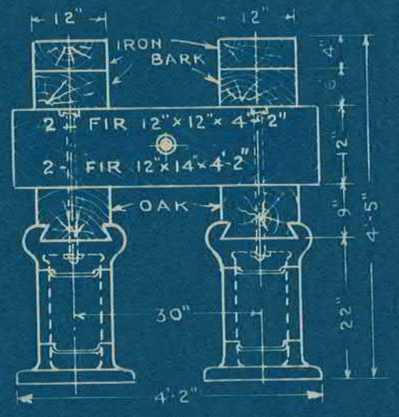


SINGLE LOW BLOCK WITH 1 WEDGE

8

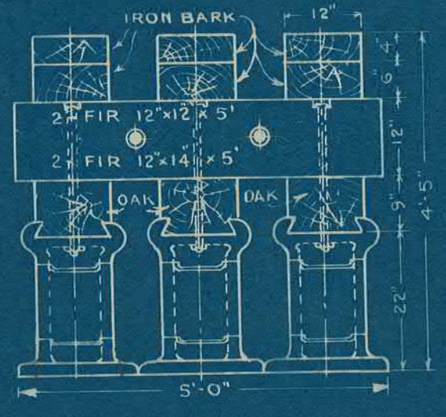
SINGLE BLOCK UNIT WITH 2 WEDGES

300



DOUBLE BLOCK UNIT WITH SINGLE WEDGES

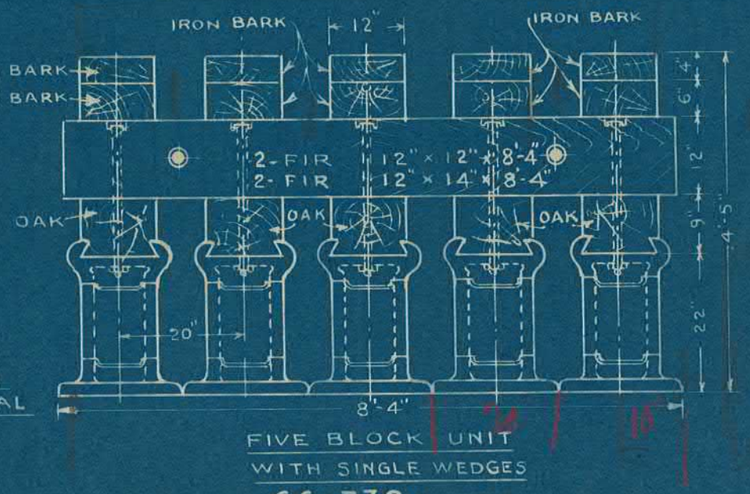
70=140 BLOCKS



THREE BLOCK UNIT WITH SINGLE WEDGES

7= 21 BLOCKS

UNLESS OTHERWISE NOTED
ALL BLOCKS ARE 4'-4" LONG



FIVE BLOCK UNIT WITH SINGLE WEDGES

66=330 BLOCKS

—NOTE—

4"x12" IRON BARK CAP REPLACED BY 4"x12" FIR FOR COMMERCIAL VESSELS.

KEEL BLOCKS & WEDGES

	UNITS	BLOCKS	WEDGES
FIVE BLOCK UNIT	66	330	330
THREE " "	7	21	21
SINGLE LOW BLOCK	8	8	8
SINGLE BLK. UNIT (WITH 2 WEDGES)	247	247	494
	328	606	853

BILGE BLOCKS & WEDGES

	UNITS	BLOCKS	WEDGES
TWO BLOCK UNIT	70	140	140
SINGLE BLK. UNIT (WITH 2 WEDGES)	53	53	106
EXTRA BLOCK (WITH 1 WEDGE)	1	1	1
	124	194	247

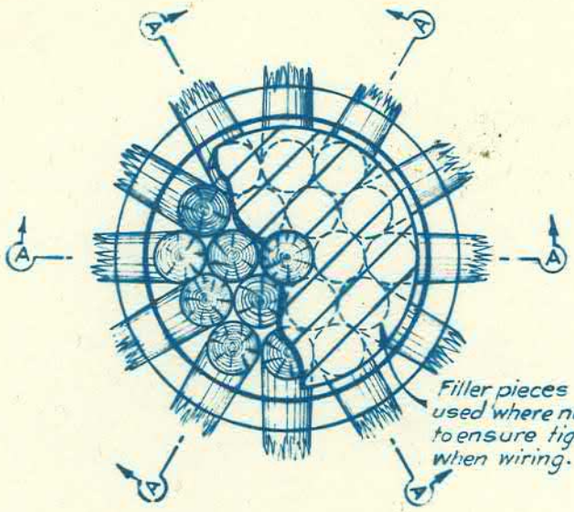
SUMMARY OF KEEL & BILGE BLOCKS AND WEDGES

	UNITS	BLOCKS	WEDGES
SINGLE LOW BLOCK	8	8	8
SINGLE BLK. UNIT (WITH 2 WEDGES)	300	300	600
EXTRA BLOCK (WITH 1 WEDGE)	1	1	1
TWO BLOCK UNIT	70	140	140
THREE " "	7	21	21
FIVE " "	66	330	330
	452	800	1100

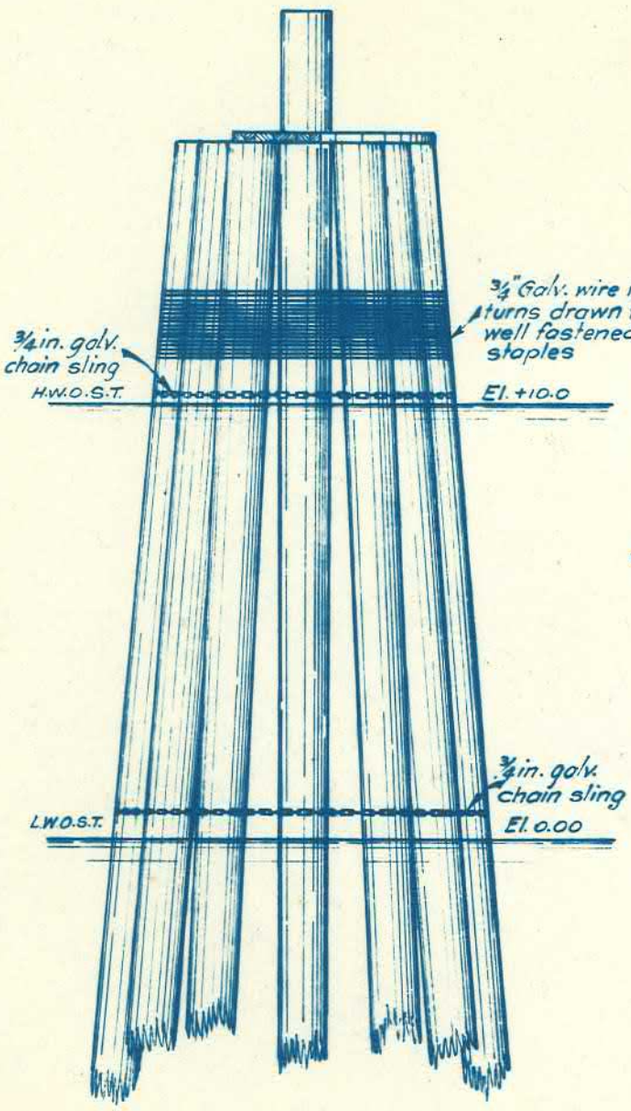
SCALE: 1/2" = 1'-0"

36b

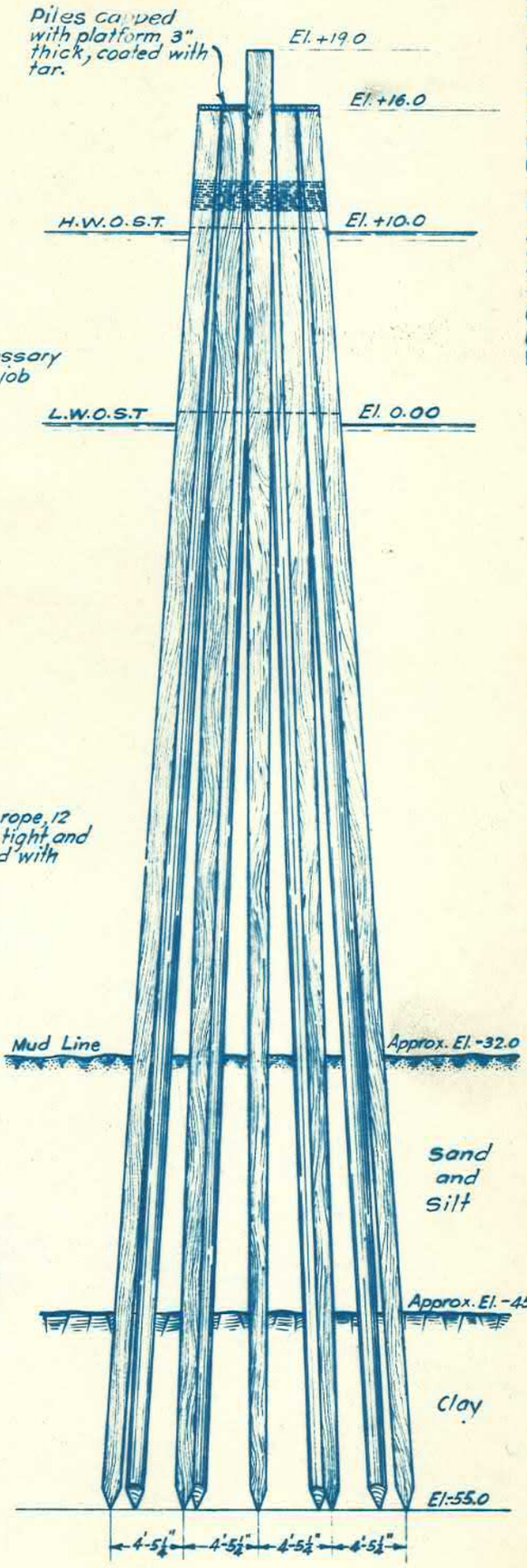
PREPARED FROM SKETCH SENT BY DIST. ENGR. DEC. 17-1940. AND LETTER JAN. 22-1941 CONFIDENTIAL FILE 52



PLAN

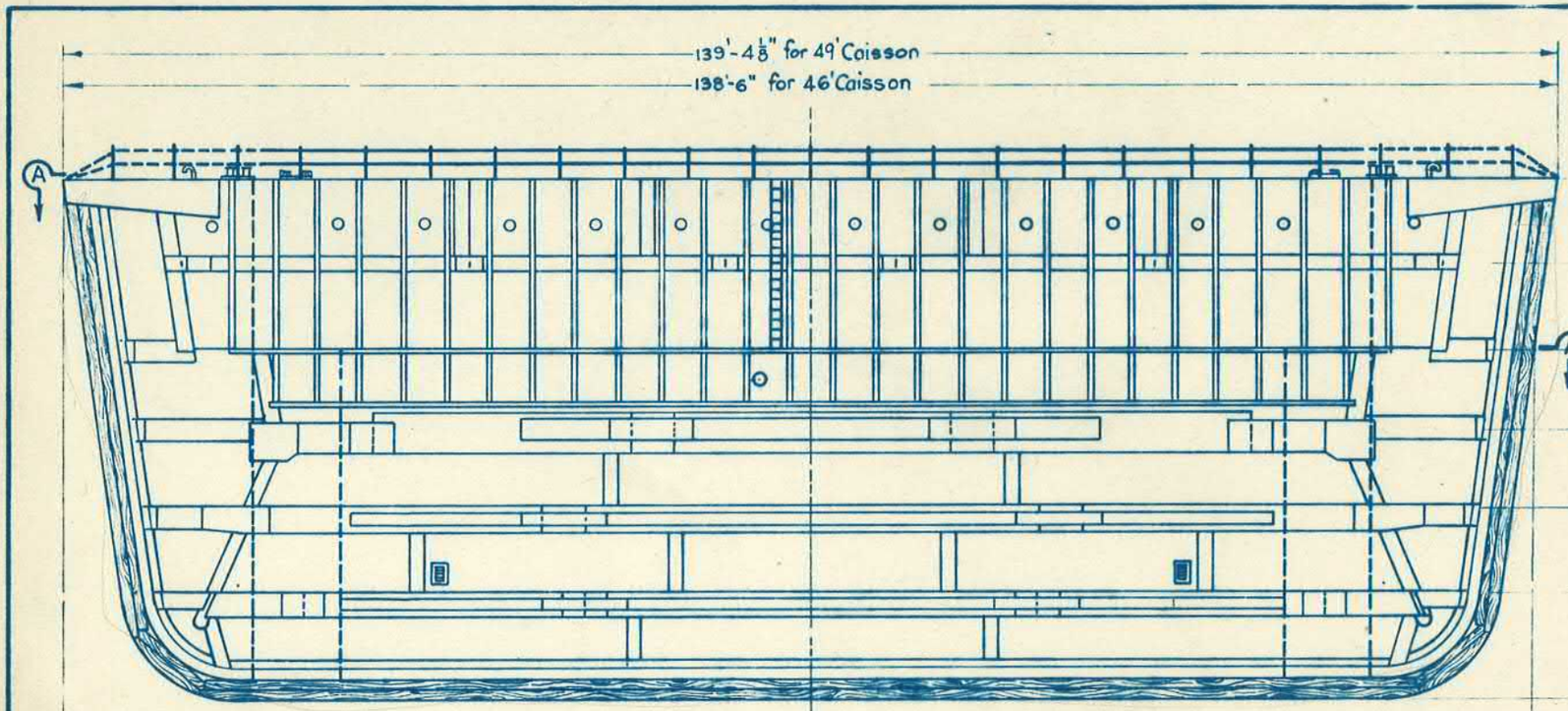


PART ELEVATION
Scale:- ¼ in. = 1 ft.

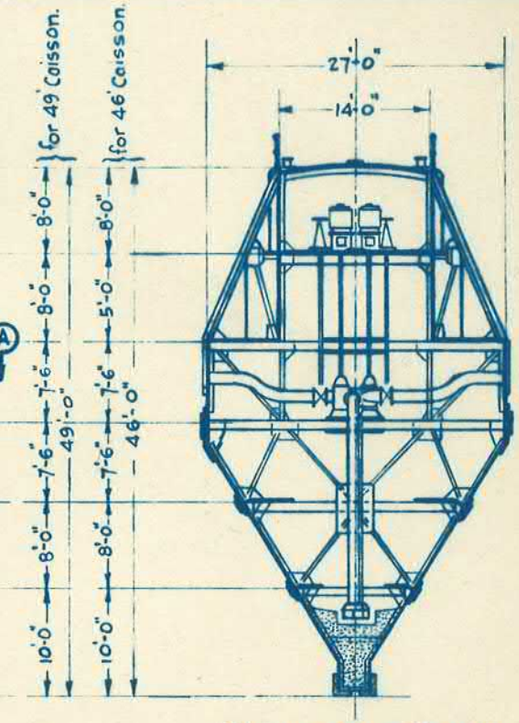


SECTION "A-A"
Scale:- ⅛ in. = 1 ft.

DOLPHINS

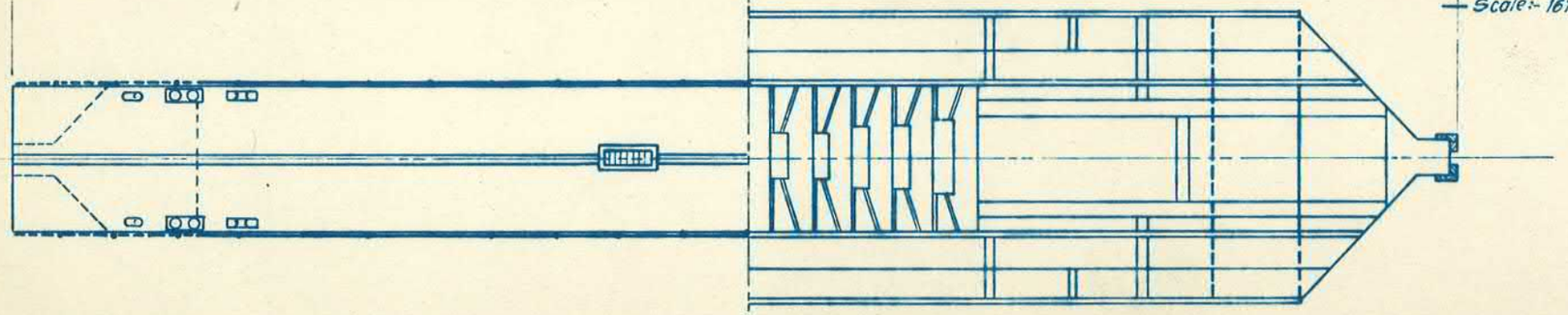


SIDE ELEVATION



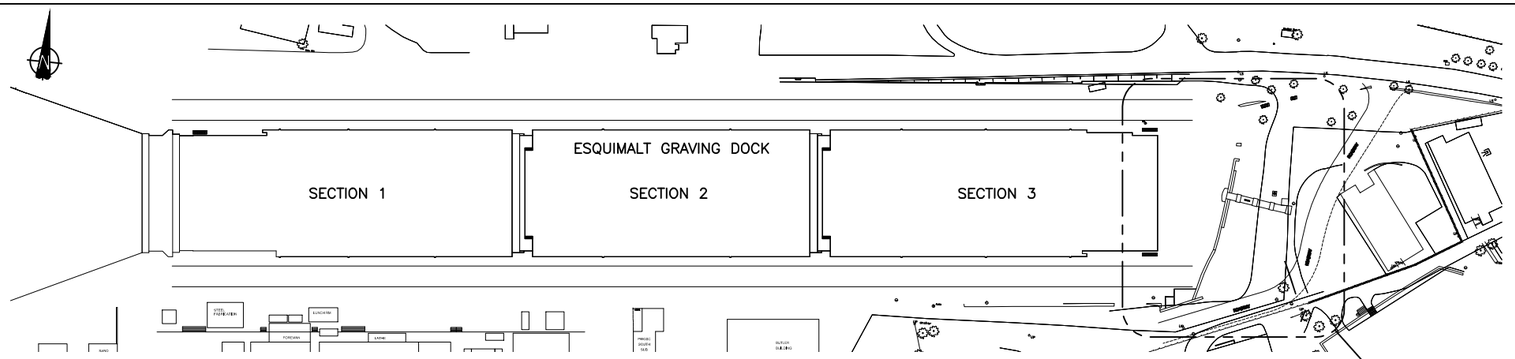
TYPICAL CROSS SECTION

— Scale:- 16ft. to One inch. —

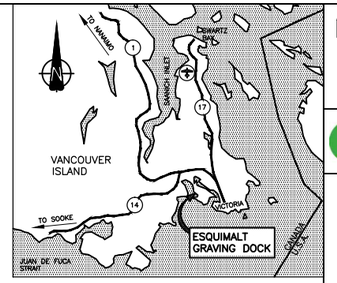


HALF PLAN AND HALF SECTION AT "A-A"

CAISSONS



SITE PLAN
1:1000



KEY PLAN
N.T.S.

1. GENERAL NOTES:

1.1 DETAILED REQUIREMENTS FOR MATERIALS AND FABRICATION ARE DESCRIBED IN THE SPECIFICATIONS. FOR CONVENIENCE, CERTAIN EXTRACTS ARE REPRODUCED BELOW.

1.2 DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE. ELEVATIONS ARE IN METRES, TO CHART DATUM.

1.3 DIMENSIONS, LAYOUT AND DETAILS OF EXISTING STRUCTURES ARE BASED ON DRAWINGS OBTAINED FROM PUBLIC WORKS AND GOVERNMENT SERVICES CANADA AND MAY BE SUBJECT TO CONSTRUCTION VARIATIONS AND MODIFICATIONS. THE CONTRACTOR SHALL VERIFY DIMENSIONS AND CONFIGURATION PRIOR TO ANY DEMOLITION AND REMOVAL AND BRING ANY DISCREPANCIES OR POTENTIAL CONFLICTS TO THE ATTENTION OF THE DEPARTMENTAL REPRESENTATIVE. REFERENCE DRAWINGS ARE LISTED IN THE SPECIFICATIONS.

1.4 THE CONTRACTOR SHALL COORDINATE ALL ACTIVITIES WITH THE DEPARTMENTAL REPRESENTATIVE. LOCATION OF THE CONTRACTOR'S SITE OFFICE AND MATERIAL STORAGE SHALL BE APPROVED BY THE DEPARTMENTAL REPRESENTATIVE.

1.5 TIDE ELEVATIONS (CHART DATUM):

EXTREME HIGH WATER LEVEL (EHWL)	3.8m
HIGHER HIGH WATER LEVEL (HHWL)	3.4m
MEAN WATER LEVEL (MWL)	1.9m
LOWER LOW WATER LEVEL (LLWL)	0.1m
EXTREME LOW WATER LEVEL	−0.5m

1.6 PWGSC SITE BENCHMARK IS "BOLT". FROM PWGSC PLAN SK4593−1 DATED OCTOBER 1989, "BOLT" IS ELEVATION 4.722m TO PWGSC DATUM, BOLT IS 4.849m ABOVE LLWL; LLWL IS 0.124m BELOW PWGSC DATUM 0.0; LLWL IS 1.871m BELOW GEODETIC ELEVATION.

TO CONVERT FROM GEODETIC DATUM TO CHART DATUM, ADD 1.871m.

TO CONVERT FROM GEODETIC DATUM TO PWGSC DATUM, ADD 1.747m.

TO CONVERT FROM PWGSC DATUM TO CHART DATUM, ADD 0.124m.

1.7 THE EAST END RETAINING WALL STRUCTURES HAVE BEEN DESIGNED FOR FORCES ASSOCIATED WITH USAGE E.G. APRON LIVE LOADS, CRANE LOADS, BERTHING AND MOORING LOADS, IN ADDITION TO THE ENVIRONMENTAL FORCES SET FORTH IN THE NATIONAL BUILDING CODE OF CANADA, 2005. THE DESIGN SERVICE LIFE FOR MAJOR STRUCTURAL COMPONENTS AND ROCK/SOIL ANCHORS IS 75 YEARS.

1.8 APRON LIVE LOADS: (ALL LOADS ARE UNFACTORED)
- a) UNIFORMLY DISTRIBUTED LOAD (UDL): 48kPa
- b) HILLSIDE UDL FOR UPPER RETAINING WALL (NON−SEISMIC CASE) = 10kPa
- c) APRON UDL NEED NOT BE CONSIDERED COINCIDENT WITH VEHICLE WHEEL LOADS
- d) AXLE LOADING:

TRUCK LOADING (CL−625 PER S6−06):
FRONT AXLE 50kN (DISTRIBUTED TO 2 WHEELS)
REAR AXLE 175kN (DISTRIBUTED TO 2 PAIRS OF WHEELS)

MOBILE CRANE LOADING (GROVE RT530E):
OUTRIGGER LOAD: 220kN ON 420mm x 420mm PAD

ESQUIMALT FIRE TRUCK (TYPE 1), 1993 THIBAULT ENGINE:
FRONT AXLE 75kN (DISTRIBUTED TO 2 WHEELS)
REAR AXLE 100kN (DISTRIBUTED TO 2 PAIRS OF WHEELS)

ESQUIMALT FIRE TRUCK (TYPE 2), 1999 E LADDER TRUCK:
FRONT AXLE 85kN (DISTRIBUTED TO 2 WHEELS)
REAR AXLES 210kN (DISTRIBUTED TO 2 PAIRS OF WHEELS)

ESQUIMALT FIRE TRUCK (TYPE 3), 2008 FORT GARY RESCUE TRUCK:
FRONT AXLE 55kN (DISTRIBUTED TO 2 WHEELS)
REAR AXLES 105kN (DISTRIBUTED TO 2 PAIRS OF WHEELS)

DYNAMIC LOAD ALLOWANCE (DLA) SHOULD BE ADDED TO ALL AXLE/WHEEL LOADS.

1.9 30T GANTRY CRANE:
MAXIMUM WHEEL LOADS (ALL LOADS ARE UNFACTORED)

STATIC LOAD:	299kN
OPERATING LOAD:	377kN
WORKING WIND LOAD:	464kN

1.10 MOORING LOADS: (ALL LOADS ARE UNFACTORED)
- a) 100 TONNE BOLLARD: 980kN

THE MOORING LINE LOADS CAN BE APPLIED AT UP TO 30° ABOVE HORIZONTAL, AND IN ANY OFFSHORE DIRECTION (−90° TO +90°) ON PLAN.

1.11 SEISMIC LOADS:
LOADING BASED ON SITE SPECIFIC PEAK HORIZONTAL GROUND ACCELERATIONS OBTAINED FROM THE PACIFIC GEOSCIENCE CENTER, AS FOLLOWS:

	A475 EVENT
PROBABILITY OF EXCEEDANCE PER ANNUM	0.0021
PROBABILITY OF EXCEEDANCE IN 50 YEARS	10%
Sa(0.2)	0.657
Sa(0.5)	0.436
Sa(1.0)	0.202
Sa(2.0)	0.094
PEAK HORIZONTAL GROUND ACCELERATION, A	0.329g

1.12 SITE CONTOURS SHOWN ON THE DRAWINGS ARE TAKEN FROM FOCUS CORPORATION DWG. 030200583−1091S1 DATED 2009−12−21

1.13 FOR GEOTECHNICAL INVESTIGATIONS AND BOREHOLE LOGS, SEE KCBL REPORTS
- − ESQUIMALT GRAVING DOCK EAST END GPR AND AIR TRACK INVESTIGATION − DATA REPORT (SEPT 5, 2008)
- − ESQUIMALT GRAVING DOCK EAST SLOPE STABILITY INVESTIGATION − DATA REPORT (SEPT 17, 2008)
- − ESQUIMALT GRAVING DOCK EAST END EXTENSION − GEOTECHNICAL DATA REPORT (FEB 25, 2010)

1.14 SCALES INDICATED ON DRAWINGS ARE FULL SIZE A1 DRAWINGS.

1.15 TYPICAL ABBREVIATIONS:

BOT	BOTTOM	EQ.SP	EQUALLY SPACED	N.F.	NEAR FACE	T	TOP
C/C	CENTRE TO CENTRE	E.W.	EACH WAY	NOM.	NOMINAL	T.O.C.	TOP OF CONCRETE
CJ	CONSTRUCTION JOINT	F.F.	FAR FACE	PROJ	PROJECTION	T.O.R.	TOP OF RAIL
CL	CLEAR	EXP JT	EXPANSION JOINT	RAD.,R.	RADIUS	U/S	UNDERSIDE
E.F.	EACH FACE	GALV	GALVANIZED	REINF	REINFORCING	U.N.O.	UNLESS NOTED OTHERWISE
EL.	ELEVATION	INV	INVERT	STA	STATIONING		

2. CONCRETE:

2.1 ALL CONCRETE SHALL HAVE COMPRESSIVE STRENGTH OF:

TYPE	USE	COMPRESSIVE STRENGTH (MPa)
A	EAST END RETAINING WALL.	35 @ 56 DAYS
B	REINFORCED CONCRETE STRUCTURES NOT IDENTIFIED AS TYPE A.	35 @ 28 DAYS
C	MASS CONCRETE UNDER BASE SLAB AT EAST END RETAINING WALL, DUCT BANKS AND OTHER MISCELLANEOUS CONCRETE.	30 @ 28 DAYS

FOR EXPOSURE CLASS AND OTHER REQUIREMENTS, REFER TO SPECIFICATIONS.

2.2 ALL EXPOSED EDGES SHALL HAVE 20mm CHAMFER, U.N.O.

3. CONCRETE REINFORCEMENT:

3.1 REINFORCING BARS SHALL BE BILLET STEEL BARS CONFORMING TO CAN/CSA G30.18−09, 400 MPa MIN. YIELD.

3.2 DESIGNATION OF REINFORCING BARS:
3−10M0800 MEANS THREE 10M BARS 800 LONG. 2−C20M1500 MEANS TWO 20M BARS, EACH WITH A 90 DEGREE STANDARD HOOK ON EACH END AND A TOTAL LENGTH OF 1500 PER BAR.
— — — — — DENOTES BOTTOM BARS.
————— DENOTES TOP BARS.

3.3 DIMENSIONS TO REINFORCEMENT ARE TO CENTRELINES OF BARS, EXCEPT WHERE CONCRETE COVER OR CLEARANCE BETWEEN BARS IS SHOWN.

3.4 CLEAR COVER FOR REINFORCEMENT (mm):

TOP SURFACES OF STRUCTURES	70
ALL OTHER CONCRETE FACES U.N.O	70
STRUCTURES CAST AGAINST SOIL/ROCK	100

4 STRUCTURAL STEEL AND STEEL FABRICATIONS:

4.1 STRUCTURAL STEEL SHALL MEET CAN/CSA G40.20−04 FOR GENERAL REQUIREMENTS, AND CAN/CSA G40.21−04 FOR QUALITY.
GRADES OF MATERIAL, UNLESS NOTED OTHERWISE:

STRUCTURAL STEEL AND MISC. METAL	350W
BOLTS, NUTS AND WASHERS	ASTM A325M
ANCHOR BOLTS	ASTM A307
ROCK ANCHORS	ASTM A615 (YIELD STRESS = 517MPa) (ULTIMATE TENSILE STRESS = 690MPa)
STEEL PIPE	ASTM A53 (GRADE B)

4.2 ALL STEEL TO BE HOT DIPPED GALVANIZED, U.N.O.

4.3 ROCK ANCHORS TO BE DOUBLE CORROSION PROTECTED.

4.4 CORE DRILLED MECHANICAL ANCHORS SHALL BE HEAVY DUTY TYPE AND INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

DRAWING LIST:

DRAWING NO.	TITLE
C1	SITE PLAN, GENERAL NOTES AND DRAWING LIST
C2	SPARE
C3	EXISTING SITE − PLAN
C4	EXISTING SITE − SECTION
C5	SITE PREPARATION − CONTRACTOR'S WORK AREA
C6	GENERAL ARRANGEMENT − PLAN
C7	GENERAL ARRANGEMENT − SECTIONS
C8	EXISTING SERVICES − PLAN
C9	TEMPORARY SERVICES − FIRE WATER AND STORM DRAINAGE − PLAN AND DETAILS
C10	PERMANENT SERVICES − FIRE WATER, STORM DRAINAGE AND ASPHALT PAVEMENT − PLAN
C11	PERMANENT SERVICES − FIRE WATER, STORM DRAINAGE AND ASPHALT PAVEMENT − DETAILS − SHEET 1
C12	PERMANENT SERVICES − FIRE WATER, STORM DRAINAGE AND ASPHALT PAVEMENT − DETAILS − SHEET 2
D1	DEMOLITION − PLAN
D2	EXCAVATION − PLAN
D3	EXCAVATION − SECTION
D4	PHOTOGRAPHS OF ORIGINAL DOCK CONSTRUCTION
E1	TEMPORARY SERVICES − ELECTRICAL − PLAN AND CABLE SCHEDULE
E2	PERMANENT SERVICES − ELECTRICAL − PLAN, DETAILS & CABLE SCHEDULE
S1	EAST END RETAINING WALL − PLAN AND ELEVATION − SHEET 1
S2	EAST END RETAINING WALL − PLAN AND ELEVATION − SHEET 2
S3	EAST END RETAINING WALL − CONSTRUCTION AND EXPANSION JOINTS
S4	EAST END RETAINING WALL − ROCK ANCHORS
S5	EAST END RETAINING WALL − REINFORCEMENT − SHEET 1
S6	EAST END RETAINING WALL − REINFORCEMENT − SHEET 2
S7	EAST END RETAINING WALL − REINFORCEMENT − SHEET 3
S8	EAST END RETAINING WALL − MOORING DETAILS
S9	EAST END RETAINING WALL − GUARDRAIL DETAILS

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région de Pacifique

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS−BUILT BY KINETIC CONSTRUCTION	11/11/02

Client/client
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
G.COOPER

Drawn by/Dessine par
A.R.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services/Gestionnaire régionale, Services d'architectural et de génie, TPSGC
PREETIPAL PAUL

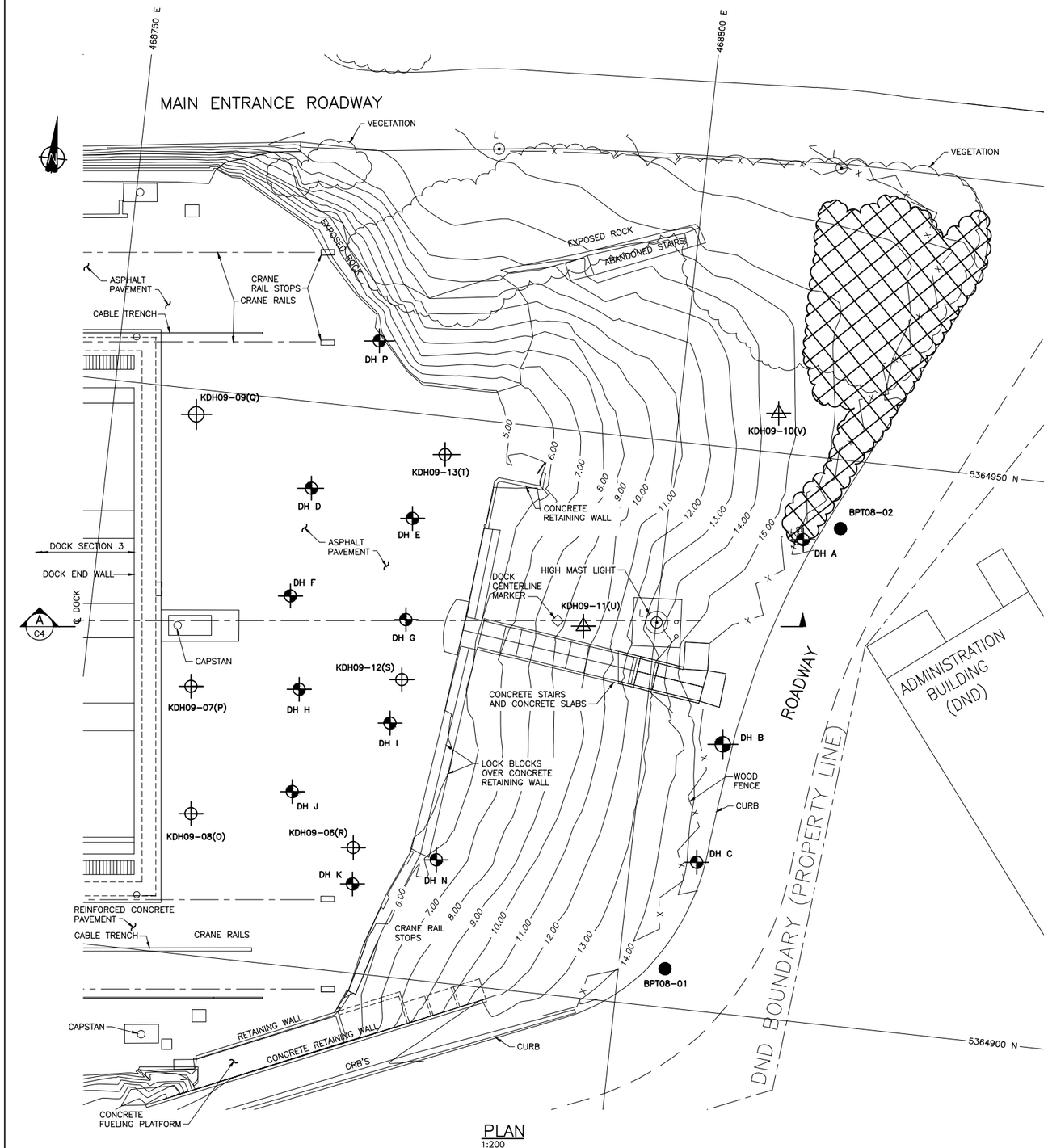
Drawing title/Titre du dessin
SITE PLAN, GENERAL NOTES AND DRAWING LIST

Project No./No. du projet	Sheet/Feuille	Revision no./ La révision no.
R.041547.001	C1 OF XX	

PWGSC − A1 − 841X594

0 10 20 30 40 50 60 70 80 90 100mm

DM5XXXXXX



PLAN
1:200

NOTES:

1. DIMENSIONS AND SERVICES SHOWN FOR THE EXISTING ESQUIMALT GRAVING DOCK ARE INFERRED FROM ORIGINAL "RECORD" DRAWINGS AND FIELD MEASUREMENTS.
2. DRILL HOLE LOCATIONS ARE APPROXIMATE.
3. FOR EXISTING UNDERGROUND SERVICES SEE DWG C8.

LEGEND

- SONGHEES FIRST NATION "MIDDEN SOIL PILES"
- EGD — ESQUIMALT GRAVING DOCK
- DH K — AIR TRACK DRILL HOLE. MAY 26 2008
- BPT08-01 — BECKER HAMMER TEST HOLE. JULY 17 2008
- KDH09-08 (O) — DIAMOND CORE HOLE. DEC 2009
- KDH09-10 (V) — MUD ROTARY DRILL HOLE. DEC 2009
- MH — MANHOLE
- CB — CATCH BASIN
- E — ELECTRICAL PULL PIT
- L — LAMP STANDARD
- FH — FIRE HYDRANT

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS-BUILT BY KINETIC CONSTRUCTION	11/11/02

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
G. COOPER

Drawn by/Dessine par
A.R.

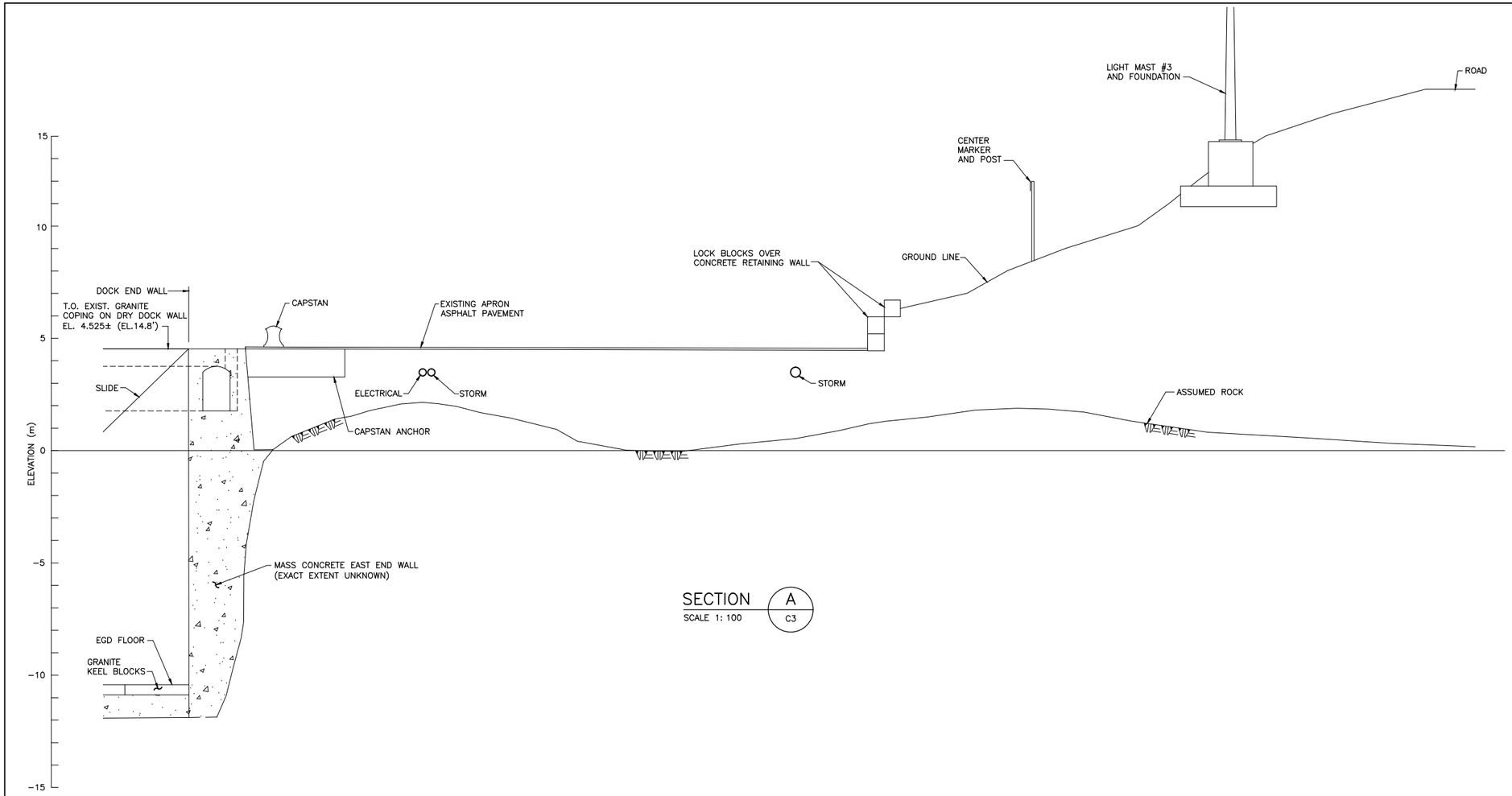
PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

Drawing title/Titre du dessin
EXISTING SITE PLAN

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	C3 OF XX	

DM5XXXXXX



SECTION A
SCALE 1: 100
C3

NOTES:

1. DIMENSIONS AND SERVICES SHOWN FOR THE EXISTING ESQUIMALT GRAVING DOCK ARE INFERRED FROM ORIGINAL "RECORD" DRAWINGS AND FIELD MEASUREMENTS.
2. LOCATION OF ELECTRICAL AND STORM WATER SERVICE APPROXIMATE.

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
0	As Constructed	11/07/18

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet

ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
G. COOPER

Drawn by/Dessine par
A.R.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

Drawing title/Titre du dessin

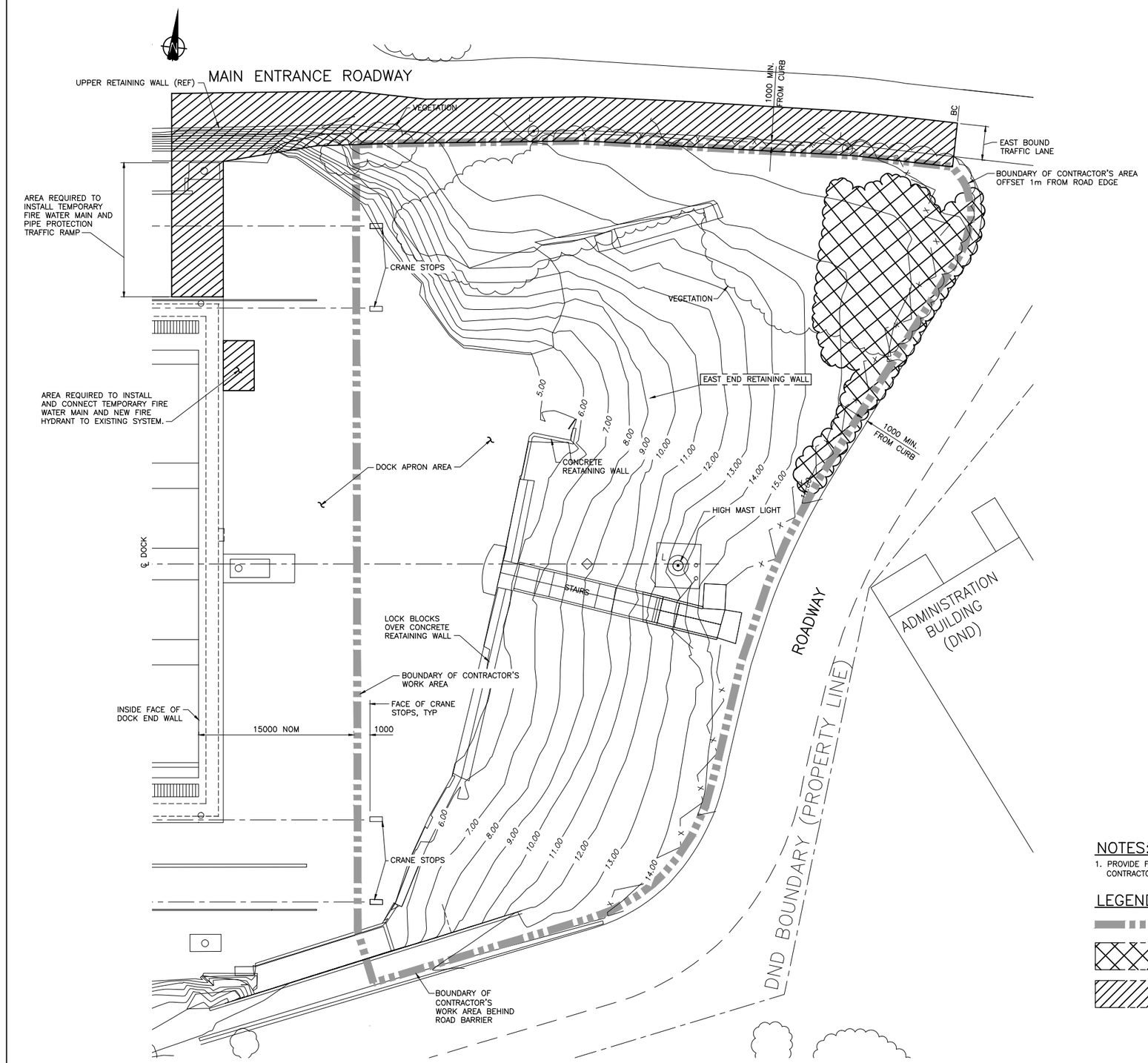
EXISTING SITE SECTION

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	C4 OF XX	0

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

DM5XXXXXX



PLAN
1:200

NOTES:

1. PROVIDE FENCING AS REQUIRED TO PREVENT UNAUTHORIZED ACCESS TO CONTRACTOR'S WORK AREA.

LEGEND

- CONTRACTOR'S FENCED CONSTRUCTION BOUNDARY
- SONGHEES FIRST NATION "MIDDEN SOIL PILES" DO NOT DISTURB OR EXCAVATE.
- TEMPORARY WORK AREA FOR INSTALLING AND REMOVING TEMPORARY SERVICES. COORDINATE LANE CLOSURE WITH DEPARTMENTAL REPRESENTATIVE.

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS-BUILT BY KINETIC CONSTRUCTION	11/11/02

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
G. COOPER

Drawn by/Dessine par
A.R.

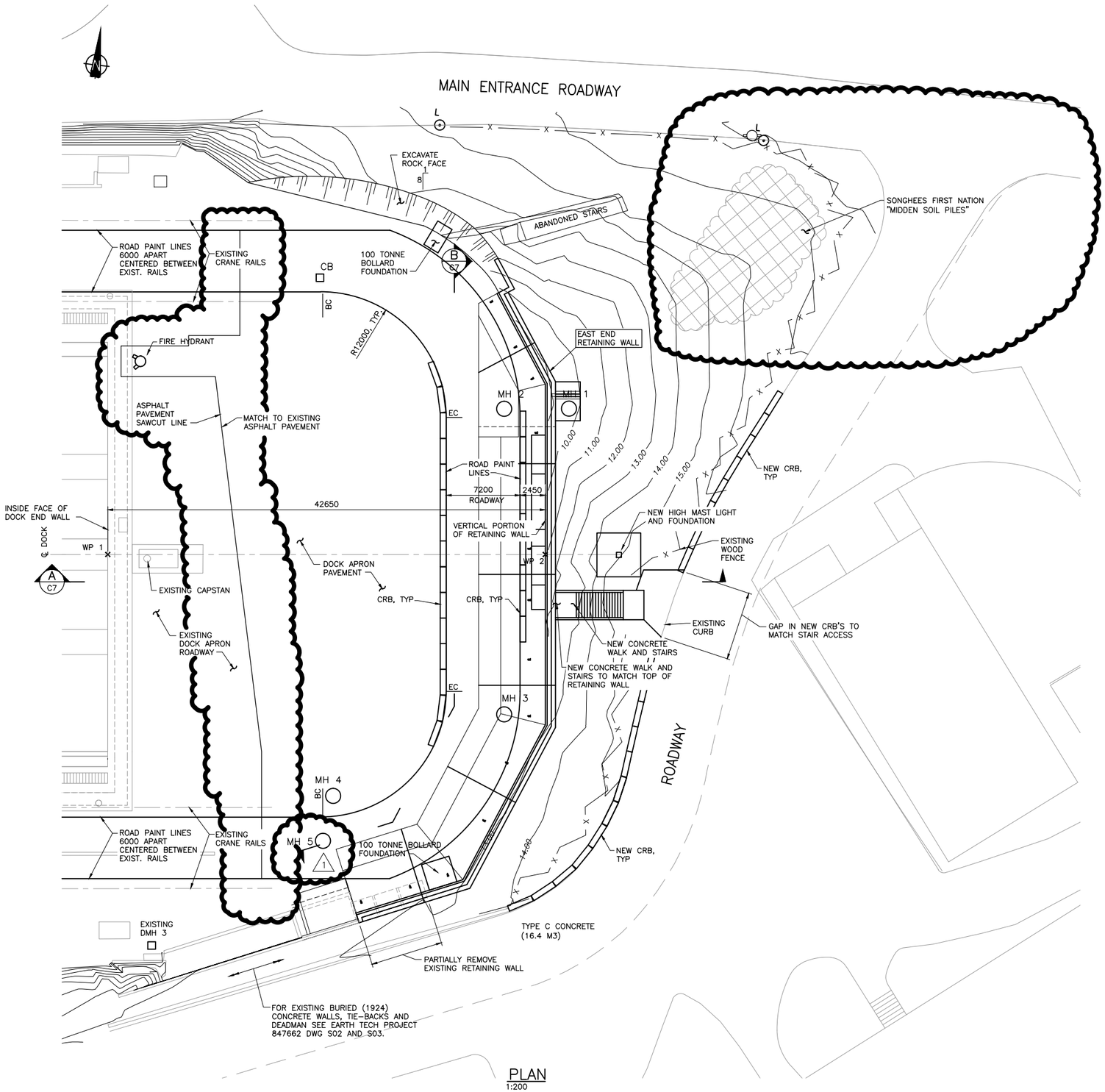
PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

Drawing title/Titre du dessin
SITE PREPARATION
CONTRACTOR'S WORK AREA

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	C5 OF XX	

DM5XXXXXX



PLAN
1:200

NOTES:

1. FOR NOTES SEE DWG. C1.

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS-BUILT BY KINETIC CONSTRUCTION	12/01/30

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet

ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
G. COOPER

Drawn by/Dessine par
A.R.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

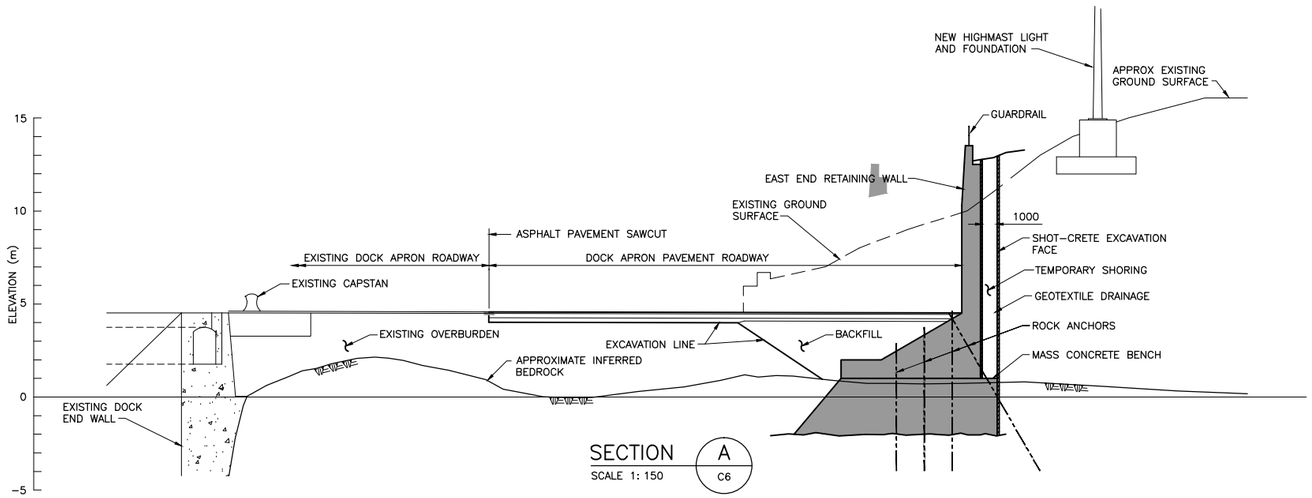
Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

Drawing title/Titre du dessin

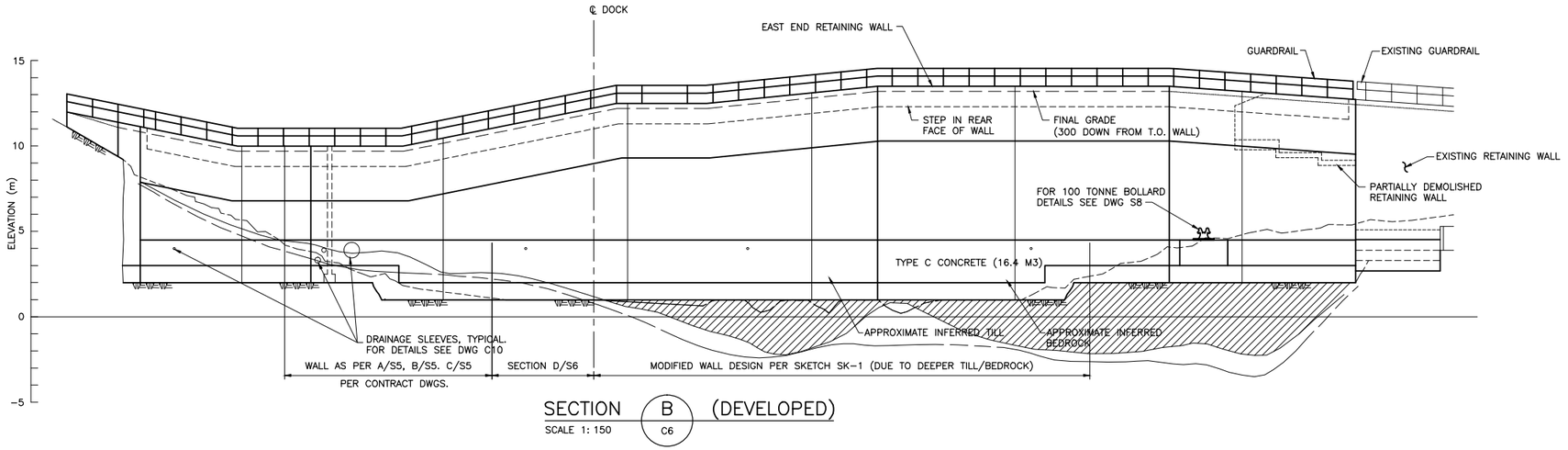
GENERAL ARRANGEMENT PLAN

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	C6 OF XX	

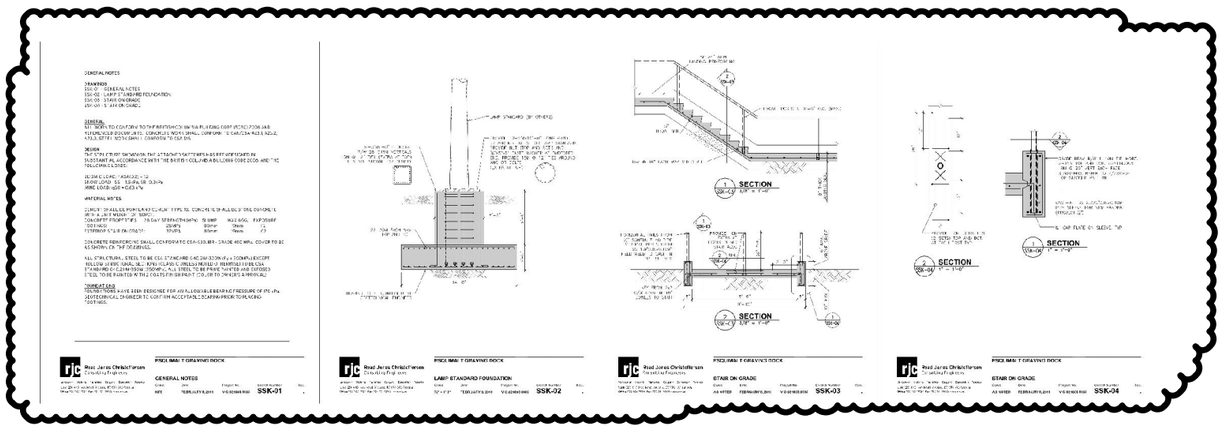
DM5XXXXX



SECTION A
SCALE 1: 150
C6



SECTION B (DEVELOPED)
SCALE 1: 150
C6



PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS-BUILT BY KINETIC CONSTRUCTION	12/01/30

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
G. COOPER

Drawn by/Dessine par
G.M.

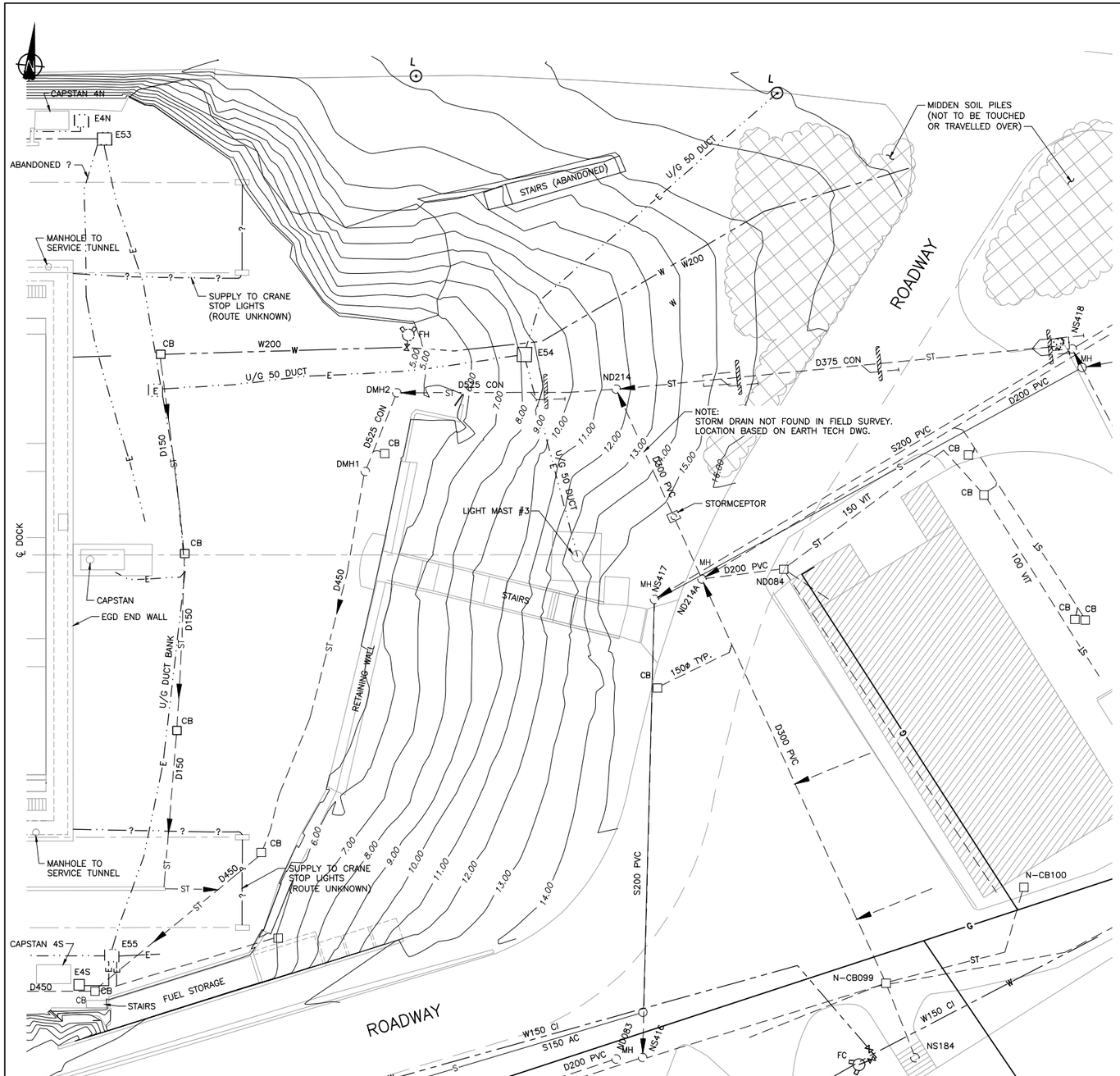
PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

Drawing title/Titre du dessin
GENERAL ARRANGEMENT SECTIONS

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	C7 OF XX	

DM5XXXXX



PLAN
1:200

NOTES:

1. BASEPLAN BASED ON PWGSC DWGS AND FOCUS TOPOGRAPHIC SURVEY, SHEET NO. 030200583–104TS1.
2. ALL EXISTING UTILITIES ARE SHOWN ACCORDING TO AVAILABLE RECORD DRAWINGS. NO RESPONSIBILITY IS IMPLIED OR ASSUMED BY PWGSC OR KCB AS TO AS FOUND LOCATION. THE CONTRACTOR SHALL LOCATE ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION, INCLUDING UNDERGROUND POWER AND TELEPHONE SERVICE DUCTS AND SHALL NOTIFY THE SITE REPRESENTATIVE OF ANY CONFLICTS A MINIMUM OF 72 HOURS PRIOR TO CONSTRUCTION. ANY ADDITIONAL WORK REQUIRED AS A RESULT OF FAILING TO PRE–LOCATE KNOWN OR POTENTIAL CONFLICTS WILL BE COMPLETED AT THE CONTRACTOR'S EXPENSE.

LEGEND

- W — EXISTING FIRE WATER / VALVE
- FH — EXISTING FIRE HYDRANT
- ST — EXISTING STORM DRAIN / MANHOLE
- CB — EXISTING CATCH BASIN
- E — EXISTING ELECTRICAL
- Exx — PULL PIT
- L — LAMP STANDARD

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS–BUILT BY KINETIC CONSTRUCTION	11/11/02

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
A. MACK

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

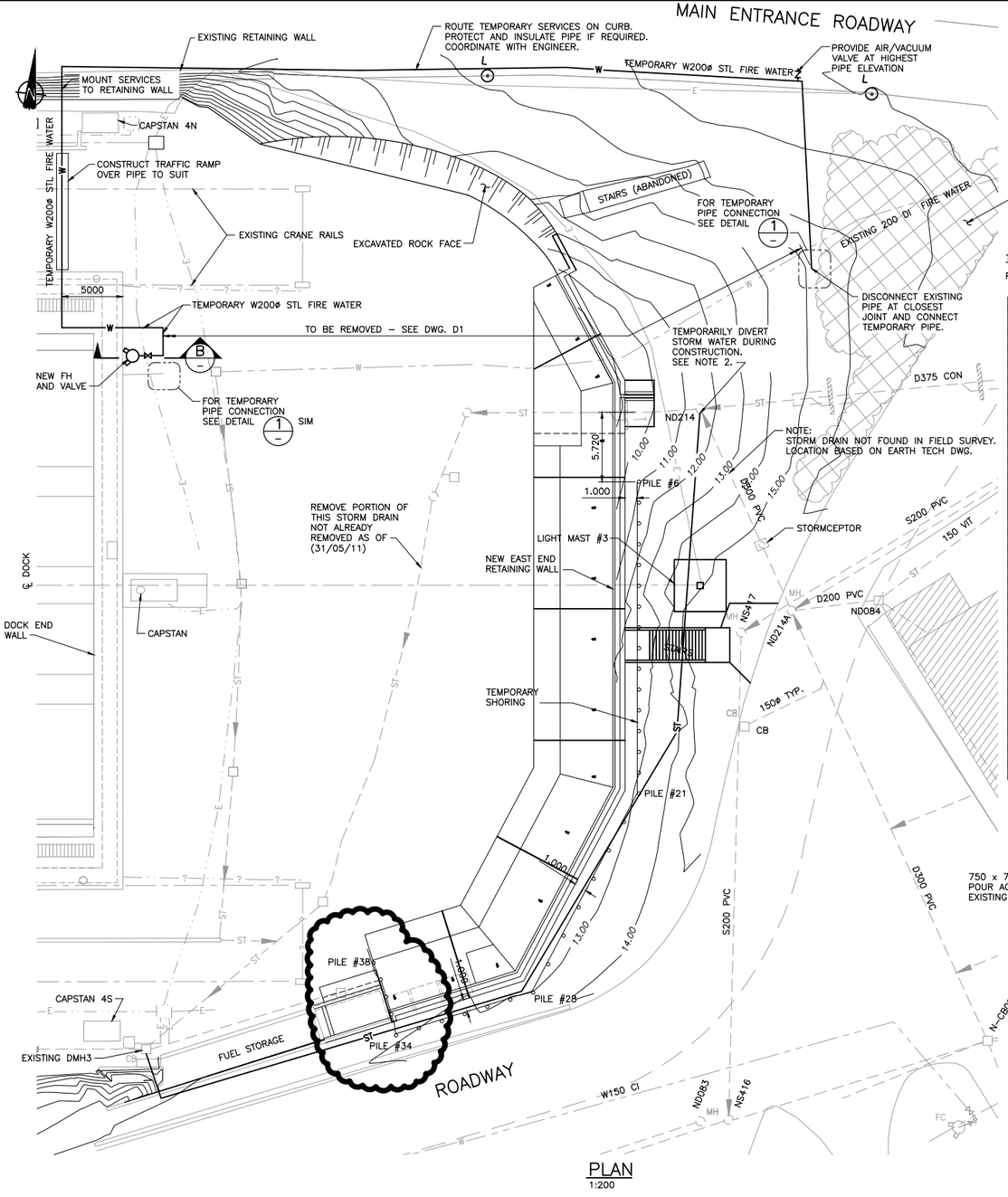
Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

Drawing title/Titre du dessin
EXISTING SERVICES PLAN

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	C8 OF XX	

DM5XXXXXX

MAIN ENTRANCE ROADWAY



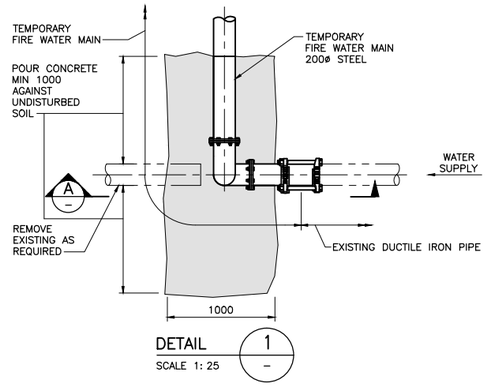
PLAN
1:200

TEMP. SHORING AS–BUILTS

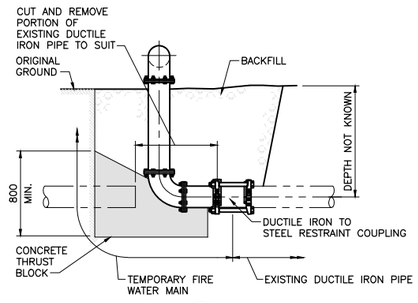
PILE#	T.O.PILE DEPTH BELOW T.O.WALL
6	–1.47
7	–1.42
8	–1.57
9	–.635
10	–1.17
11	–1.42
12	–.686
13	–.508
14	–.482
15	–.533
16	–.599
17	–.812
18	–1.041
19	–1.22
20	–1.54
21	–1.60
22	–1.65
23	–1.60
24	–1.54
25	–1.50
26	–1.56
27	–1.34
28	–1.21
29	–.670
30	–.530
31	–.560
32	–.450
33	–.279
34	–.270

NOTES:

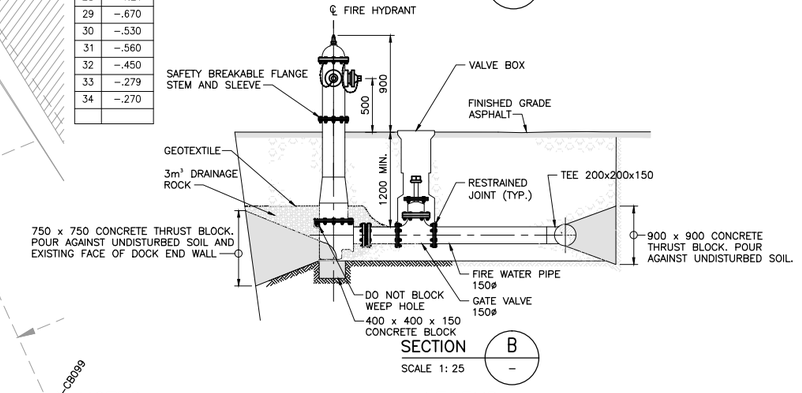
1. BASEPLAN BASED ON PWGSC DWGS AND FOCUS TOPOGRAPHIC SURVEY, SHEET NO. 030200583–104TS1.
2. CONTRACTOR TO PROVIDE TEMPORARY STORM DRAINAGE. SEE SPECIFICATIONS.
2. FIRE MAIN TO BE GALVANIZED STEEL WITH GROOVED END MECHANICAL CONNECTIONS, SCH 20.
3. FLUSH AND DISINFECT TEMPORARY FIRE WATER MAIN TO AWWA C651. DISCHARGE TO SANITARY SEWER.
4. CONNECT TO EXISTING FIRE WATER MAIN ONLY AFTER PRESSURE TEST, FLUSHING AND DISINFECTION OF TEMPORARY MAIN TO SATISFACTION OF DEPARTMENTAL REPRESENATIVE.



DETAIL 1
SCALE 1: 25



SECTION A
SCALE 1: 25



SECTION B
SCALE 1: 25

LEGEND

- W — EXISTING FIRE WATER / VALVE
- ST — EXISTING STORM DRAIN / MANHOLE
- CB — EXISTING CATCH BASIN
- E — EXISTING ELECTRICAL
- W — TEMPORARY FIRE WATER / VALVE
- FH — FIRE HYDRANT
- ST — TEMPORARY STORM WATER DIVERSION
- E — TEMPORARY ELECTRICAL
- L — LAMP STANDARD

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS–BUILT BY KINETIC CONSTRUCTION	12/01/30

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
A. MACK

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

Drawing title/Titre du dessin

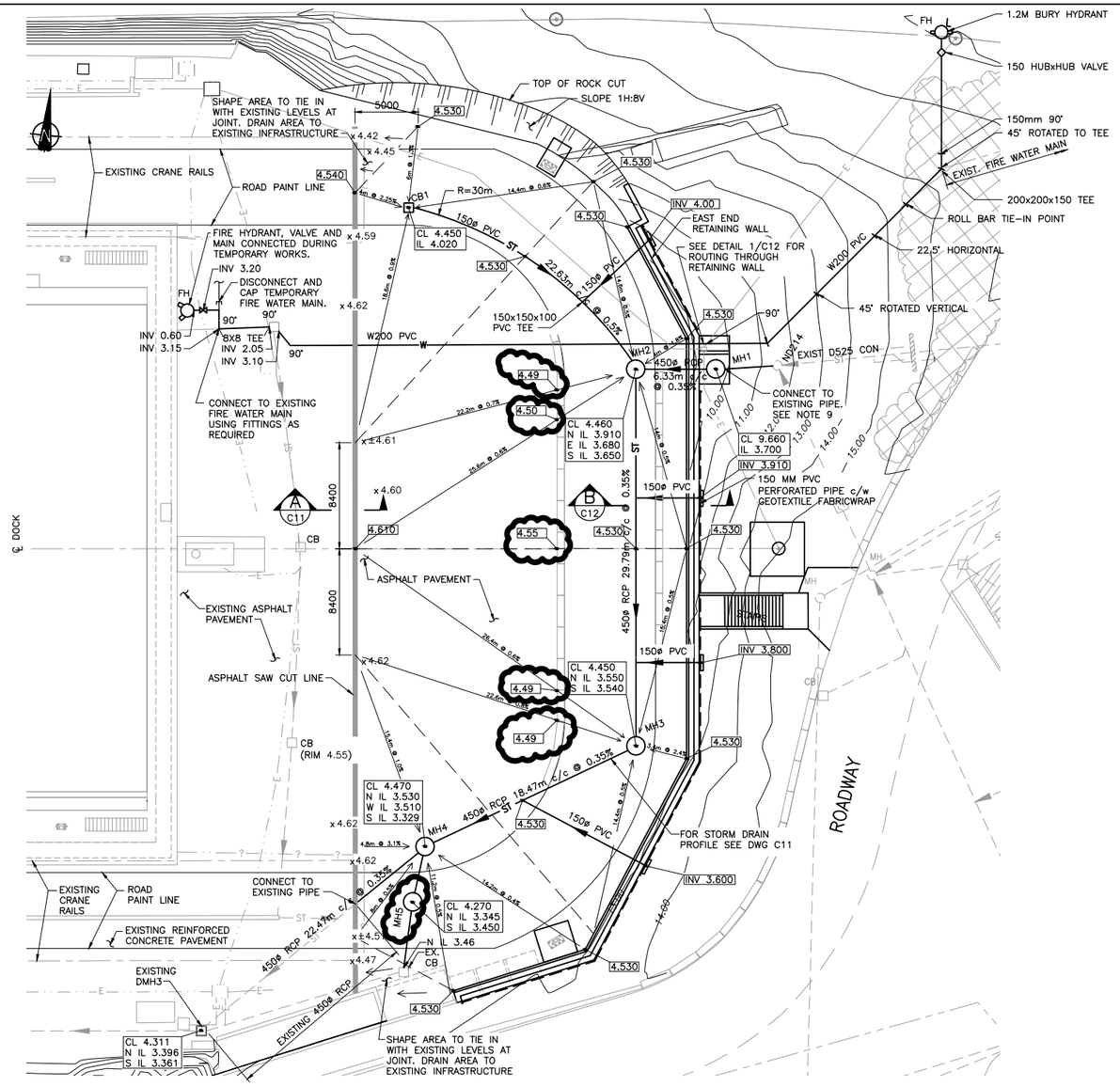
TEMPORARY SERVICES FIRE WATER AND STORM DRAINAGE PLAN AND DETAILS

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	C9 OF XX	

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

DMSXXXXXX



PLAN
1:200

NOTES:

1. BASEPLAN BASED ON PWGSC DWGS AND FOCUS TOPOGRAPHIC SURVEY, SHEET NO. 030200583-104TS1.
2. SEE DWGS. C11 & C12 FOR DETAILS OF STORM WATER DRAINAGE INFRASTRUCTURE.
3. MANHOLE AND CATCHBASIN ELEVATIONS ARE SHOWN FOR COVER AND INVERT (AT OUTLET) LEVEL.
4. BURIED FIRE WATER MAIN TO BE PVC C900 DR14 MECHANICALLY RESTRAINED FULL LENGTH.
5. ALL MATERIALS FOR FIRE WATER MAIN TO BE ULC OR FM LISTED.
6. ALL NUTS, BOLTS, WASHERS, TIE RODS AND RELATED MISCELLANEOUS HARDWARE TO BE STAINLESS STEEL.
7. FLUSH AND DISINFECT NEW FIRE WATER MAIN TO AWWA C651.
8. CONNECT TO EXISTING FIRE WATER MAIN ONLY AFTER PRESSURE TEST, FLUSHING AND DISINFECTION OF NEW MAINS TO SATISFACTION OF DEPARTMENTAL REPRESENTATIVE.
9. ALL BURIED MECHANICAL JOINT RESTRAINTS, FLANGE ADDAPTERS AND VALVES SHALL BE WRAPPED WITH DENSO TAPE TO MANUFACTURER'S INSTRUCTIONS.
10. SEE DWG. D1 FOR LIMITS OF DEMOLITION.

LEGEND

- EXISTING FIRE WATER / VALVE
- EXISTING STORM DRAIN / MANHOLE
- EXISTING CATCH BASIN
- EXISTING ELECTRICAL
- NEW FIRE WATER / VALVE
- FIRE HYDRANT
- NEW STORM DRAIN / MANHOLE
- NEW CATCH BASIN
- NEW ELECTRICAL
- LAMP STANDARD
- X.XXX — SURFACE ELEVATION (IN METRES)
- CL X.XXX / IL X.XXX — MANHOLE/CATCHBASIN COVER LEVEL AND INVERT LEVEL (IN METRES)
- x X.XX / x ±X.XX — SURVEYED ELEVATION (IN METRES)
- SURFACE DRAINAGE
- CATCHMENT AREA
- SAW CUT ASPHALT
- GEOTEXTILE DRAINAGE WITHIN SHORING

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/Revision	Description/Description	Date/Date
1	AS-BUILT BY KINETIC CONSTRUCTION	12/01/30

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
A. MACK & G. COOPER

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

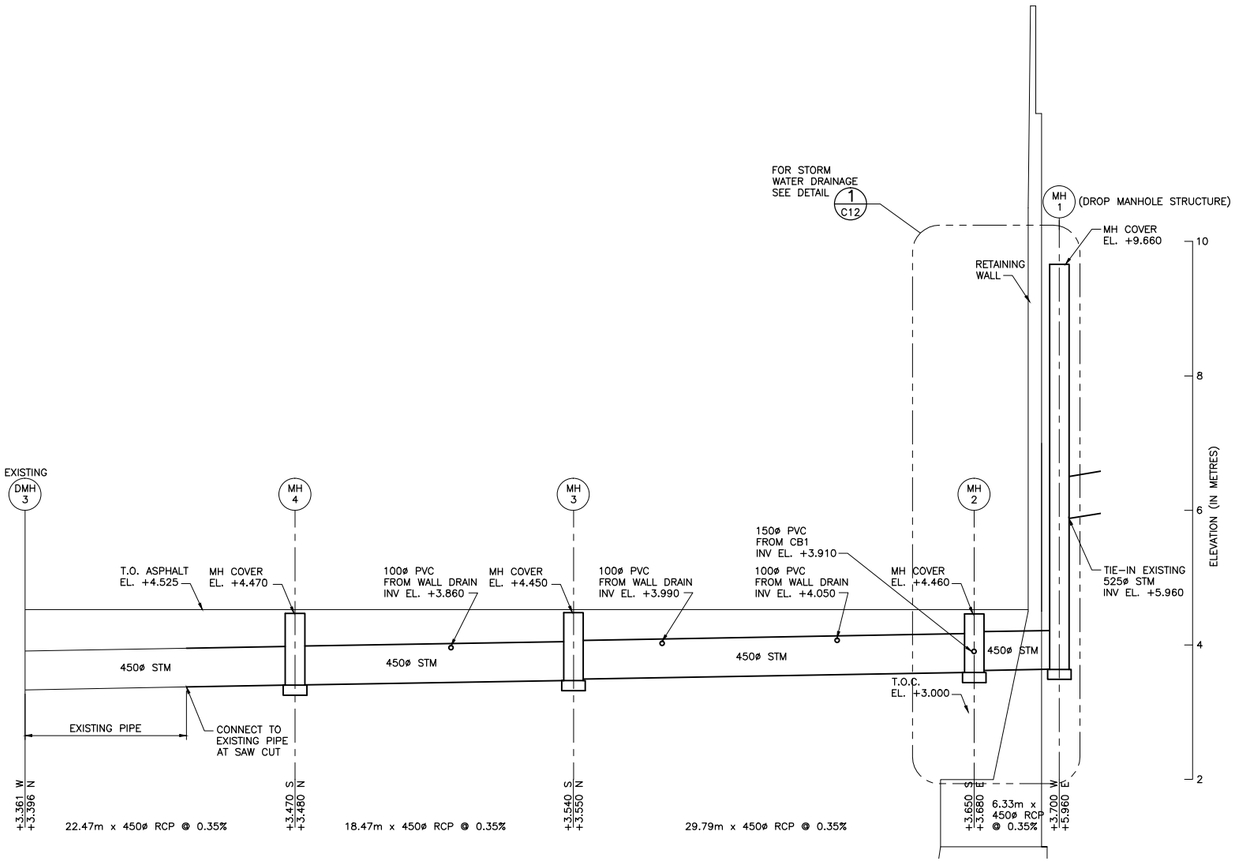
Drawing title/Titre du dessin
PERMANENT SERVICES
FIRE WATER, STORM DRAINAGE AND ASPHALT PAVEMENT
PLAN

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	C10 OF XX	

PWGSC – A1 – 841X594

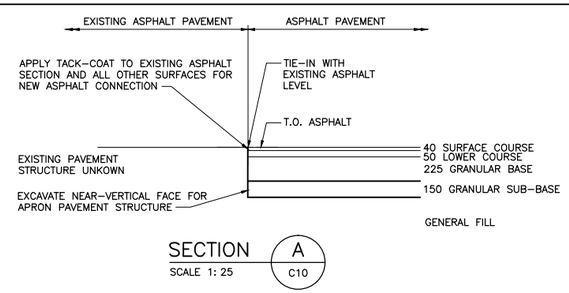
0 10 20 30 40 50 60 70 80 90 100mm

DMSXXXXXX



STORM WATER DRAINAGE PROFILE (DEVELOPED)
LOOKING WEST (MH1 TO DMH3)

H 1:200
V 1:40



SECTION A C10
SCALE 1: 25

ASPHALT PAVEMENT STRUCTURE TIE-IN

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS-BUILT BY KINETIC CONSTRUCTION	11/11/02

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
G. COOPER

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

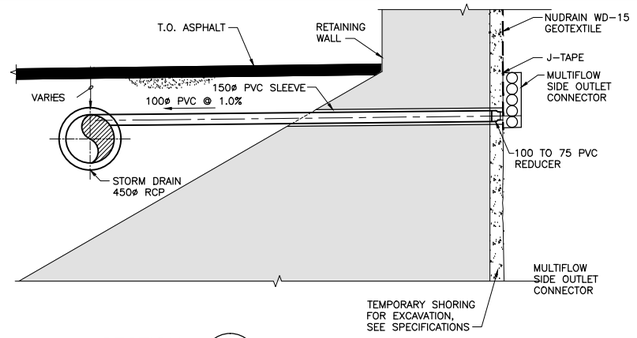
Drawing title/Titre du dessin
PERMANENT SERVICES
FIRE WATER, STORM DRAINAGE AND ASPHALT PAVEMENT
DETAILS
SHEET 1

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	C11 OF XX	

PWGSC – A1 – 841X594

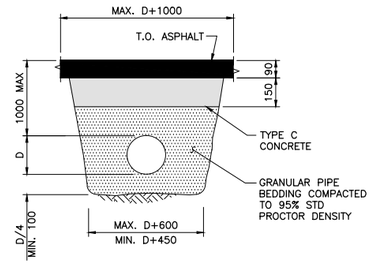
0 10 20 30 40 50 60 70 80 90 100mm

DM5XXXXXX



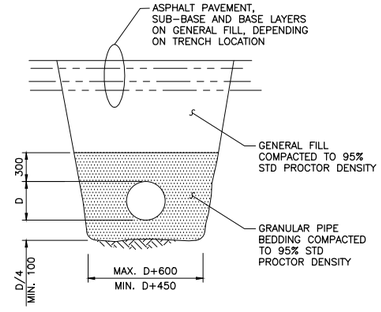
SECTION B C10 TYPICAL WALL DRAIN

SCALE 1: 50



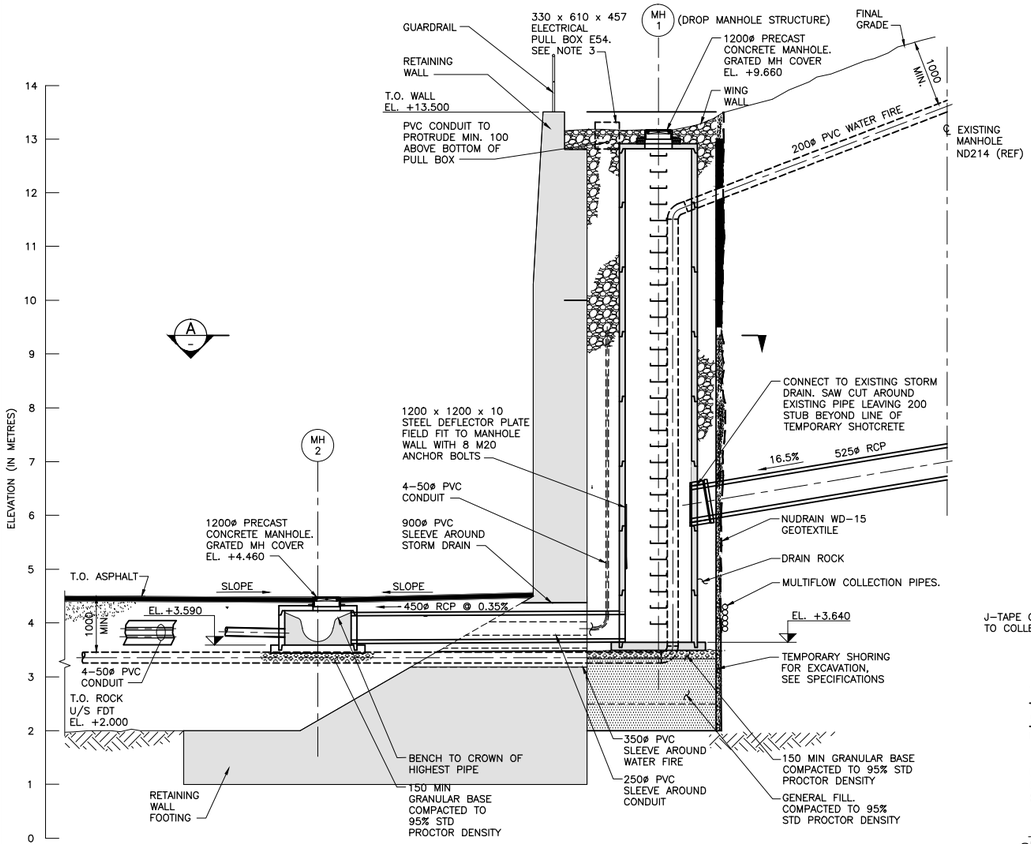
TYPICAL TRENCH DETAIL FOR PIPES WITH LESS THAN 1000 COVER

N.T.S.



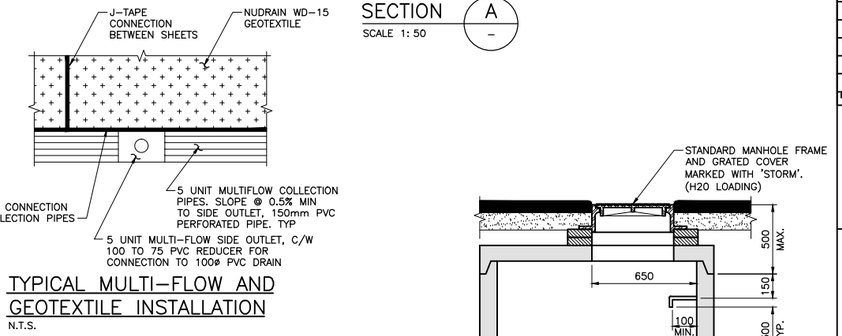
TYPICAL TRENCH DETAIL FOR PIPES WITH MORE THAN 1000 COVER

N.T.S.

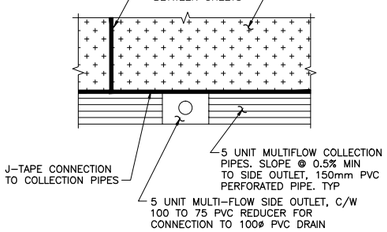


DETAIL 1 C11 STORM WATER DRAINAGE

SCALE 1: 150

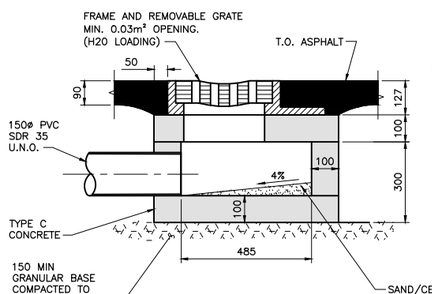


SECTION A – SCALE 1: 50



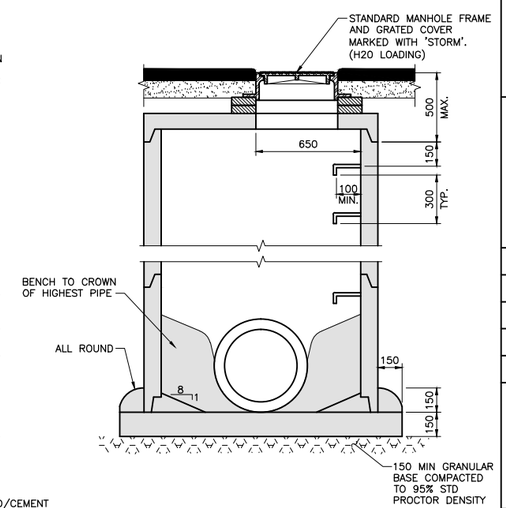
TYPICAL MULTI-FLOW AND GEOTEXTILE INSTALLATION

N.T.S.



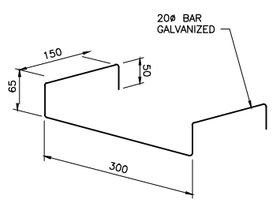
CATCHBASIN DETAIL

N.T.S.



TYPICAL 1200ø MANHOLE DETAIL

N.T.S.



TYPICAL RUNG DETAIL

N.T.S.

NOTES:

1. ALL ELEVATIONS ARE IN CHART DATUM.
2. DIMENSIONS ARE IN MILLIMETRES AND ELEVATIONS ARE IN METRES UNLESS NOTED OTHERWISE.
3. PULL BOX TO BE TAPERED POLYMER CONCRETE WITH OPEN BOTTOM ON DRAIN ROCK BACKFILL. TOP OF PULL BOX TO BE MIN. 100 ABOVE FINISHED GRADE.

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS-BUILT BY KINETIC CONSTRUCTION	11/11/02

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet

ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
A. MACK & G. COOPER

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

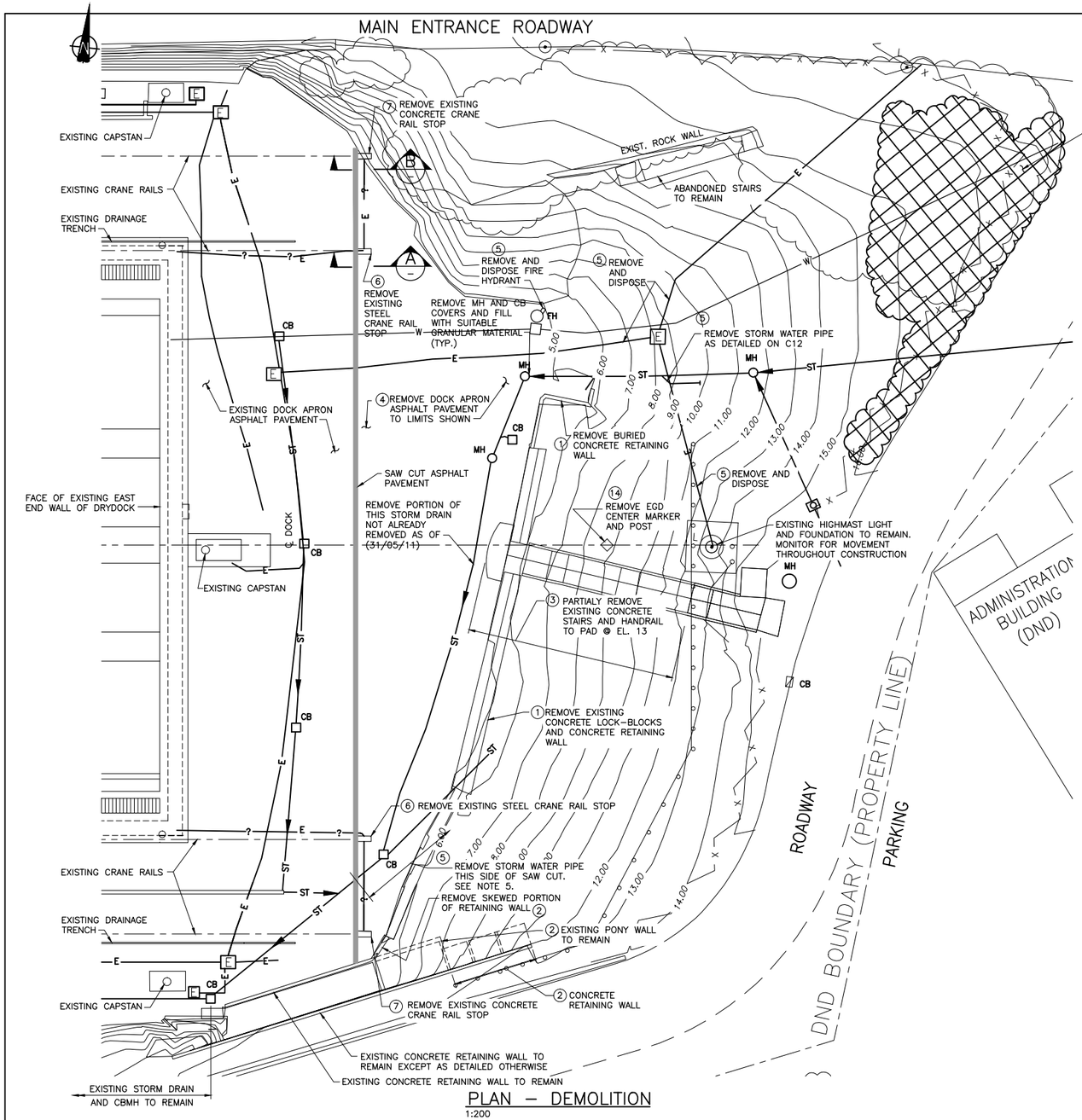
Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

Drawing title/Titre du dessin

PERMANENT SERVICES
FIRE WATER, STORM DRAINAGE AND ASPHALT PAVEMENT
DETAILS
SHEET 2

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	C12 OF XX	

DM5XXXXXX



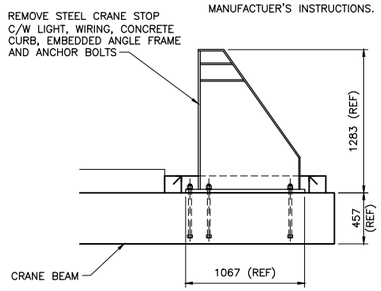
PLAN – DEMOLITION
1:200

LEGEND

- SONGHEES FIRST NATION "MIDDEN SOIL PILES"
- CB — CATCH BASIN
- ST — STORM DRAIN / MANHOLE
- W — WATER MAIN / VALVE
- E — ELECTRICAL
- E — ELECTRICAL PULL PIT
- L — LAMP STANDARD
- FH — FIRE HYDRANT

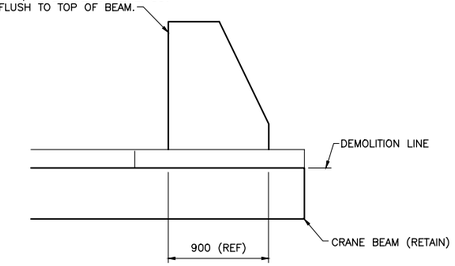
NOTES:

1. THE CONTRACTOR IS RESPONSIBLE FOR TREATING AND DISPOSING OF CONTAMINATED WATER FROM EXCAVATION AND CONSTRUCTION. SEE SPECIFICATIONS FOR ENVIRONMENTAL/CLEANLINESS REQUIREMENTS.
2. REMOVE ELECTRICAL AND MECHANICAL SERVICES AFTER TEMPORARY SERVICES ARE INSTALLED AND CONNECTED.
3. PROVIDE TEMPORARY ROCK SUPPORT AND TEMPORARY SOIL SUPPORT DURING EXCAVATION.
4. WHEN REMOVING 2 CONCRETE RAIL STOPS, DO NOT DAMAGE CRANE RAIL SYSTEM OR FOUNDATION STRUCTURE.
5. ALL BURIED MECHANICAL JOINT RESTRAINTS, FLANGE ADAPTERS AND VALVES SHALL BE WRAPPED WITH DENSO TAPE TO MANUFACTUER'S INSTRUCTIONS.



SECTION A
SCALE 1: 25

REMOVE ASPAHLT TO SUIT AND DEMOLISH 460 WIDE x 1310 HIGH REINFORCED CONCRETE CRANE STOP C/W WIRING, TO DEMOLITION LINE. CUT REBAR FLUSH TO TOP OF BEAM.



SECTION B
SCALE 1: 25

ITEMS DEMOLISHED, REMOVED, STORED OR RE-USED		
ITEM NUMBER	BRIEF DESCRIPTION OF ITEMS	ACTION
(1)	APPROX 61 LOCK-BLOCKS AND REINFORCED CONCRETE RETAINING WALL AT EAST END OF APRON	RETURN LOCK-BLOCKS TO PWGSC. STORE IN LOCATION DESIGNATED BY DEPARTMENTAL REPRESENTATIVE. REMOVE AND DISPOSE REINF. CONC. RETAINING WALL.
(2)	REINFORCED CONCRETE RETAINING WALL	FOR DEMOLITION LIMITS AT EAST END OF WALL SEE DWG S2
(3)	REINFORCED CONCRETE STAIRS AND HANDRAIL TO PAD AT EL. 13m	REMOVE AS INDICATED AND DISPOSE
(4)	DOCK APRON ASPHALT PAVEMENT	CUT AS INDICATED AND DISPOSE
(5)	ELECTRICAL, STORM DRAINS AND WATER SERVICES	REMOVE AS INDICATED AND DISPOSE.
(6)	2 STEEL RAIL STOPS AND 4 LIGHTS	RETAIN STEEL RAIL STOPS AND RETURN TO PWGSC. STORE IN LOCATION DESIGNATED BY DEPARTMENTAL REPRESENTATIVE.
(7)	2 CONCRETE RAIL STOPS. SEE NOTE 4.	REMOVE AND DISPOSE
(8)	EGD CENTER MARKER AND POST	REMOVE AND DISPOSE

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région de Pacifique

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS-BUILT BY KINETIC CONSTRUCTION	11/11/02

Client/client
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
A. MACK

Drawn by/Dessine par
A.R.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services, Gestionnaire régionale, Services d'architectural et de génie, TPSGC
PREETIPAL PAUL

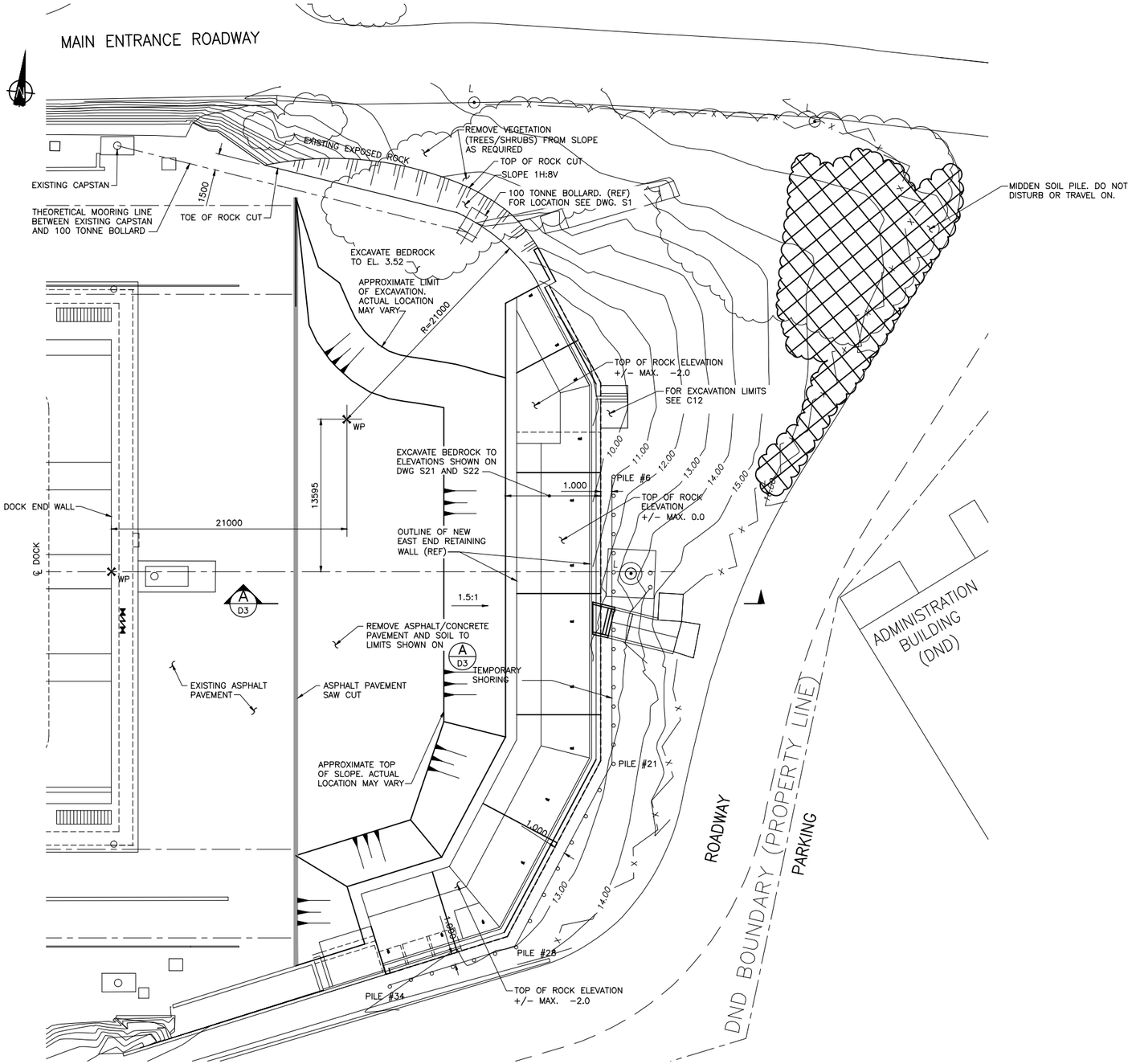
Drawing title/Titre du dessin
DEMOLITION PLAN

Project No./No. du projet	Sheet/Feuille	Revision no./ La révision no.
R.041547.001	D1 OF XX	

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

DM5XXXXXX



PLAN – EXCAVATION

1:200

NOTE:
EXISTING, TEMPORARY AND PERMANENT SERVICES NOT SHOWN.

LEGEND

SONGHEES FIRST NATION "MIDDEN SOIL PILES"

NOTES:

1. SOIL & ROCK CONDITIONS ARE ONLY KNOWN AT DRILL HOLE LOCATIONS AS SHOWN IN KCBL DATA REPORTS. CONDITIONS MAY VARY BETWEEN DRILL HOLES. STRATIGRAPHY BETWEEN DRILL HOLES IS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY & SHOULD NOT BE RELIED UPON FOR DESIGN OR CONSTRUCTION.
2. TEMPORARY EXCAVATION SLOPES SHOULD NOT EXCEED 1.5H:1V. THIS RECOMMENDATION IS BASED ON THE ASSUMPTION THAT THE WATER TABLE IS KEPT AT LEAST 0.6m BELOW THE BOTTOM OF THE EXCAVATION. ALL EXCAVATION SLOPES SHALL COMPLY WITH WORKER'S COMPENSATION BOARD REGULATIONS. ALL TEMPORARY EXCAVATION SUPPORT SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA AND RETAINED BY THE CONTRACTOR.
3. FOR ROCK EXCAVATION REFER TO SPECIFICATION SECTION 31 23 16.26.

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région de Pacifique

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS–BUILT BY KINETIC CONSTRUCTION	11/11/02

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet

ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
A. PORT & G. COOPER

Drawn by/Dessine par
A.R.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

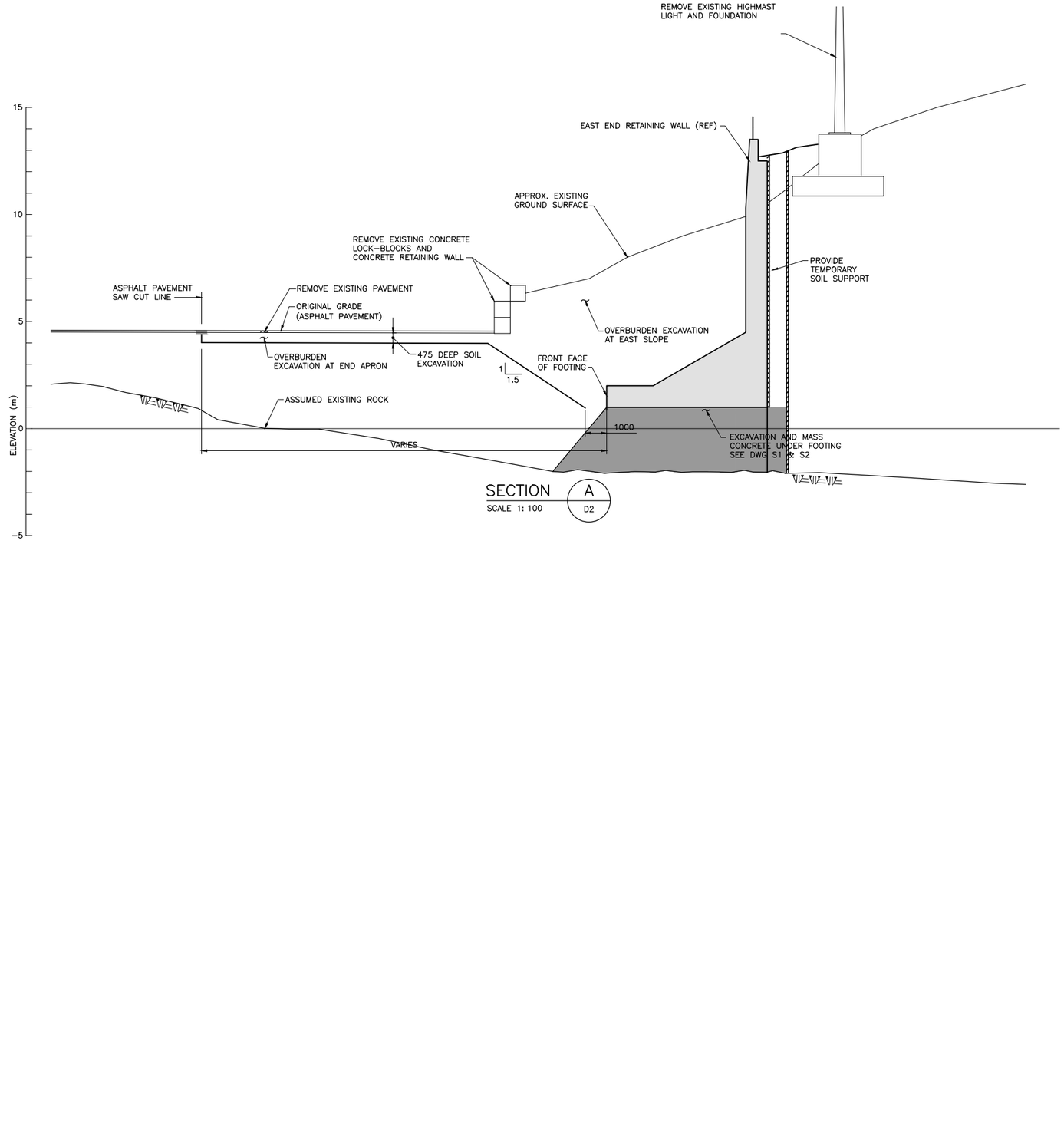
Regional Manager, Architectural and Engineering Services, Gestionnaire régionale, Services d'architectural et de génie, TPSGC
PREETIPAL PAUL

Drawing title/Titre du dessin

EXCAVATION PLAN

Project No./No. du projet	Sheet/Feuille	Revision no./ La Révision no.
R.041547.001	D2 OF XX	

DM5XXXXXX



SECTION A / D2

SCALE 1: 100

NOTES:

1. SOIL & ROCK CONDITIONS ARE ONLY KNOWN AT DRILL HOLE LOCATIONS AS SHOWN IN KCBL DATA REPORTS. CONDITIONS MAY VARY BETWEEN DRILL HOLES. STRATIGRAPHY BETWEEN DRILL HOLES IS SHOWN FOR ILLUSTRATIVE PURPOSES ONLY & SHOULD NOT BE RELIED UPON FOR DESIGN OR CONSTRUCTION.
2. FOR ROCK EXCAVATION REFER TO SPECIFICATION SECTION 31 23 16.26.
3. TEMPORARY EXCAVATION SLOPES SHOULD NOT EXCEED 1.5H:1V. THIS RECOMMENDATION IS BASED ON THE ASSUMPTION THAT THE WATER TABLE IS KEPT AT LEAST 0.6m BELOW THE BOTTOM OF THE EXCAVATION. ALL EXCAVATION SLOPES SHALL COMPLY WITH WORKER'S COMPENSATION BOARD REGULATIONS. ALL TEMPORARY EXCAVATION SUPPORT SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF BRITISH COLUMBIA AND RETAINED BY THE CONTRACTOR.

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région de Pacifique

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS-BUILT BY KINETIC CONSTRUCTION	11/11/02

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet

ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
A. PORT & G. COOPER

Drawn by/Dessine par
A.R.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services / Gestionnaire régional, Services d'architecturel et de génie, TPSGC
PREETIPAL PAUL

Drawing title/Titre du dessin

EXCAVATION SECTION

Project No./No. du projet	Sheet/Feuille	Revision no./ La Révision no.
R.041547.001	D3 OF XX	

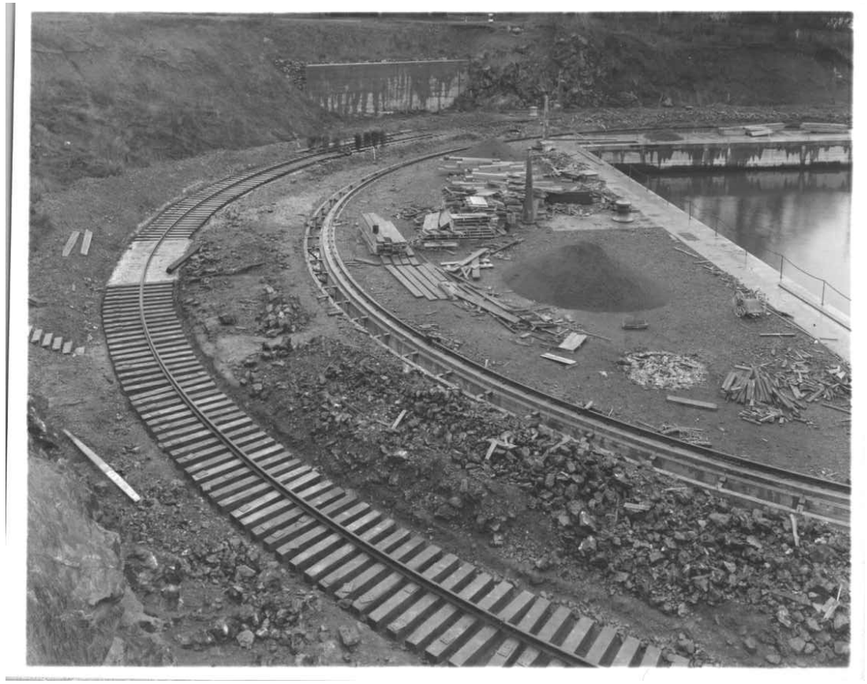
PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

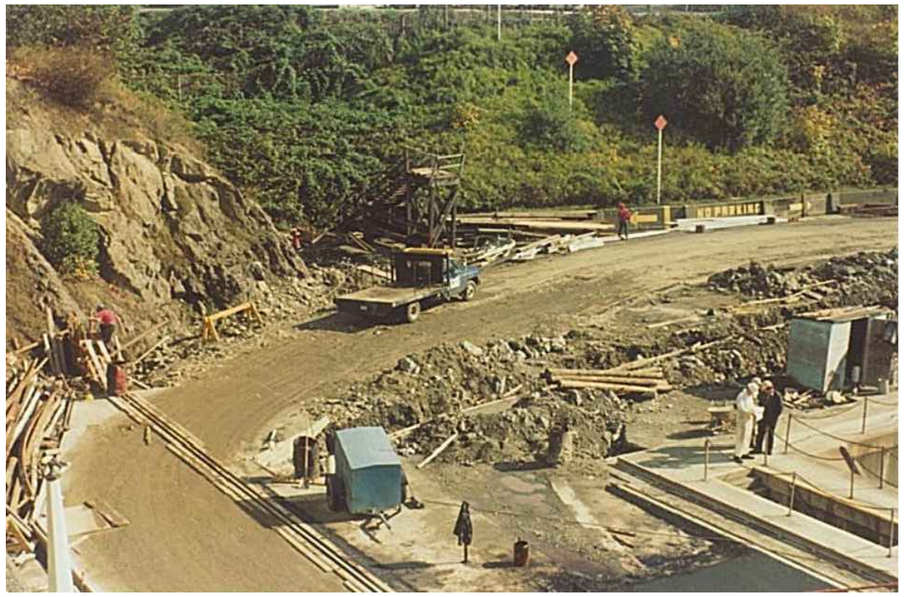
DM5XXXXXX

DOCK EXCAVATION AT EAST END WALL, LOOKING EAST (NOV 1922)

EAST END WALL AND APRON COMPLETE (OCT 1924)



ORIGINAL CRANE RAILS AROUND EAST END APRON (JAN 1927)



EAST END DUCT BANK INSTALLATION, LOOKING EAST (CIRCA 1980)

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

1	AS-BUILT BY KINETIC CONSTRUCTION	11/11/02
Revision/ Revision	Description/Description	Date/Date

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet

ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
G. COOPER

Drawn by/Dessine par
A.R.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

Drawing title/Titre du dessin

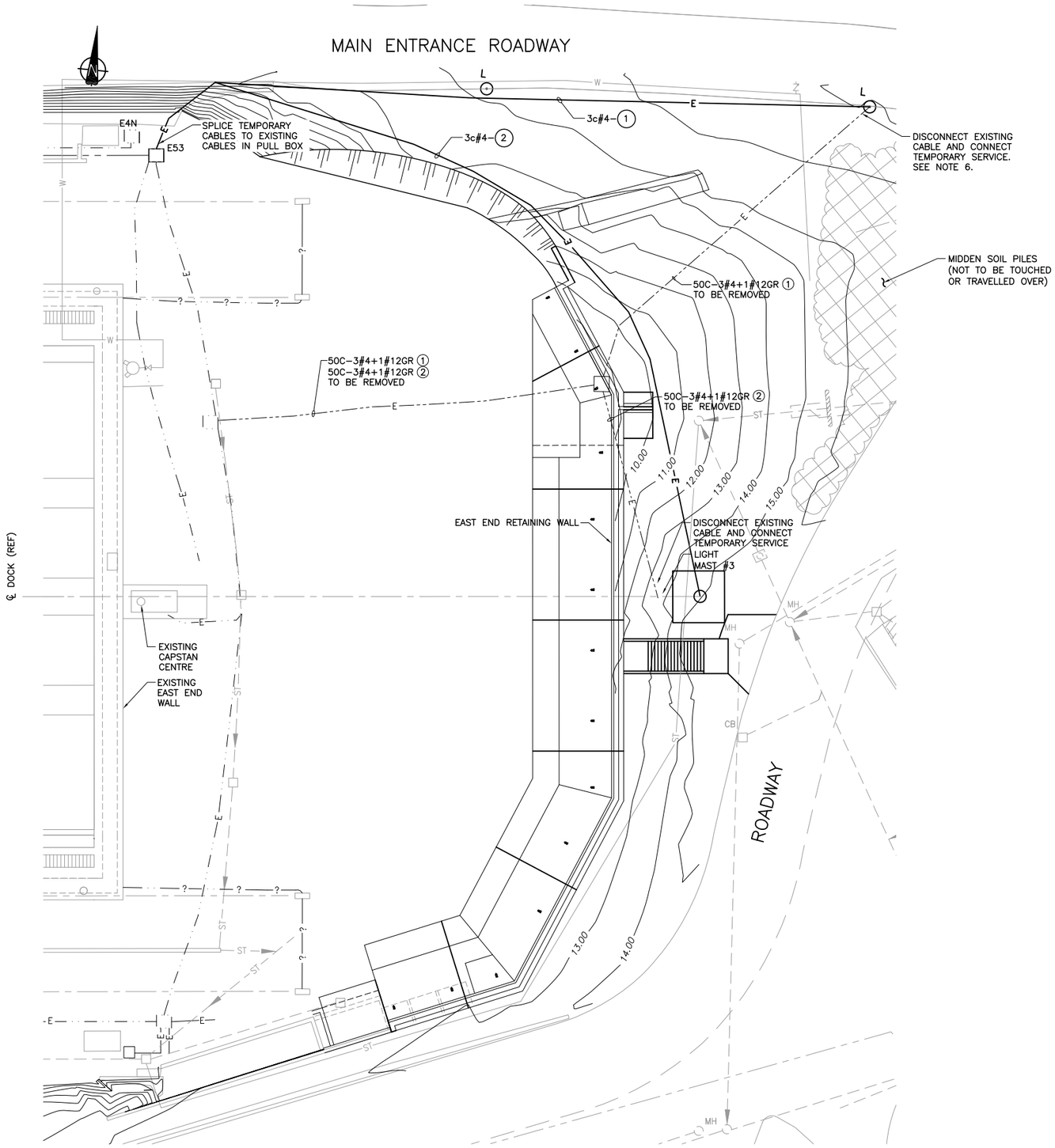
PHOTOGRAPHS OF ORIGINAL DOCK CONSTRUCTION

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	D4 OF XX	

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

DM5XXXXXX



PLAN
1:200

TEMPORARY CABLE SCHEDULE

ID	CABLE SIZE	CABLE TYPE	VOLTAGE	SERVICE	FROM	TO	PRESENT STATUS	ACTION
1	3c#4	TECK 90	?	LIGHT STANDARDS 7–12	E53	LIGHT STANDARDS 7–12	ACTIVE	NOTE 2
2	3c#4	TECK 90	347V	HIGH MAST LIGHT #3	E53	HIGH MAST LIGHT #3	ACTIVE	NOTE 2

NOTES:

1. ALL INSTALLATIONS SHALL BE PER THE CANADIAN ELECTRICAL CODE 2009.
2. ROUTE TEMPORARY CABLE AS SHOWN. APPLY LOCKOUT AND CHECK TO ENSURE EXISTING CABLE IS DE–ENERGIZED. SPLICE TEMPORARY CABLE TO EXISTING CABLE AND CONNECT TO LIGHT. REMOVE EXISTING CABLE TO PULL BOX E53. EXISTING CABLE IS PVC JACKET. TEMPORARY CABLE TO BE TECK 90.
3. CABLE SPLICE LOCATIONS TO BE APPROVED BY DEPARTMENTAL REPRESENTATIVE.
4. CABLES TO MATCH EXISTING UNLESS OTHERWISE NOTED.
5. I.D. NUMBER SHOWN IN CIRCLE ON PLAN CORRESPONDS TO I.D. NUMBER IN TEMPORARY CABLE SCHEDULE TABLE BELOW.
6. CONNECT TEMPORARY CABLE TO FURTHEST EAST LIGHT STANDARD. DO NOT DISTURB INTERCONNECTION WIRING BETWEEN LIGHTS.

LEGEND

- W — VALVE — EXISTING WATER / VALVE
- ST — xxx — EXISTING STORM DRAIN / MANHOLE
- CB — EXISTING CATCH BASIN
- E — EXISTING ELECTRICAL
- W — VALVE — TEMPORARY FIRE WATER / VALVE
- FH — FIRE HYDRANT
- ST — TEMPORARY STORM WATER DIVERSION
- E — TEMPORARY ELECTRICAL
- Exx — PULL PIT
- L — LAMP STANDARD
- X — CABLE I.D.

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS–BUILT BY KINETIC CONSTRUCTION	11/11/02

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
R. JEPSON

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

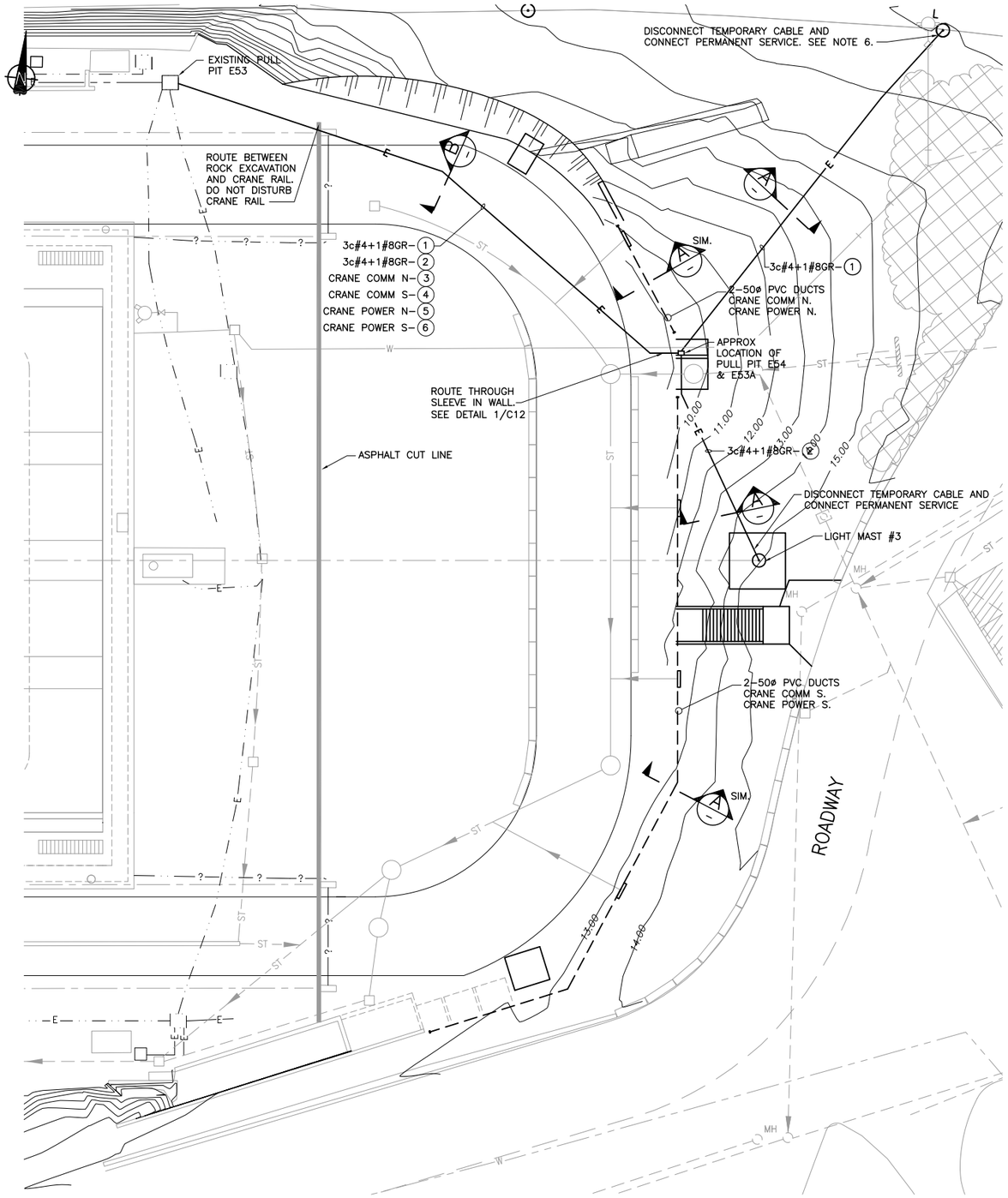
Drawing title/Titre du dessin
TEMPORARY SERVICES
ELECTRICAL
PLAN AND CABLE SCHEDULE

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	E1 OF XX	

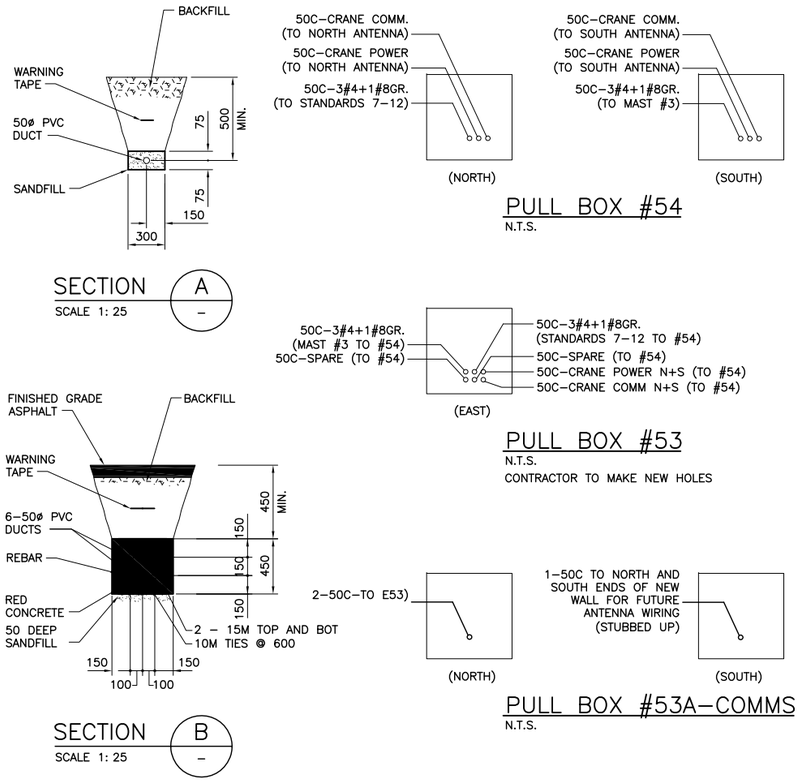
PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

DM5XXXXXX



PLAN
1:200



TYPICAL DUCT BANK TYPE CDB2

NOTES:

1. ALL ELECTRICAL INSTALLATIONS SHALL BE PER THE CANADIAN ELECTRICAL CODE 2009.
2. ELECTRICAL SERVICE TO BE ROUTED IN ACCORDANCE WITH CABLE SCHEDULE TABLE BELOW. ROUTE PERMANENT CABLES PRIOR TO DISCONNECTING AND/OR CUTTING TEMPORARY CABLE. COORDINATE CHANGEOVER TO PERMANENT CABLE WITH DEPARTMENTAL REPRESENTATIVE.
3. ROUTE PERMANENT CABLE. APPLY LOCKOUT AND CHECK EXISTING CABLE IS DE–ENERGIZED. REMOVE TEMPORARY SPLICE AND SPLICE NEW CABLE TO EXISTING CABLE IN PULL BOX E53. ROUTE THROUGH PULL BOX E54.
4. CABLES TO MATCH EXISTING UNLESS OTHERWISE NOTED.
5. ID NUMBER SHOWN IN CIRCLE ON PLAN CORRESPONDS TO ID NUMBER IN PERMANENT CABLE SCHEDULE TABLE BELOW.
6. CONNECT PERMANENT CABLE TO FURTHEST EAST LIGHT STANDARD. DO NOT DISTURB INTERCONNECTION WIRING BETWEEN LIGHTS.
7. ROUTE PERMANENT CABLES FRO CRANE NORTH AND SOUTH ANTENNAE THROUGH PULL BOXES 53 AND 54.

LEGEND

- W — EXISTING WATER / VALVE
- ST — XXX — EXISTING STORM DRAIN / MANHOLE
- CB — EXISTING CATCH BASIN
- E — EXISTING ELECTRICAL
- Exx — EXISTING PULL PIT
- W — NEW FIRE WATER / VALVE
- FH — FIRE HYDRANT
- ST — XXX — NEW STORM DRAIN / MANHOLE
- E — NEW ELECTRICAL
- Exx — NEW PULL PIT
- L — LAMP STANDARD
- (X) — CABLE I.D.

PERMANENT CABLE SCHEDULE

ID	CABLE SIZE	CABLE TYPE	VOLTAGE	SERVICE	FROM	TO	ACTION
1	3c#4+1#8GR	RWU90	?	LIGHT STANDARDS 7–12	E53 & E54	LIGHT STANDARDS 7–12	NOTE 3
2	3c#4+1#8GR	RWU90	347V	HIGH MAST LIGHT #3	E53 & E54	HIGH MAST LIGHT #3	NOTE 3
3	BY OTHERS	BY OTHERS	COMM	CRANE NORTH ANTENNA	E53 & E54	CRANE NORTH ANTENNA	NOTE 7
4	BY OTHERS	BY OTHERS	COMM	CRANE SOUTH ANTENNA	E53 & E54	CRANE SOUTH ANTENNA	NOTE 7
5	BY OTHERS	BY OTHERS	120V	CRANE NORTH ANTENNA	E53 & E54	CRANE NORTH ANTENNA	NOTE 7
6	BY OTHERS	BY OTHERS	120V	CRANE SOUTH ANTENNA	E53 & E54	CRANE SOUTH ANTENNA	NOTE 7

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS–BUILT BY KINETIC CONST. / RAYLEC POWER	11/11/02

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
R. JEPSON

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

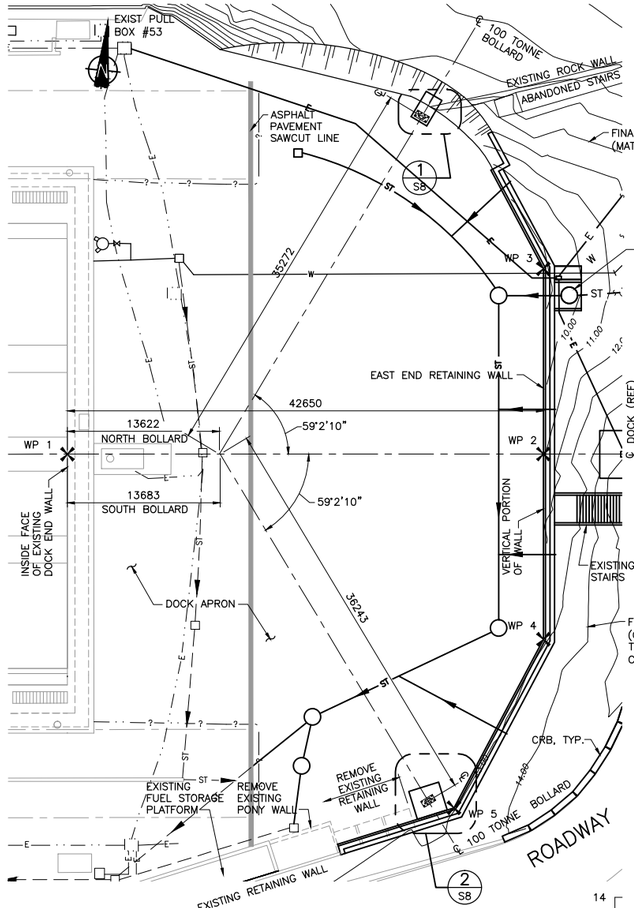
Drawing title/Titre du dessin
PERMANENT SERVICES
ELECTRICAL
PLAN, DETAILS & CABLE SCHEDULE

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	E2 OF XX	

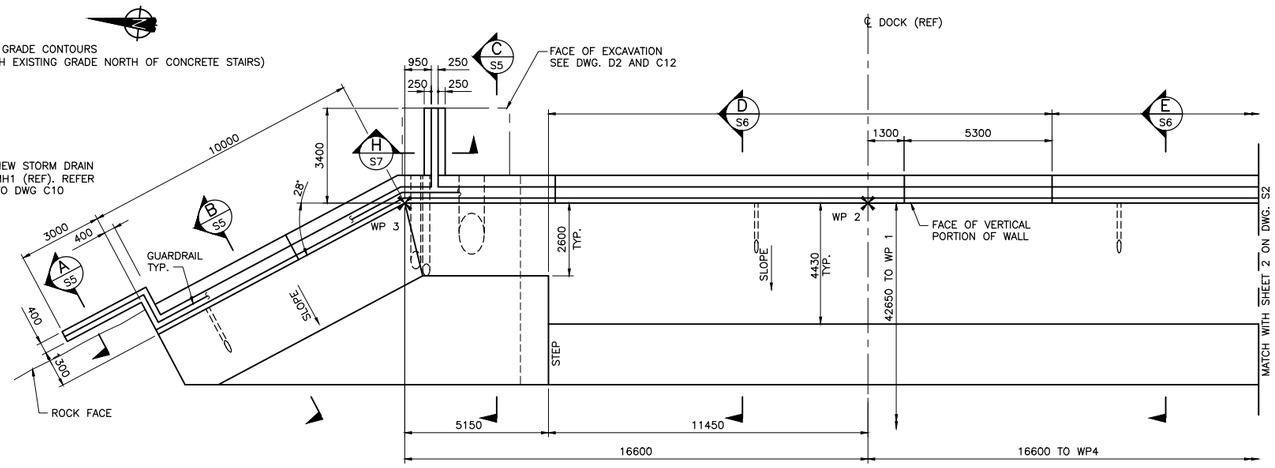
PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

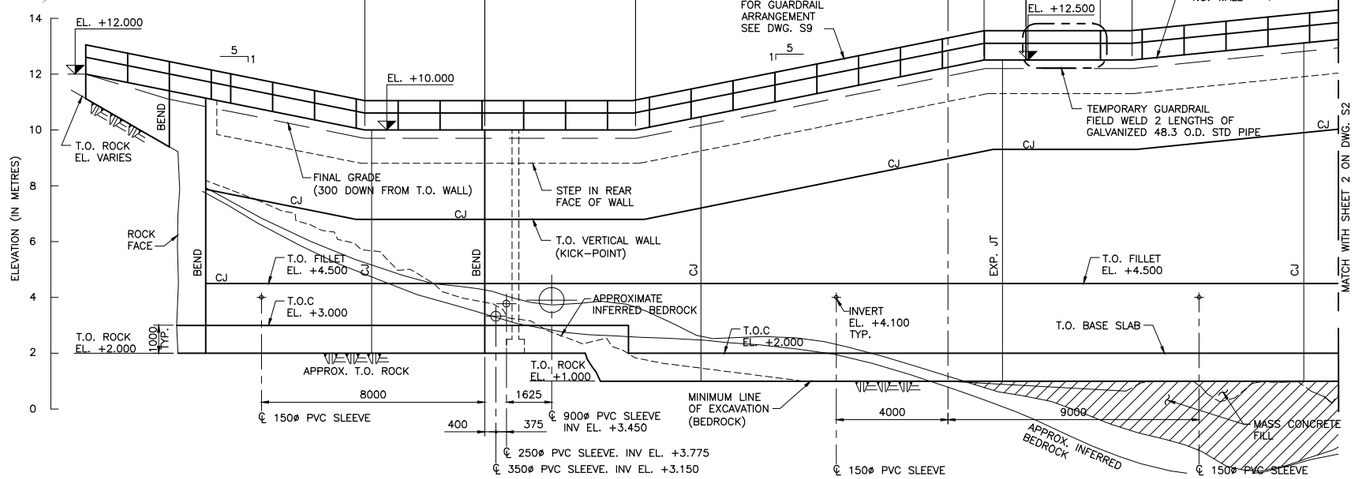
DM5XXXXXX



PLAN
1:250



PLAN
1:100



ELEVATION LOOKING EAST (DEVELOPED)
1:100

LEGEND

FINAL GRADE PROFILE (BEHIND WALL)

ROCK ELEVATION

NOTES:

1. FOR GENERAL NOTES, SEE DWG. C1.
2. AFTER SOIL EXCAVATION, BUT PRIOR TO ROCK EXCAVATION FOR BASE SLAB AT EACH WALL SECTION, SURVEY AND REPORT THE ACTUAL BEDROCK PROFILE TO DEPARTMENTAL REPRESENTATIVE. THE DEPARTMENTAL REPRESENATIVE WILL DETERMINE IF FIELD ADJUSTMENTS TO THE DESIGN WILL BE NECESSARY. DESIGN ADJUSTMENTS MAY BE REQUIRED IF BEDROCK ELEVATIONS ARE BELOW EL. +1.00. ALLOW FOR 14 DAYS TURNAROUND TIME FOR THESE DESIGN ADJUSTMENTS.

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS-BUILT BY KINETIC CONSTRUCTION	12/01/30

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet

ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK
EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
R. LEECH

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

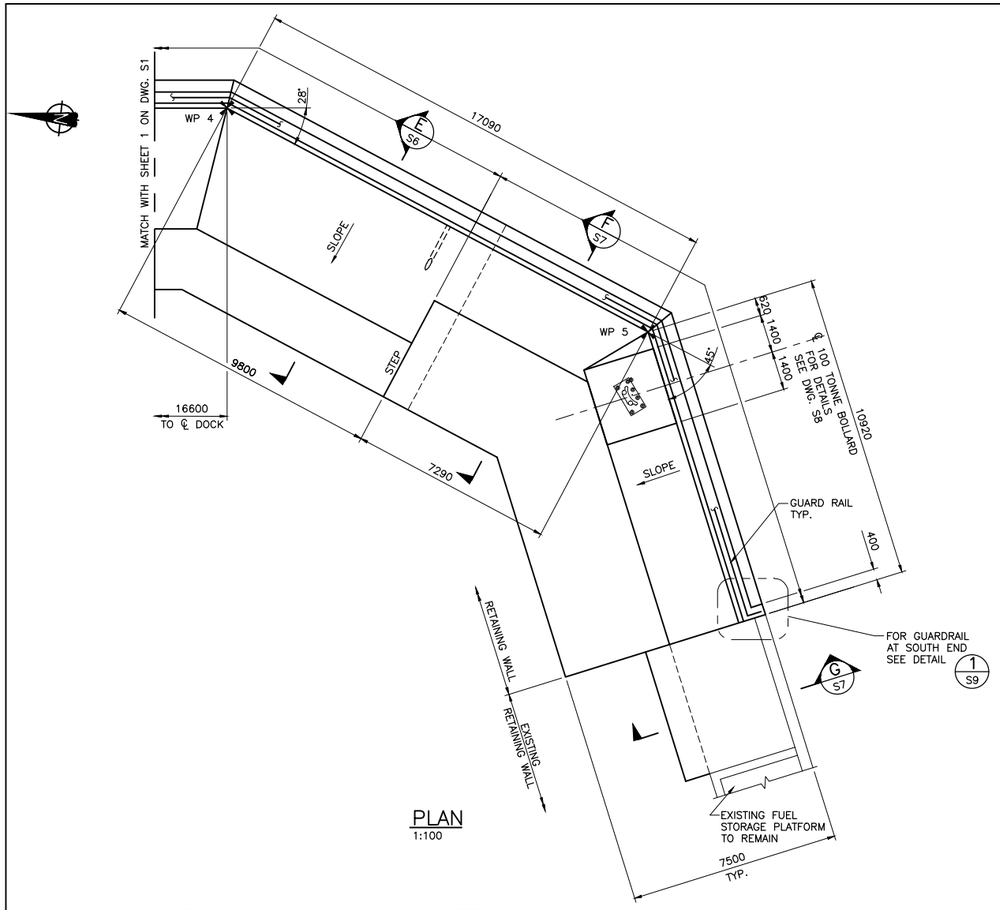
Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

Drawing title/Titre du dessin

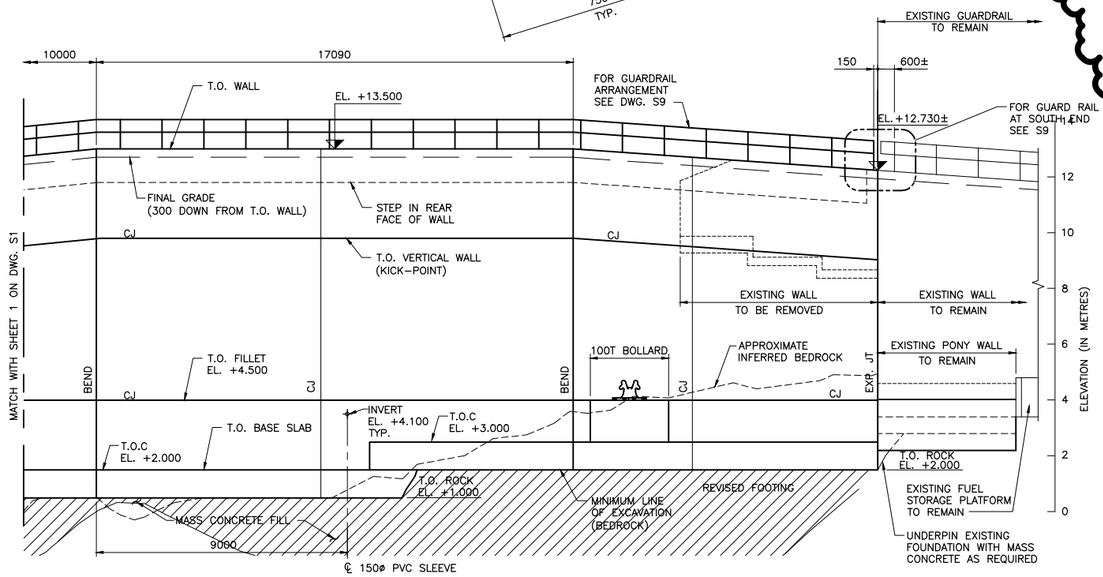
EAST END RETAINING WALL
PLAN AND ELEVATION
SHEET 1

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	S1 OF XX	

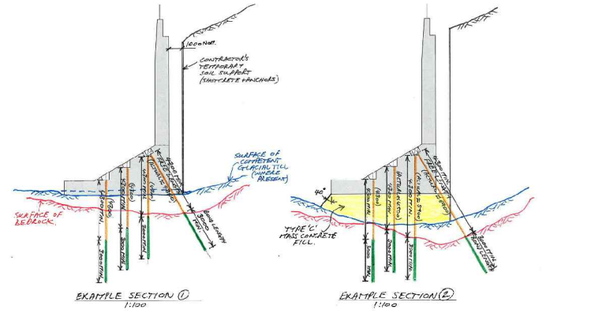
DM5XXXXXX

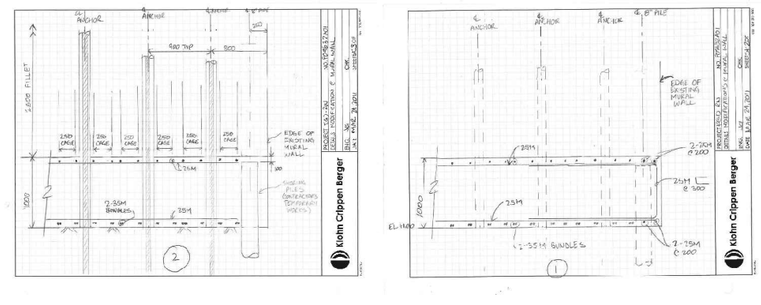


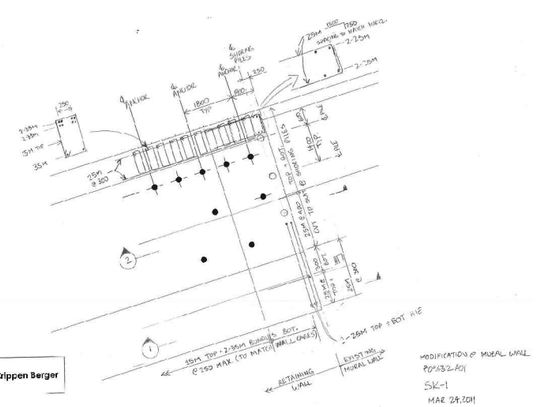
PLAN
1:100



ELEVATION LOOKING EAST (DEVELOPED)
1:100







NOTES:
1. SEE DWG. S1 FOR NOTES.

LEGEND
FINAL GRADE PROFILE (BEHIND WALL)
ROCK ELEVATION

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/Revision	Description/Description	Date/Date
1	AS-BUILT BY KINETIC CONSTRUCTION	12/01/30

Client/client
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
R. LEECH

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

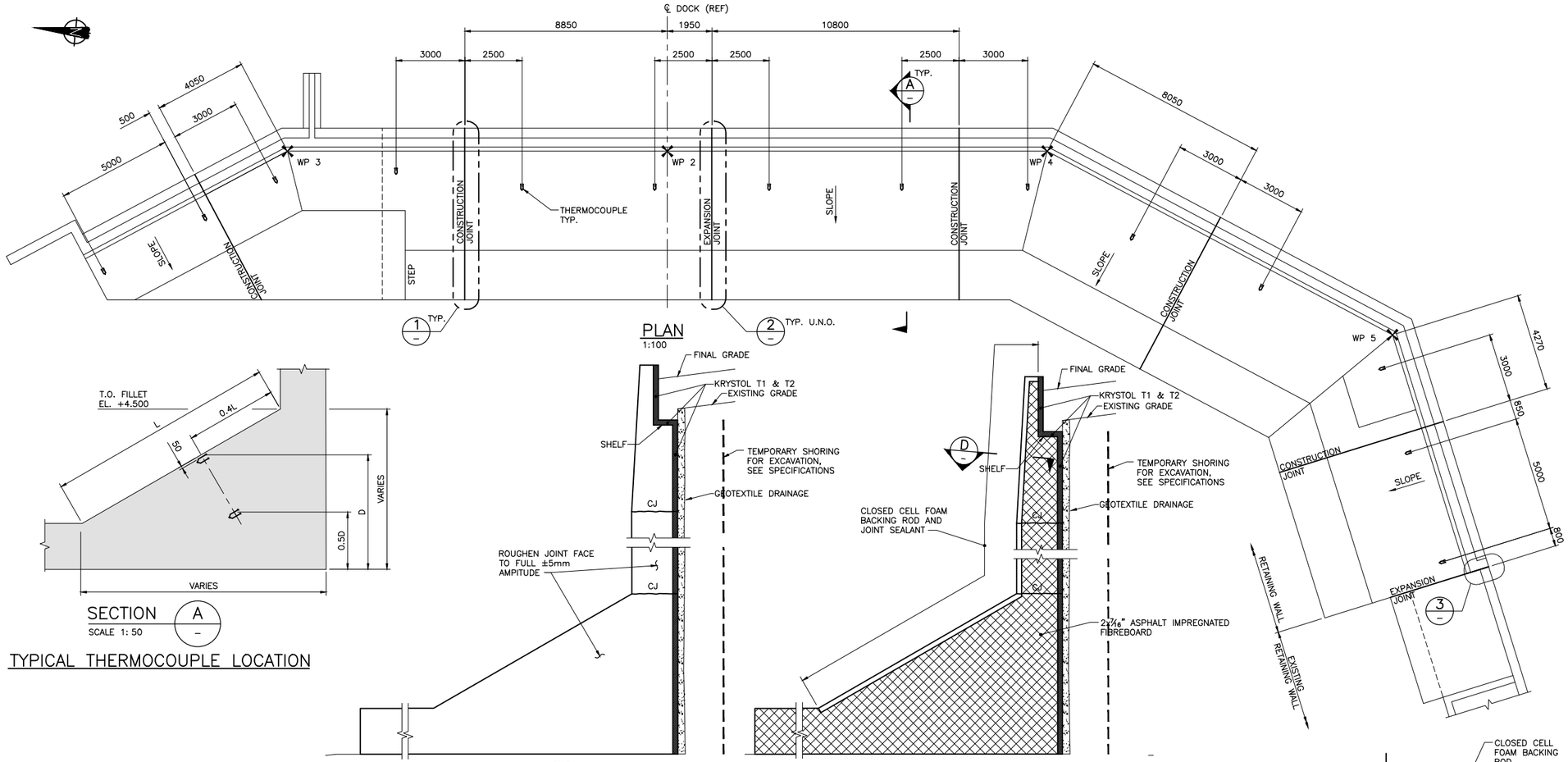
Drawing title/Titre du dessin
EAST END RETAINING WALL
PLAN AND ELEVATION
SHEET 2

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	S2 OF XX	

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

DM5XXXXXX



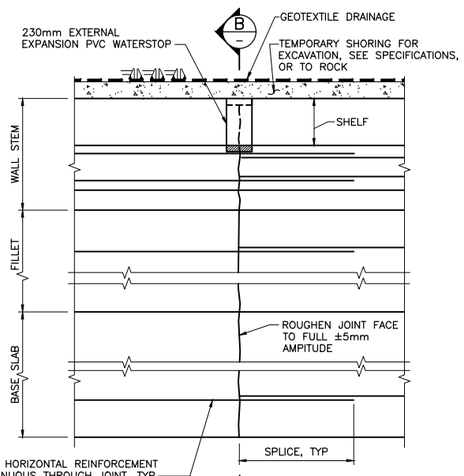
PLAN
1:100

SECTION A
SCALE 1: 50

TYPICAL THERMOCOUPLE LOCATION

SECTION B
SCALE 1: NTS

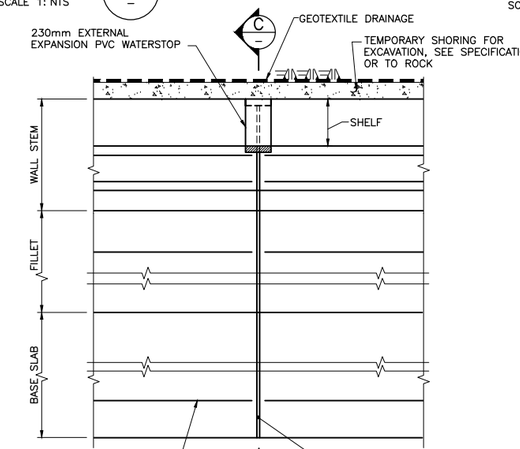
SECTION C
SCALE 1: NTS



DETAIL 1
SCALE 1: 25

TYPICAL CONSTRUCTION JOINT

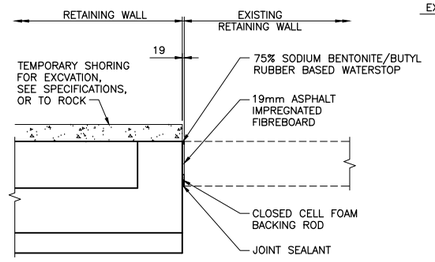
NOTE:
VERTICAL REINFORCING NOT SHOWN FOR CLARITY



DETAIL 2
SCALE 1: 25

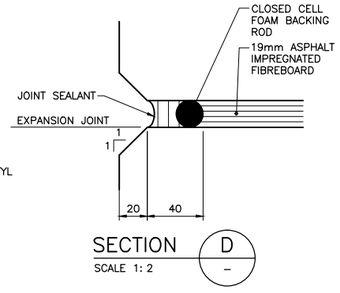
EXPANSION JOINT

NOTE:
VERTICAL REINFORCING NOT SHOWN FOR CLARITY



DETAIL 3
SCALE 1: 25

EXPANSION JOINT AT EXISTING WALL



SECTION D
SCALE 1: 2

NOTES:
1. FOR NOTES SEE C1.

LEGEND
THERMOCOUPLE

Revision/ Revision	Description/Description	Date/Date
1	AS-BUILT BY KINETIC CONSTRUCTION	11/11/02

Client/client
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
R. LEECH

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

Drawing title/Titre du dessin
EAST END RETAINING WALL CONSTRUCTION AND EXPANSION JOINTS

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	S3 OF XX	

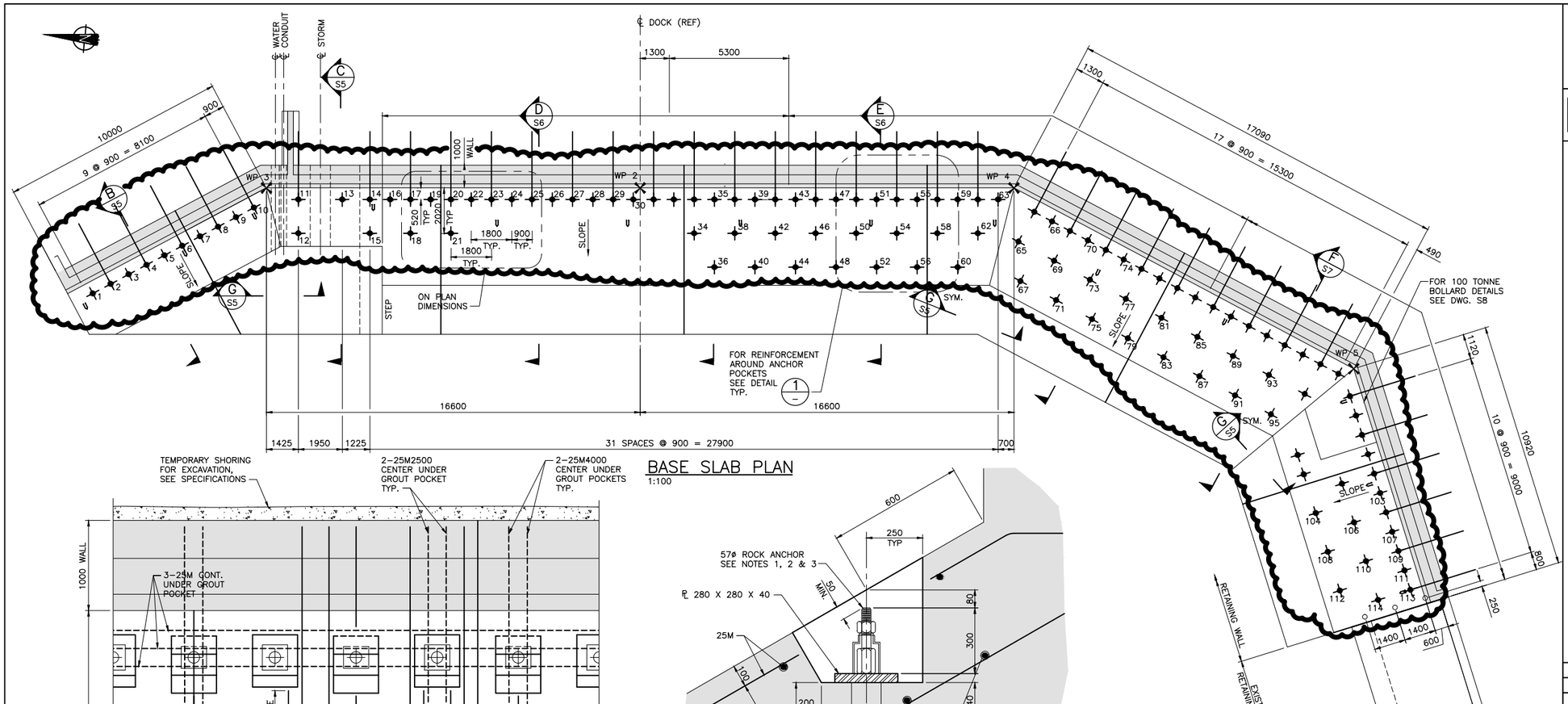
Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

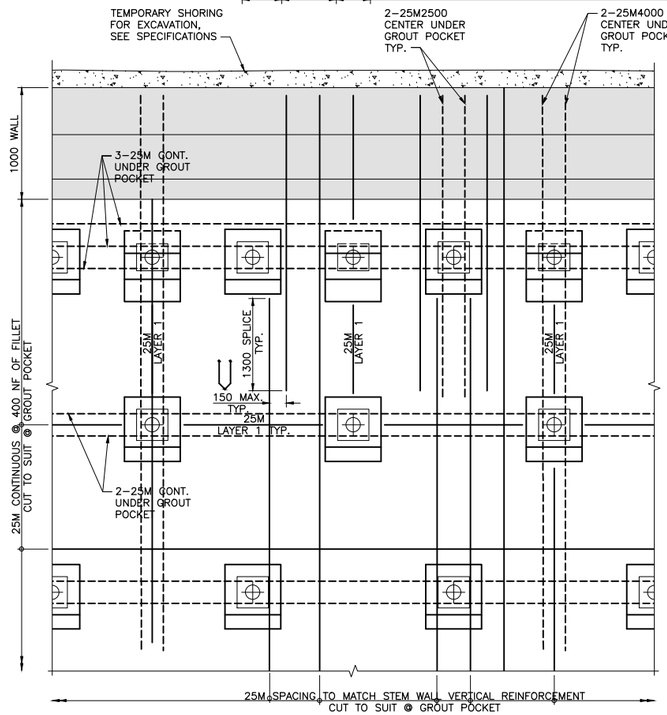
PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

DM5XXXXXX



BASE SLAB PLAN
1:100



DETAIL 1
SCALE 1: 25

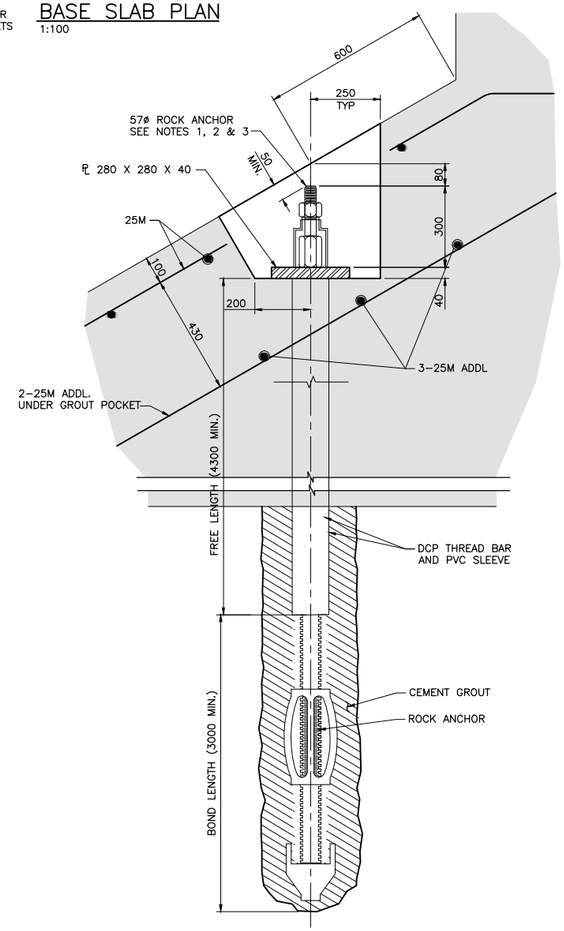
NOTES:

1. FACTORED ANCHOR DESIGN FORCES:
   a) STATIC, 560 kN.
   b) SEISMIC, 1197 kN.
2. TRANSFER (LOCK–OFF) LOAD = 1200kN
3. FILL ANCHOR POCKETS WITH GROUT AFTER ANCHORS HAVE BEEN STRESSED AND LOCKED OFF.
5. FOR NOTES SEE DWG. S1.
6. STAGGER SPLICE LOCATIONS FOR LONGITUDINAL BARS.

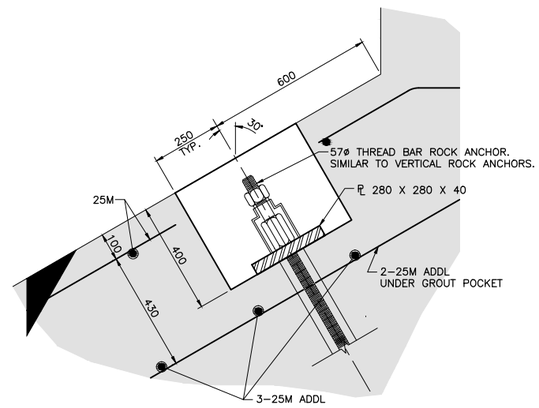
LEGEND

VERTICAL ANCHORS

SLOPING ANCHORS 30° FROM VERTICAL



TYPICAL VERTICAL ROCK ANCHOR POCKET AT FILLET
1:10



TYPICAL SLOPING ROCK ANCHOR POCKET AT FILLET
1:10

0 10 20 30 40 50 60 70 80 90 100mm

PWGSC – A1 – 841X594

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

SK2 – 32 ADDITIONAL ANCHORS

Revision/ Revision	Description/Description	Date/Date
1	AS–BUILT BY KINETIC CONSTRUCTION	12/01/30

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
A. PORT & R. LEECH

Drawn by/Dessine par
G.M.

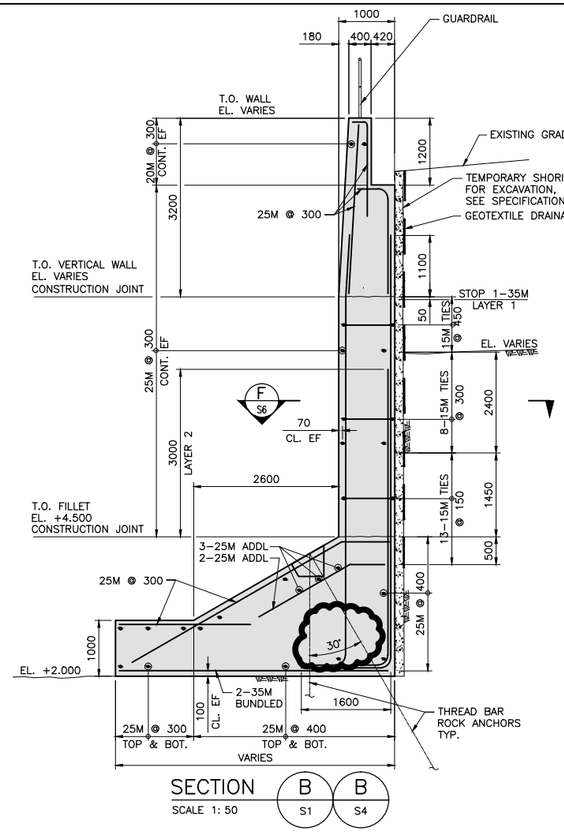
PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

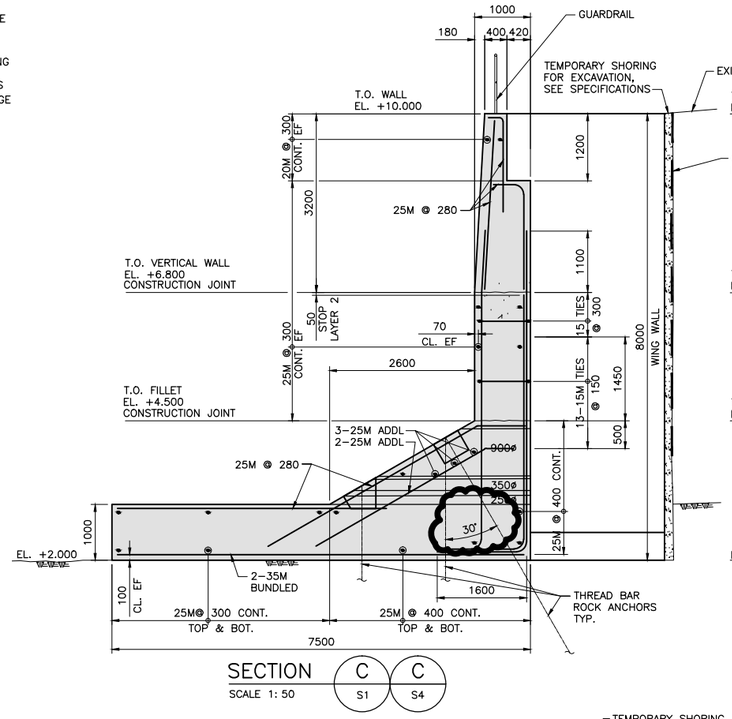
Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

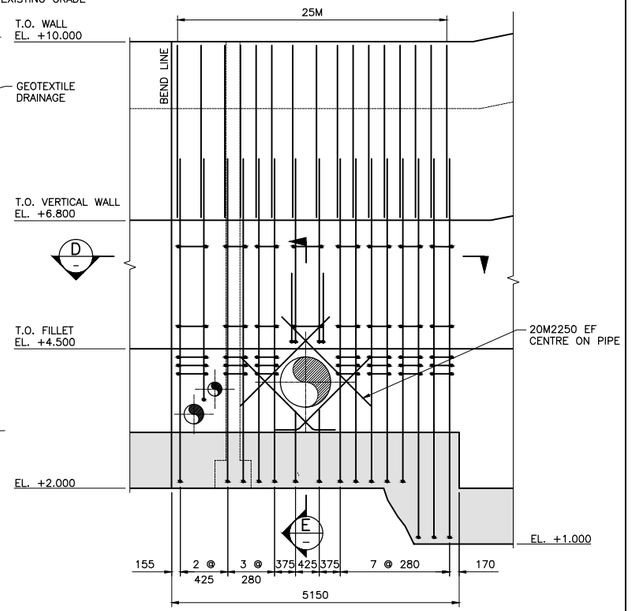
Drawing title/Titre du dessin
EAST END RETAINING WALL
ROCK ANCHORS

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	S4 OF XX	

DM5XXXXXX

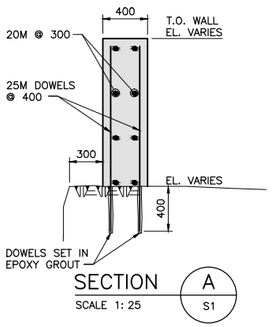


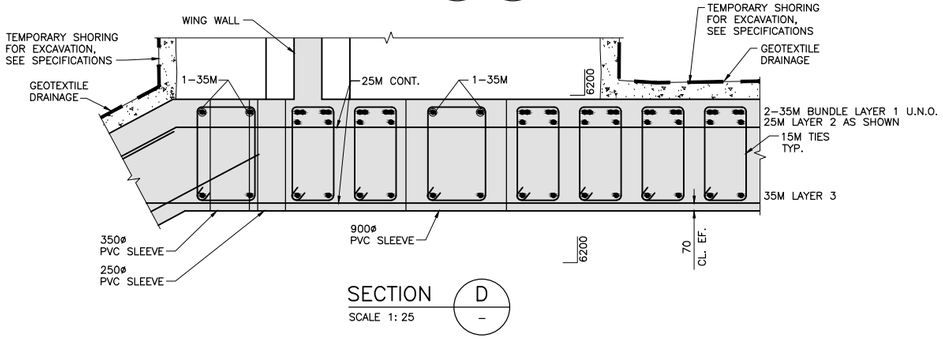


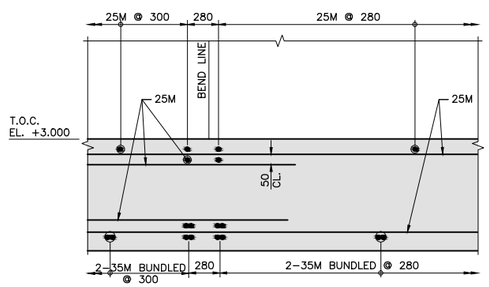


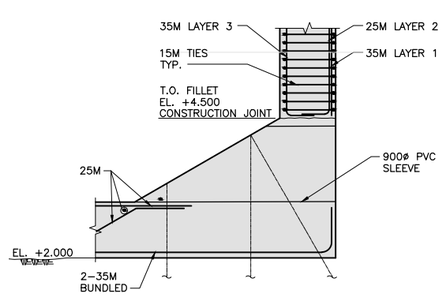
VERTICAL BAR ARRANGEMENT LAYERS 1 & 3 @ SECTION C

NOTE:
LAYER 2 NOT SPLICED.









NOTES:

1. FOR NOTES SEE DWG. S1.
2. TOP SURFACE OF FILLET IS TO BE A FORMED SURFACE.
3. STAGGER SPLICE LOCATIONS FOR ALL LONGITUDINAL BARS.

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS–BUILT BY KINETIC CONSTRUCTION	12/01/30

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet

ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
R. LEECH

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

Drawing title/Titre du dessin

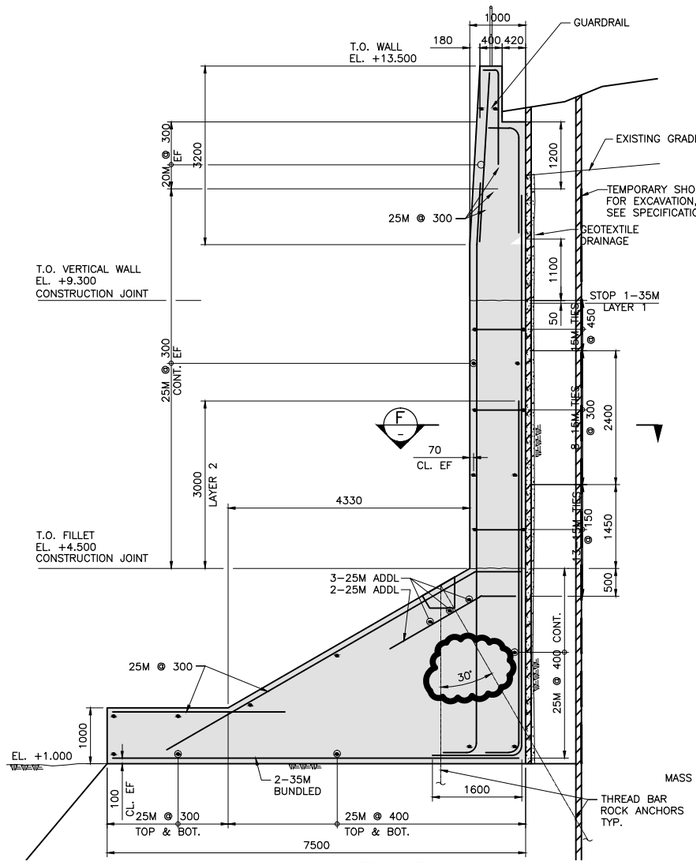
EAST END RETAINING WALL
REINFORCEMENT
SHEET 1

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	S5 OF XX	

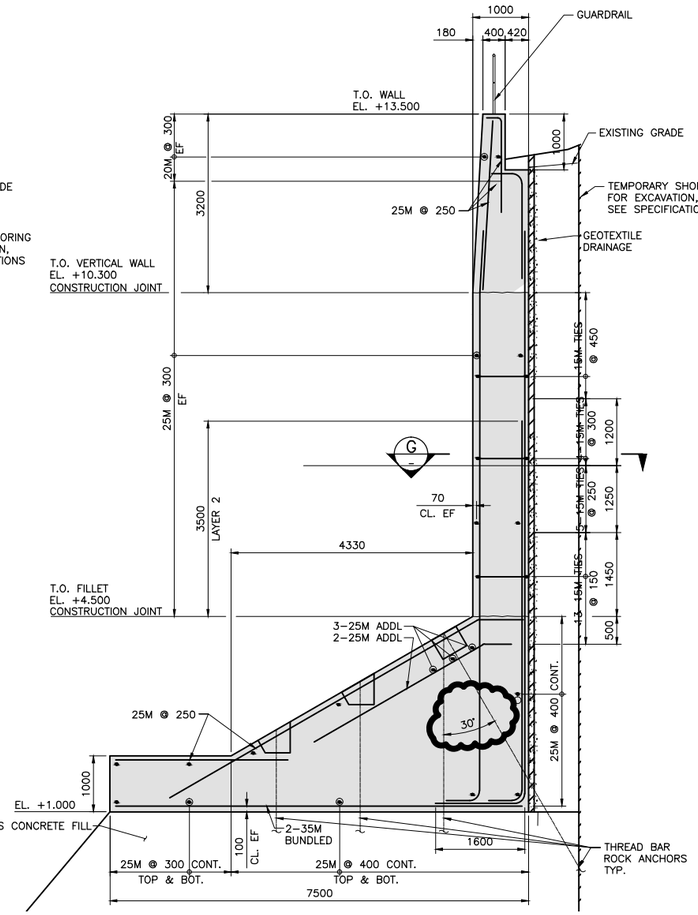
PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

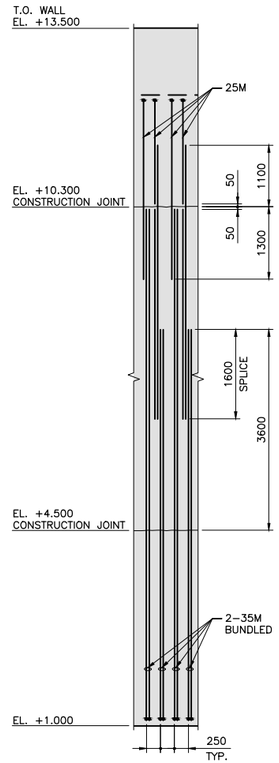
DM5XXXXXX



SECTION D D
SCALE 1: 50 S1 S4

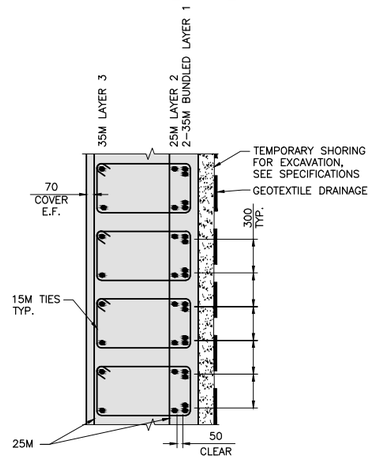


SECTION E E E
SCALE 1: 50 S1 S2 S4

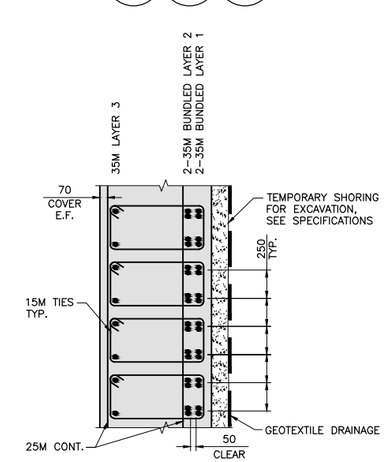


VERTICAL SPLICE ARRANGEMENT LAYER 1 @ SECTION E

NOTE: LAYER 3 SPLICE LOCATIONS SIMILAR.
ALTERNATE LOCATIONS WITH LAYER 1.
LAYER 2 NOT SPLICED.



SECTION F F
SCALE 1: 25 – S5



SECTION G
SCALE 1: 25 –

NOTES:

1. FOR NOTES SEE DWG. S1.
2. TOP SURFACE OF FILLET IS TO BE A FORMED SURFACE.
3. STAGGER SPLICE LOCATIONS FOR ALL LONGITUDINAL BARS.

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS–BUILT BY KINETIC CONSTRUCTION	12/01/30

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
R. LEECH

Drawn by/Dessine par
G.M.

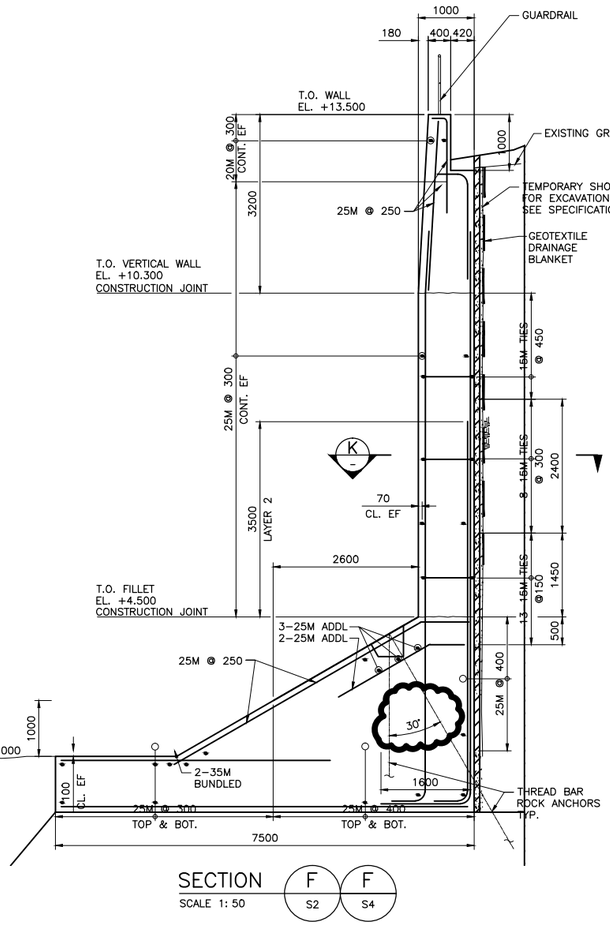
PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

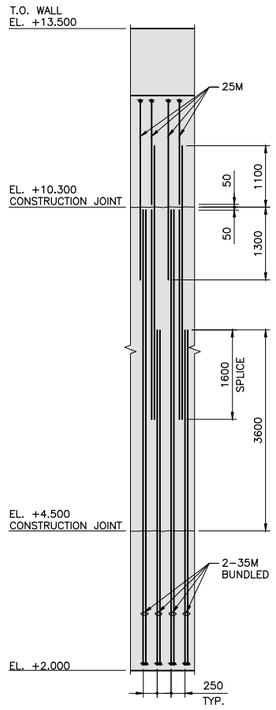
Drawing title/Titre du dessin
EAST END RETAINING WALL REINFORCEMENT SHEET 2

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	S6 OF XX	

DM5XXXXXX

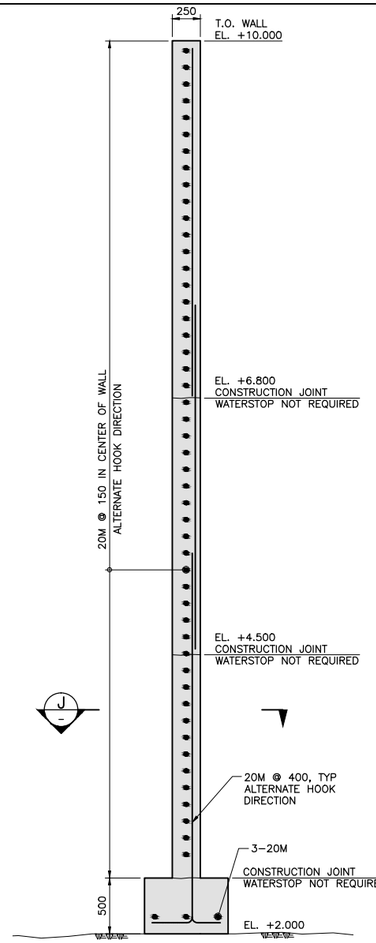


SECTION F / F
SCALE 1: 50
S2 S4

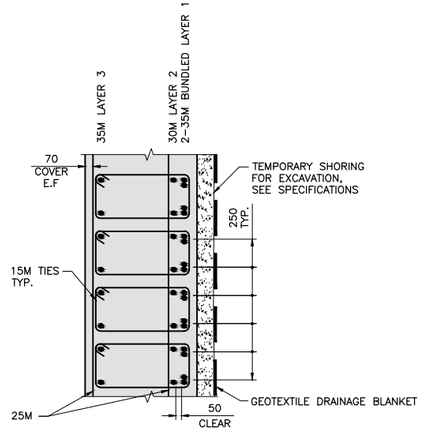


VERTICAL SPLICE ARRANGEMENT LAYER 1 @ SECTION F

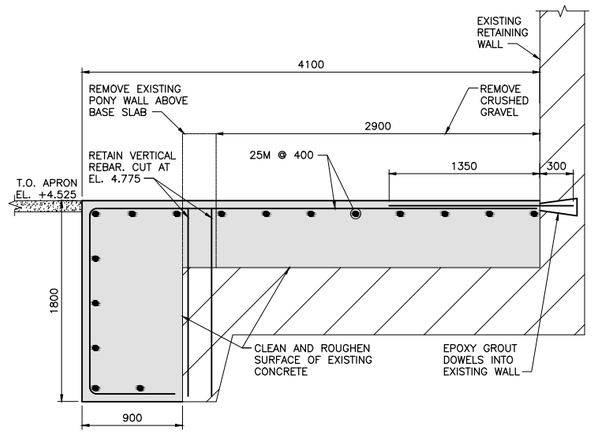
NOTE: LAYER 3 SPLICE LOCATIONS SIMILAR. ALTERNATE LOCATIONS WITH LAYER 1. LAYER 2 NOT SPLICED.



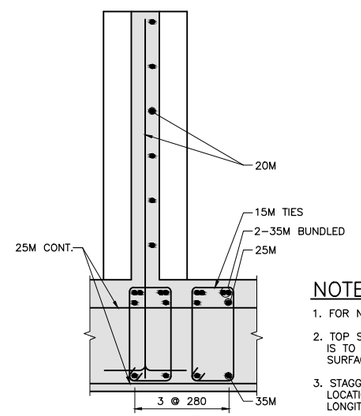
SECTION H
SCALE 1: 25
S1



SECTION K
SCALE 1: 25
–



SECTION G
SCALE 1: 25
S2



SECTION J
SCALE 1: 25
–

NOTES:

1. FOR NOTES SEE DWG. S1.
2. TOP SURFACE OF FILLET IS TO BE A FORMED SURFACE.
3. STAGGER SPLICE LOCATIONS FOR ALL LONGITUDINAL BARS.

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS-BUILT BY KINETIC CONSTRUCTION	12/01/30

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
R. LEECH

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

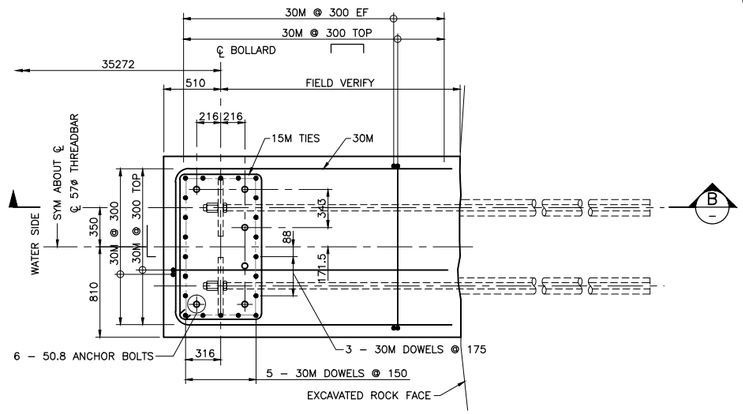
Drawing title/Titre du dessin
EAST END RETAINING WALL REINFORCEMENT SHEET 3

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	S7 OF XX	

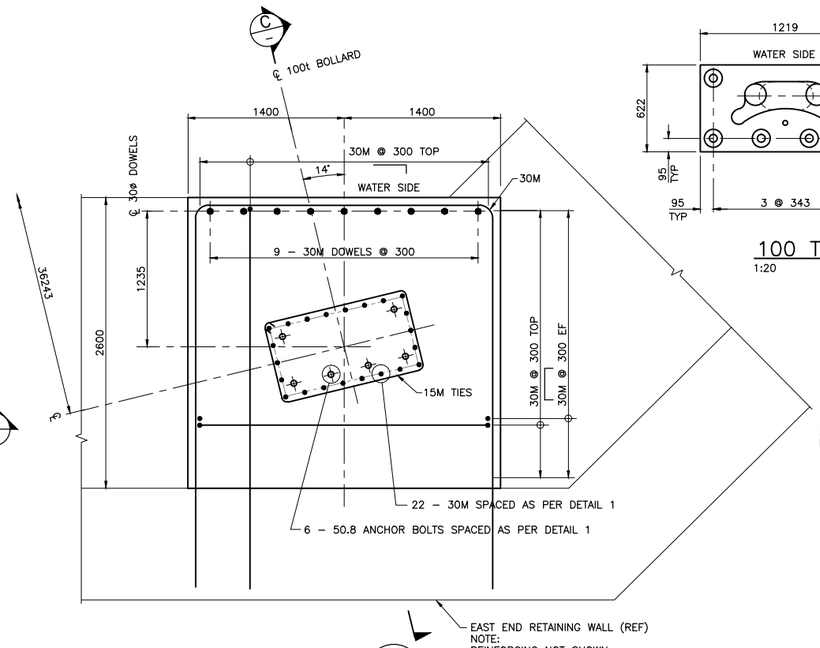
PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

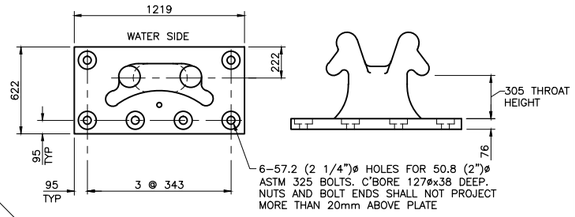
DM5XXXXXX



DETAIL 1
SCALE 1: 25
S1



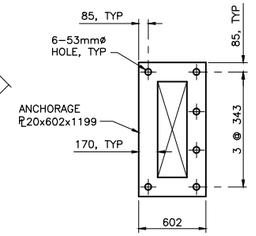
DETAIL 2
SCALE 1: 25
S1



100 TONNE MOORING BOLLARD

1:20

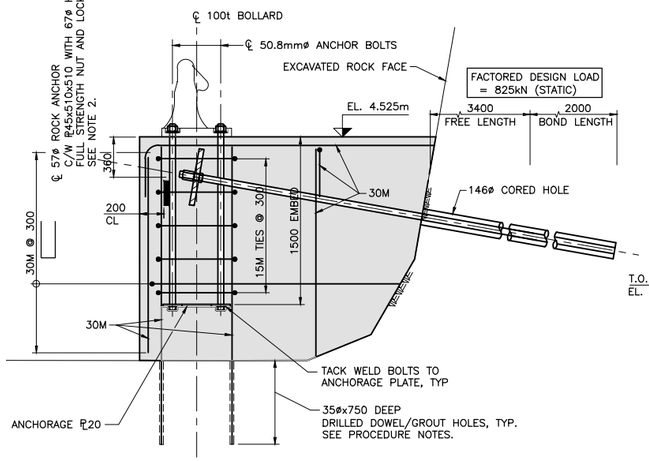
2 – MODEL NO. TYPE A–19–2X



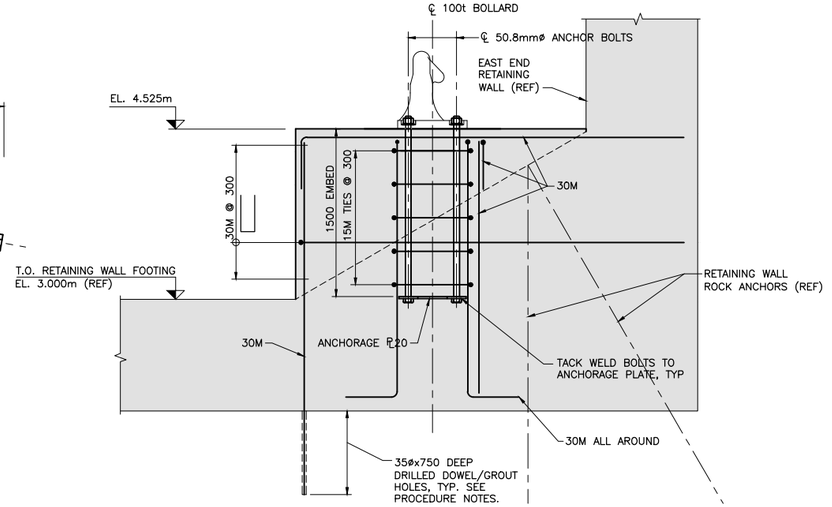
BOLLARD – ANCHORAGE PLATE

1:25

2 – REQUIRED



SECTION B
SCALE 1: 25
–



SECTION C
SCALE 1: 25
–

NOTE:
RETAINING WALL REINFORCING NOT SHOWN FOR CLARITY

PROCEDURE FOR GROUTED DOWELS:

1. DRILL HOLES A MINIMUM OF 25mm LARGER IN DIAMETER THAN DOWELS INDICATED.
2. USE TEMPLATES TO DRILL HOLES TO ACHIEVE THE FOLLOWING TOLERANCES:
   a) LOCATION ±10mm
   b) HOLE DIAMETER ±5mm
   c) HOLE ALIGNMENT 1:100
3. ENSURE ADEQUATE ROUGHNESS INSIDE DOWEL HOLES TO TRANSMIT TENSION LOAD (YIELD STRENGTH OF DOWELS).
4. SET DOWELS IN DRILLED HOLES COMPLETELY FILLED WITH GROUT. PLACE GROUT CONTINUOUSLY AT EACH DOWEL HOLE, AND IN SUCH A MANNER AS TO ENSURE THAT ALL AIR IS EXPELLED AS THE GROUT FRONT ADVANCES.
5. ENSURE THAT GROUT ATTAINS 100% CONTACT WITH THE FULL DEPTH OF THE DRILLED HOLES, AND WITH THE FULL DEPTH OF THE DOWELS.
6. PROTECT GROUT FROM WASHOUT OR OTHER DISTURBANCE UNTIL FINAL SET.

NOTES:

1. FOR NOTES SEE DWG. C1.
2. FOR ANCHOR TESTING REQUIREMENTS SEE SPECIFICATIONS.

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS–BUILT BY KINETIC CONSTRUCTION	11/11/02

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet

ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK
EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
J. TONG

Drawn by/Dessine par
A.R.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
PREETIPAL PAUL

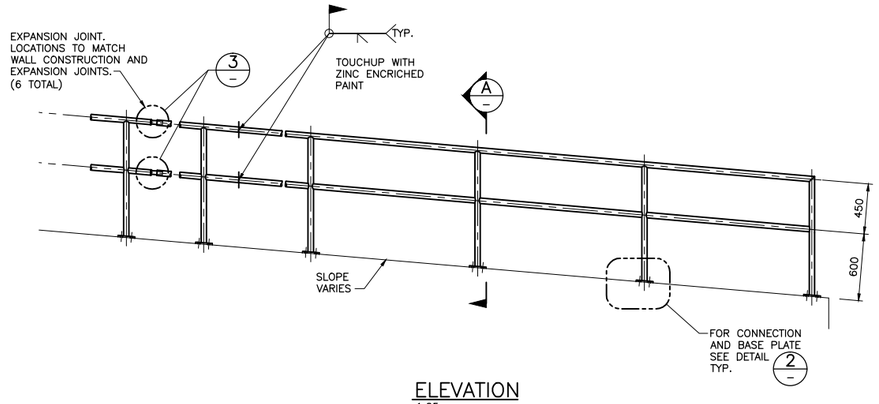
Drawing title/Titre du dessin
EAST END RETAINING WALL
MOORING DETAILS

Project No./No. du projet	Sheet/	Revision no./
R.041547.001	S8 OF XX	

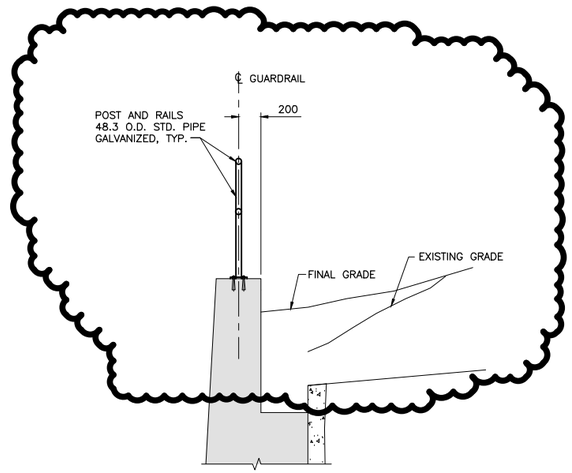
PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

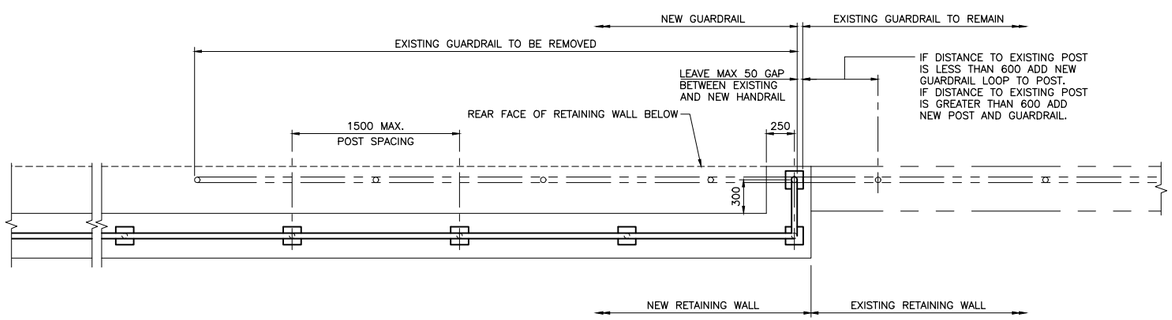
DM5XXXXXX



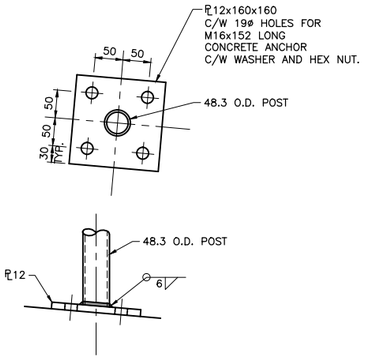
ELEVATION
1:25



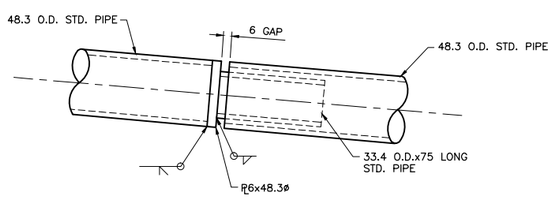
SECTION A
SCALE 1: 25



DETAIL 1
SCALE 1: 25
S2



DETAIL 2
SCALE 1: 5
–



DETAIL 3 TYPICAL EXPANSION JOINT
SCALE 1: 2
–

NOTES:

1. FOR STRUCTURAL STEEL AND STEEL FABRICATIONS NOTES SEE DWG C1.
2. GUARDRAILS SHALL BE CONSTRUCTED SUCH THAT THERE WILL BE NO OBSTRUCTION ON OR ABOVE RAIL WHICH WILL BREAK A HAND HOLD.
3. GUARDRAIL SHALL BE ALL WELDED CONSTRUCTION.
4. ALL SHARP EDGES TO BE GROUND SMOOTH.

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région de Pacifique
Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
1	AS–BUILT BY KINETIC CONSTRUCTION	12/01/30

Client/client
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK EAST END RETAINING WALL

Consultant Signature Only

Designed by/Concept par
J. TONG

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services Gestionnaire régionale, Services d'architectural et de génie, TPSGC
PREETIPAL PAUL

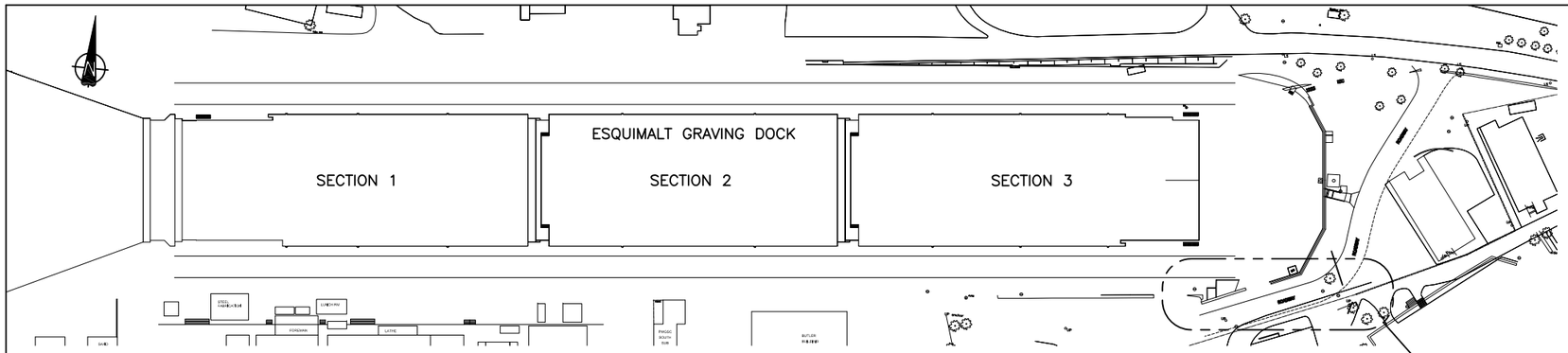
Drawing title/Titre du dessin
EAST END RETAINING WALL GUARDRAIL DETAILS

Project No./No. du projet	Sheet/Feuille	Revision no./ La Révision no.
R.041547.001	S9 OF XX	

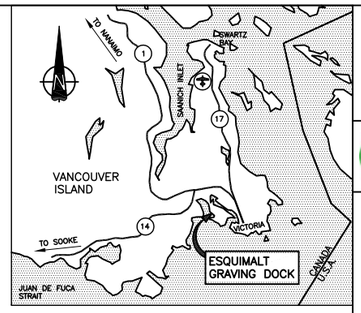
PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

DM5XXXXX



SITE PLAN
1:1000



KEY PLAN
N.T.S.

1. GENERAL NOTES:

1.1 DETAILED REQUIREMENTS FOR MATERIALS AND FABRICATION ARE DESCRIBED IN THE SPECIFICATIONS. FOR CONVENIENCE, CERTAIN EXTRACTS ARE REPRODUCED BELOW.

1.2 DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE. ELEVATIONS ARE IN METRES, TO CHART DATUM.

1.3 DIMENSIONS, LAYOUT AND DETAILS OF EXISTING STRUCTURES ARE BASED ON DRAWINGS OBTAINED FROM PUBLIC WORKS AND GOVERNMENT SERVICES CANADA AND MAY BE SUBJECT TO CONSTRUCTION VARIATIONS AND MODIFICATIONS. THE CONTRACTOR SHALL VERIFY DIMENSIONS AND CONFIGURATION PRIOR TO ANY DEMOLITION AND REMOVAL AND BRING ANY DISCREPANCIES OR POTENTIAL CONFLICTS TO THE ATTENTION OF THE DEPARTMENTAL REPRESENTATIVE. REFERENCE DRAWINGS ARE LISTED IN THE SPECIFICATIONS.

1.4 THE CONTRACTOR SHALL COORDINATE ALL ACTIVITIES WITH THE DEPARTMENTAL REPRESENTATIVE. LOCATION OF THE CONTRACTOR'S SITE OFFICE AND MATERIAL STORAGE SHALL BE APPROVED BY THE DEPARTMENTAL REPRESENTATIVE.

1.5 OVERBURDEN BEHIND EXISTING RETAINING WALL MAY CONTAIN CONTAMINATED MATERIALS. FOR DETAILS, SEE SPECIFICATIONS.

1.6 PWGSC SITE BENCHMARK IS "BOLT". FROM PWGSC PLAN SK4593-1 DATED OCTOBER 1989, "BOLT" IS ELEVATION 4.722m TO PWGSC DATUM, BOLT IS 4.849m ABOVE LLWL; LLWL IS 0.124m BELOW PWGSC DATUM 0.0; LLWL IS 1.871m BELOW GEODETIC ELEVATION.

TO CONVERT FROM GEODETIC DATUM TO CHART DATUM, ADD 1.871m.

TO CONVERT FROM GEODETIC DATUM TO PWGSC DATUM, ADD 1.747m.

TO CONVERT FROM PWGSC DATUM TO CHART DATUM, ADD 0.124m.

1.7 THE EAST END RETAINING WALL STAIRWAY HAS BEEN DESIGNED FOR LIVE LOADS SET FORTH IN THE NATIONAL BUILDING CODE OF CANADA, 2005. THE DESIGN SERVICE LIFE FOR THE MAJOR STRUCTURAL COMPONENTS IS 75 YEARS.

UNIFORMLY DISTRIBUTED LIVE LOAD =4.8kPa

SNOW LOAD S_s=1.5kPa, S_r=0.3kPa

WIND LOAD q_{10}=0.49kPa, q_{50}=0.63kPa

SEISMIC LOADS BASED ON SITE SPECIFIC PEAK HORIZONTAL GROUND ACCELERATIONS OBTAINED FROM THE PACIFIC GEOSCIENCE CENTER FOR THE A475 EVENT (SAME PERFORMANCE CRITERIA AS FOR THE EXISTING RETAINING WALL).

1.8 SCALES INDICATED ON DRAWINGS ARE FULL SIZE A1 DRAWINGS.

1.9 TYPICAL ABBREVIATIONS:

BOT	BOTTOM	NOM.	NOMINAL
C/C	CENTRE TO CENTRE	PROJ	PROJECTION
CL	CLEAR	RAD.,R.	RADIUS
E.F.	EACH FACE	REINF	REINFORCING
EL.	ELEVATION	STA	STATIONING
EQ.SP	EQUALLY SPACED	T	TOP
E.W.	EACH WAY	T.O.C.	TOP OF CONCRETE
F.F.	FAR FACE	T.O.R.	TOP OF RAIL
GALV	GALVANIZED	U/S	UNDERSIDE
N.F.	NEAR FACE	U.N.O.	UNLESS NOTED OTHERWISE

2. CONCRETE:

2.1 ALL CONCRETE SHALL HAVE COMPRESSIVE STRENGTH OF 35MPa @ 28 DAYS. FOR EXPOSURE CLASS AND OTHER REQUIREMENTS, REFER TO SPECIFICATIONS.

2.2 ALL EXPOSED EDGES SHALL HAVE 20mm CHAMFER, U.N.O.

2.3 CONCRETE SHALL HAVE A BROOM FINISH.

3. CONCRETE REINFORCEMENT:

3.1 REINFORCING BARS SHALL BE BILLET STEEL BARS CONFORMING TO CAN/CSA G30.18-09, 400 MPa MIN. YIELD.

3.2 DESIGNATION OF REINFORCING BARS:
3-10M0800 MEANS THREE 10M BARS 800 LONG. 2-C20M1500 MEANS TWO 20M BARS, EACH WITH A 90 DEGREE STANDARD HOOK ON EACH END AND A TOTAL LENGTH OF 1500 PER BAR.

———— DENOTES TOP BARS.
— — — — — DENOTES BOTTOM BARS.

3.3 DIMENSIONS TO REINFORCEMENT ARE TO CENTRELINES OF BARS, EXCEPT WHERE CONCRETE COVER OR CLEARANCE BETWEEN BARS IS SHOWN.

3.4 CLEAR COVER FOR REINFORCEMENT (mm):

TOP SURFACES OF STRUCTURES	60
ALL OTHER CONCRETE FACES U.N.O.	60
STRUCTURES CAST AGAINST SOIL/ROCK	75

4. STRUCTURAL STEEL AND STEEL FABRICATIONS:

4.1 STRUCTURAL STEEL SHALL MEET CAN/CSA G40.20-04 FOR GENERAL REQUIREMENTS, AND CAN/CSA G40.21-04 FOR QUALITY.

GRADES OF MATERIAL, U.N.O.:

STRUCTURAL STEEL AND MISC. METAL	350W
BOLTS, NUTS AND WASHERS	ASTM A325M
ANCHOR BOLTS	ASTM A307
STEEL PIPE	ASTM A53 (GRADE B)

4.2 ALL STEEL TO BE HOT DIPPED GALVANIZED, U.N.O.

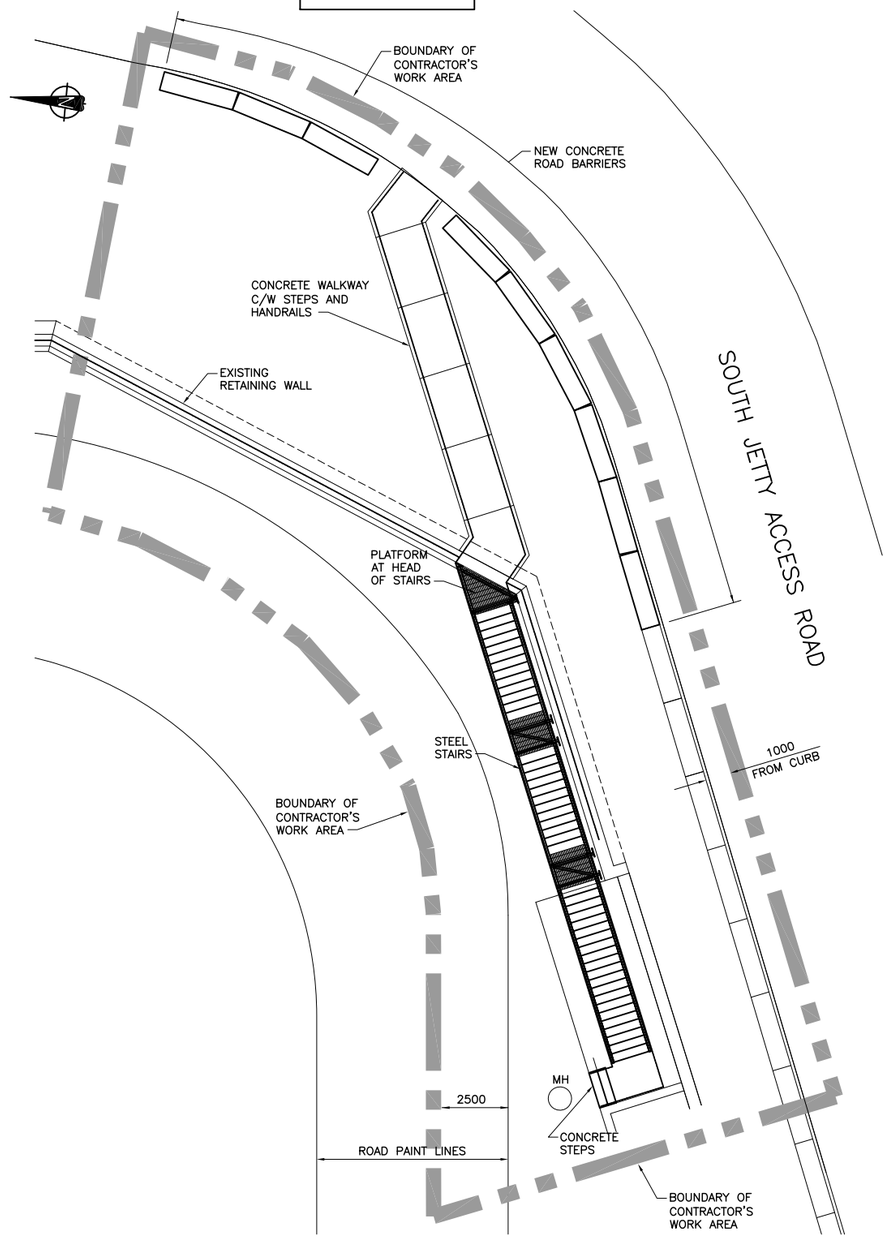
4.3 ANCHORS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

4.4 WELDING SHALL BE CARRIED OUT IN ACCORDANCE WITH CSA W59. OPERATORS PERFORMING THE WELDING WORK SHALL BE QUALIFIED UNDER CSA W47.1. WELDING ELECTRODES SHALL BE TYPE E480XX.

4.5 THE FABRICATOR SHALL BE RESPONSIBLE FOR THE INSPECTION OF THE WELDING. INSPECTORS SHALL BE QUALIFIED BY THE CWB TO CSA W178.2

DRAWING LIST:

DRAWING NO.	TITLE
C101	SITE PLAN, GENERAL ARRANGEMENT, GENERAL NOTES AND DRAWING LIST
S101	STRUCTURAL LAYOUT AND DETAILS
S102	STRUCTURAL DETAILS – SHEET 1
S103	STRUCTURAL DETAILS – SHEET 2



GENERAL ARRANGEMENT
1:100
A

RECORD DRAWING

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région de Pacifique

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
A	RECORD DRAWING	12/02/20

Client/client
PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK RETAINING WALL STEEL STAIRS

Consultant Signature Only

Designed by/Concept par
G.COOPER

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services / Gestionnaire régionale, Services d'architectural et de génie, TPSGC
PREETIPAL PAUL

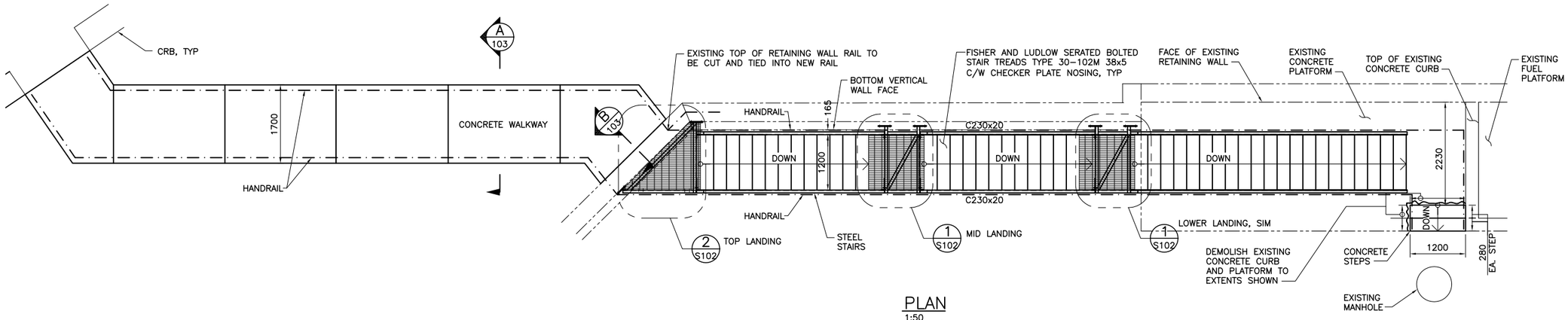
Drawing title/Titre du dessin
SITE PLAN, GENERAL ARRANGEMENT GENERAL NOTES AND DRAWING LIST

Project No./No. du projet	Sheet/Feuille	Revision no./ Le Révision no.
R.016116.082	C101 OF XX	A

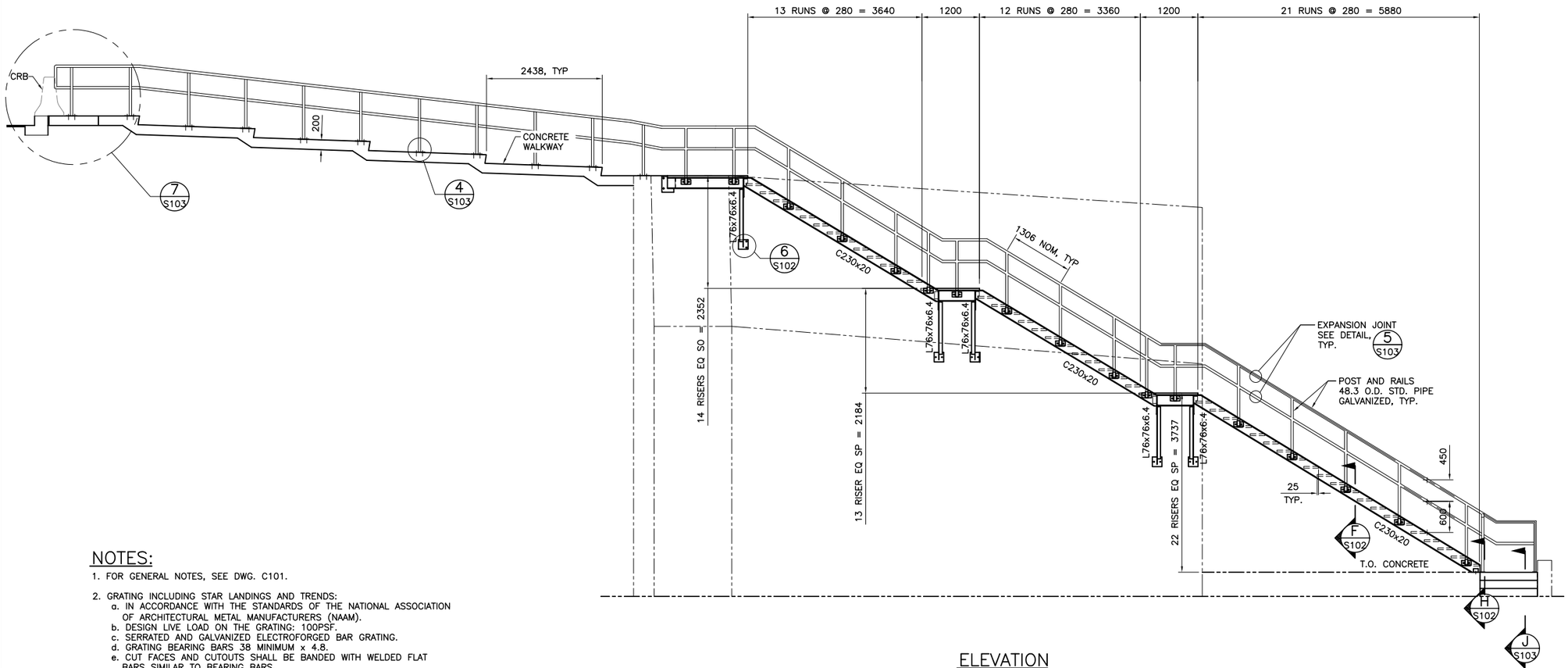
PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

DM5XXXXXX



PLAN
1:50
A



ELEVATION
1:50
A

NOTES:

1. FOR GENERAL NOTES, SEE DWG. C101.

2. GRATING INCLUDING STAR LANDINGS AND TRENDS:
   a. IN ACCORDANCE WITH THE STANDARDS OF THE NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAM).
   b. DESIGN LIVE LOAD ON THE GRATING: 100PSF.
   c. SERRATED AND GALVANIZED ELECTROFORGED BAR GRATING.
   d. GRATING BEARING BARS 38 MINIMUM x 4.8.
   e. CUT FACES AND CUTOUTS SHALL BE BANDED WITH WELDED FLAT BARS SIMILAR TO BEARING BARS.

3. GRATING FASTENERS: CONNECT BAR GRATING TO SUPPORT STEEL IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS AND AS FOLLOWS:
   a. FILLET WELDS, OR
   b. STAINLESS STEEL SADDLE CLIPS, OR
   c. HILTI GRATING DISK STAINLESS STEEL FASTENERS.
   d. FRICTION TYPE FASTENERS AND CLAMPS ARE NOT PERMITTED.

RECORD DRAWING

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région de Pacifique

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
A	RECORD DRAWING	12/02/20

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet

ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK RETAINING WALL STEEL STAIRS

Consultant Signature Only

Designed by/Concept par
G. COOPER

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

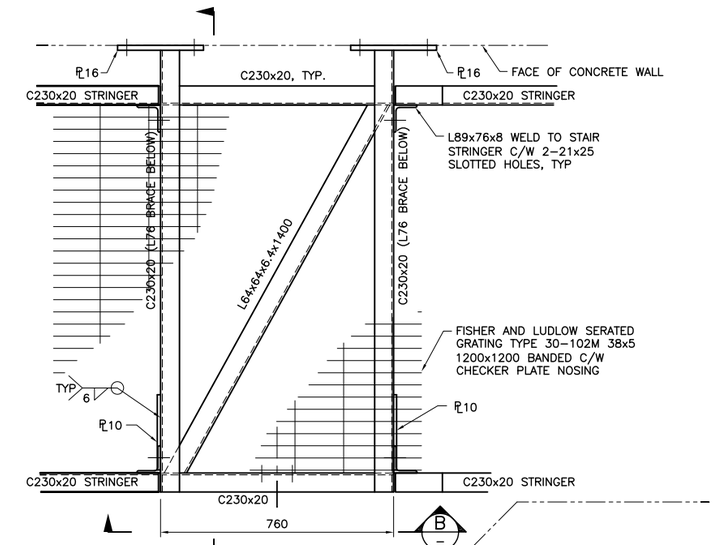
Regional Manager, Architectural and Engineering Services
Gestionnaire régionale, Services d'architectural et de génie, TPSGC
PREETPAL PAUL

Drawing title/Titre du dessin

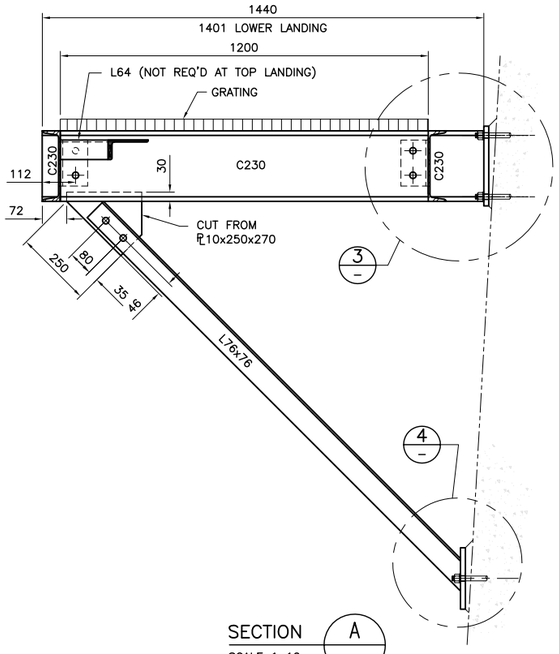
STRUCTURAL LAYOUT AND DETAILS

Project No./No. du projet	Sheet/ Feuille	Revision no./ La Révision no.
R.016116.082	S101 OF XX	A

DM5XXXXXX

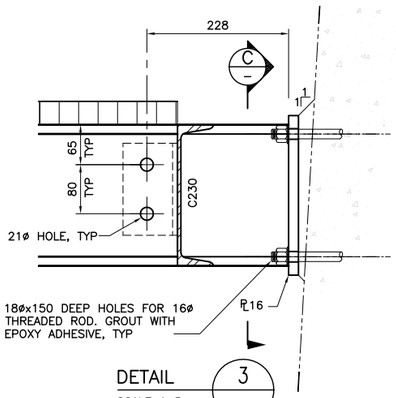


DETAIL 1 / S101
SCALE 1: 10

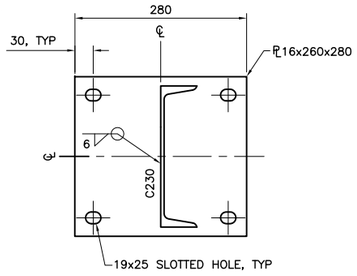


SECTION A
SCALE 1: 10

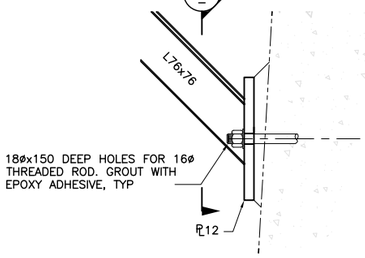
NOTE: HANDRAILS NOT SHOWN FOR CLARITY.



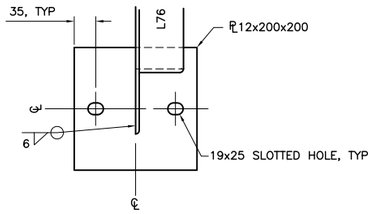
DETAIL 3
SCALE 1: 5



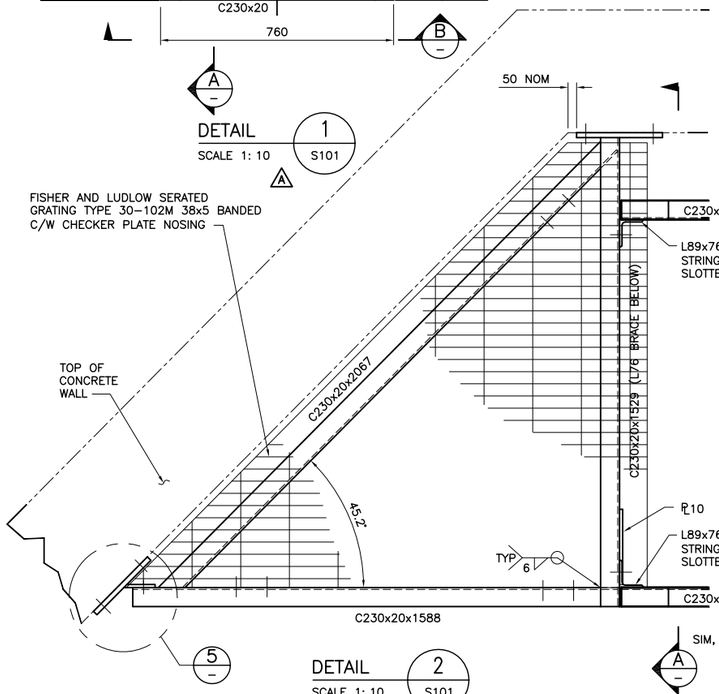
SECTION C
SCALE 1: 5



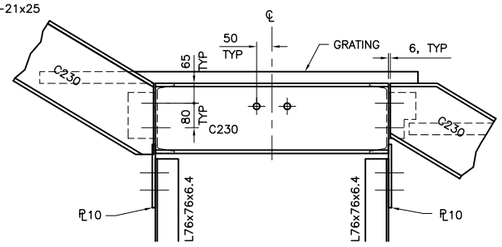
DETAIL 4
SCALE 1: 5



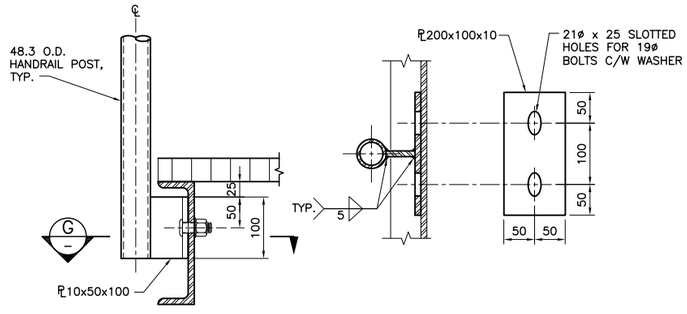
SECTION D
SCALE 1: 5



DETAIL 2
SCALE 1: 10



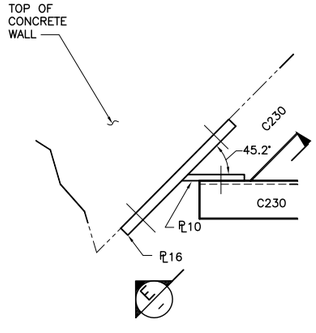
VIEW B
SCALE 1: 10



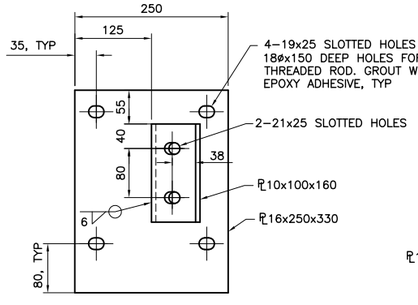
TYPICAL HANDRAIL CONNECTION TO STEEL CHANNEL

SECTION F / S101
SCALE 1: 5

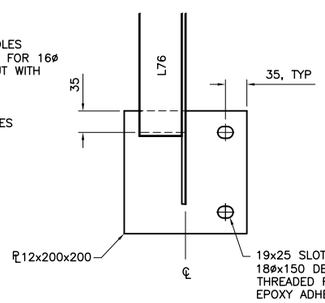
SECTION G
SCALE 1: 5



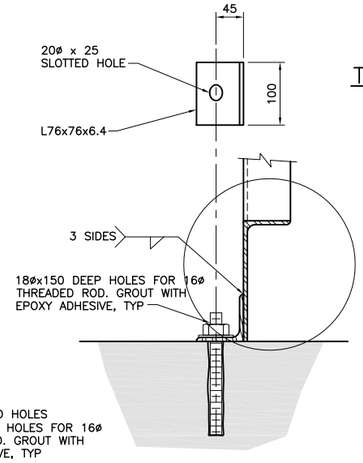
DETAIL 5
SCALE 1: 5



SECTION E
SCALE 1: 5



DETAIL 6 / S101
SCALE 1: 5



SECTION H / S101
SCALE 1: 5

NOTES:

1. FOR GENERAL NOTES, SEE DWG. C101.
2. EXISTING SURFACE TO BE CLEANED AND ROUGHENED TO A MINIMUM AMPLITUDE OF 5mm.
3. ALL WELDS TO BE 6mm WELDS U.N.O.
4. ALL BOLTS TO BE 20mmø U.N.O.

RECORD DRAWING

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région de Pacifique

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
A	RECORD DRAWING	12/02/20

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK RETAINING WALL STEEL STAIRS

Consultant Signature Only

Designed by/Concept par
G. COOPER

Drawn by/Dessiné par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services
Gestionnaire régionale, Services d'architectural et de génie, TPSGC
PREETIPAL PAUL

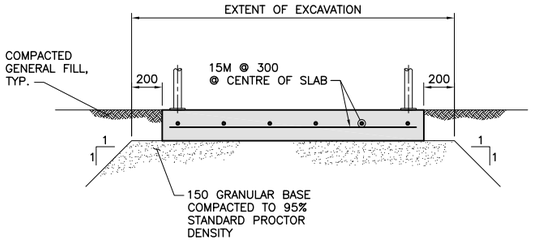
Drawing title/Titre du dessin
STRUCTURAL DETAILS
SHEET 1

Project No./No. du projet	Sheet/ Feuille	Revision no./ Le Révision no.
R.016116.082	S102 OF XX	A

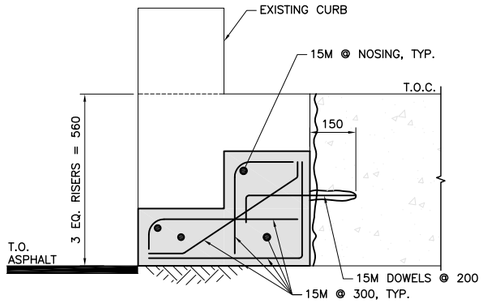
PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

DM5XXXXXX

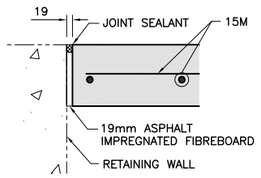


SECTION A
SCALE 1: 20 S101

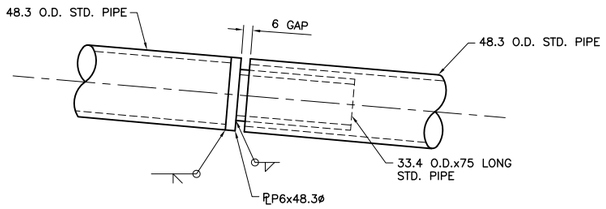


SECTION J
SCALE 1: 10 S101

NOTE: HANDRAILS NOT SHOWN FOR CLARITY.

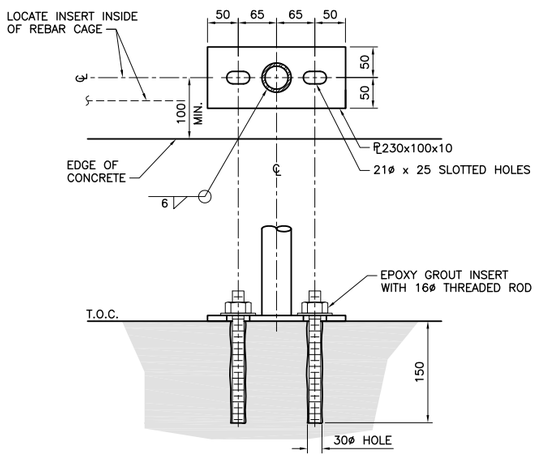


SECTION B
SCALE 1: 10 S101



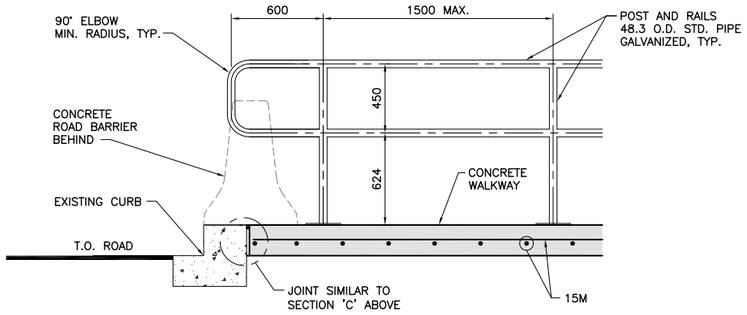
TYPICAL HANDRAIL EXPANSION JOINT DETAIL

DETAIL 5
SCALE 1: 2 S101



TYPICAL HANDRAIL CONNECTION TO CONCRETE

DETAIL 4
SCALE 1: 5 S101
A



DETAIL 7
SCALE 1: 20 S101
A

NOTES:

1. FOR GENERAL NOTES, SEE DWG. C101.

RECORD DRAWING

Public Works and Government Services Canada
Travaux publics et Services gouvernementaux Canada
REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Région de Pacifique

Klohn Crippen Berger

Revision/ Revision	Description/Description	Date/Date
A	RECORD DRAWING	12/02/20

Client/client

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

Project title/Titre du projet
ESQUIMALT GRAVING DOCK
825 ADMIRALS ROAD, VICTORIA, BC

ESQUIMALT GRAVING DOCK RETAINING WALL STEEL STAIRS

Consultant Signature Only

Designed by/Concept par
G. COOPER

Drawn by/Dessine par
G.M.

PWGSC Project Manager/Administrateur de Projets TPSGC
DOUG FERRIER

Regional Manager, Architectural and Engineering Services Gestionnaire régionale, Services d'architectural et de génie, TPSGC
PREETIPAL PAUL

Drawing title/Titre du dessin
STRUCTURAL DETAILS
SHEET 2

Project No./No. du projet	Sheet/ Feuille	Revision no./ La Révision no.
R.016116.082	S103 OF XX	A

PWGSC – A1 – 841X594

0 10 20 30 40 50 60 70 80 90 100mm

DM5XXXXXX

G

ESQUIMALT GRAVING DOCK

COVID-19: PSPC STANDARD PROTOCOLS FOR REAL PROPERTY CONSTRUCTION PROJECTS

Number of Pages: 30

COVID-19: PSPC Standard Protocols for Real Property Construction Projects

Version 1.2

1 Table of Contents

COVID-19: PSPC Standard Protocols for Real Property Construction Projects 1
DRAFT FOR REVIEW Version 1.2 1
2 Purpose 3
2.1 Communications 3
3 Requirements for PSPC Staff in Workplaces 3
3.1 Workplaces and Job Sites 3
3.1.1 Site Specific Safety Plans (SSSP) 3
3.1.2 Travel for Work and Site Visits 4
3.1.3 Personal Protective Equipment (PPE) & Mitigation Techniques 5
4 Site Issues 5
4.1 Building Inspections by Authorities Having Jurisdiction during Construction 5
4.2 Consultant / Contractor Initiated Refusal to Attend Site/Work Stoppage 5
5 Procurement Considerations 6
5.1 General 6
5.1.1 Procedures 6
5.1.2 Processing Times 6
5.2 Pre-Solicitation (Defining Upcoming Requirements) 6
5.3 Solicitation Process 6
5.3.1 New Solicitations 6
5.3.2 Existing Solicitations (already posted) 8
5.3.3 Closed Solicitations 8
5.4 Contract Administration 8
5.4.1 Essential Work 8
5.4.2 Non-Essential Work 8
5.4.3 Extension of Time Requests 9
5.4.4 Suspension of Work (aka issuing a “Stop Work Order”) 10
5.4.5 Changes Allowed for Direct Costs Related to COVID-19 Impacts 11
5.4.6 Claims for costs related to Suspension of the Work by Canada during the COVID-19 pandemic 12
5.4.7 Other Changes in the Work Related to COVID-19 13
5.4.8 Payment 13
5.4.9 Restarting a Construction Site that has been shut down or inactive 13
Appendix A – Helpful references, timelines and resources 14
Canadian COVID-19 Timeline 14
Government of Canada Publications 16

Provincial health and construction association COVID-19 information:....16
Recommended Site Specific Safety Plan Additional Requirements. 17
Construction Association Publications:....17
Regional claims representative or manager....18
Appendix B – Site Issues Example Letters....19
Response to Contractor-Initiated Site Shutdown....19
Site Closure from Building Owner, Landlord or other 3rd party (OGD)....20
Government Closure of Site 20
Appendix C – Sample response to contractors regarding claims and extension of time 22

Version number	Date of issue	Author	Brief description of change
1.0	2020-05-15	RPB PMSL Working Group	Version for Release
1.1	2020-06-25	RPB PMSL Working Group	Updates to the Appendices (Timelines and Letters)
1.2	2020-11-12	RPB PMSL Working Group	Updates related to additional allowances for eligible Direct Costs

Public Services & Procurement Canada (PSPC) gratefully acknowledges the generous assistance of BGIS (formerly known as Brookfield Global Integrated Services) for sharing their PDS COVID-19 Playbook ©, upon which much of the following is inspired.

2 Purpose

The purpose of this document is to provide guidance for Departmental Representatives while managing projects, and particularly for Departmental Representatives when administering contracts during the COVID-19 pandemic. The priority in all circumstances is the health and safety of colleagues, contractors and citizens of Canada. Departmental Representatives play a significant role in containing the spread of this disease and therefore need to use good judgment in all their activities. In these uncertain times and changing circumstances, PSPC must endeavour to carry out its construction related work as productively as possible while maintaining good working relationships and communications with our Consultants and Contractors.

2.1 Communications

- Recognize that all employees and Contractors may currently be dealing with increased uncertainty, worry, anxiety and stress as a result of the COVID-19 pandemic.
- Ensure that all communications are courteous and respectful.
- Treat all Contractors in a respectful, open and transparent manner.
- Departmental Representatives and Contracting Authorities should continue to maintain open lines of communication regarding all contracting issues.
- Since employees may be working offline, Departmental Representatives and Contracting Authorities should communicate by telephone if an issue requires urgent attention.

3 Requirements for PSPC Staff in Workplaces

The requirements apply to all workplaces where PSPC employees attend, including project sites. A project site includes, but is not limited to, any space (lease, fit-up) or asset (installation, renovation, roadways, dredging, etc.), where construction or delivery of goods or materials is taking place in a Government of Canada (GoC) owned or leased facility.

3.1 Workplaces and Job Sites

During the period of regulatory health orders affecting physical contact, visits to workplaces where others frequent should be avoided to the extent possible. If a site visit has been approved, it is recommended to limit the number people on site if physical distancing or equivalent mitigation measures are impracticable. Make use of barrier type Personal Protective Equipment (PPE) and adopt additional mitigation techniques in combination with the general techniques in place for the Federal or Provincial jurisdiction in question.

Attendance at a work site must be approved in advance by the appropriate PSPC authority and all safe work practices shall be approved by the PSPC supervisor or manager prior to attending a job site.

3.1.1 Site Specific Safety Plans (SSSP)

Contractors are required to update their Site Specific Safety plans as conditions change. It is imperative that Departmental Representatives ensure that each Contractor has updated plans and that they are received and reviewed by the Departmental Representative and the Departmental Health and Safety Advisor. Non-compliance may result in the suspension of work and must be escalated to the appropriate authorities. It is recommended that Departmental Representatives request an updated SSSP to include the Contractor's protocols for COVID-19. This update should be reviewed by PSPC (PM and Construction Safety Advisor), as well, there should be a periodic review process (not less frequent than bi-weekly) in place to confirm that the changes to the SSSP are in place, engaged by all workers and effective and to allow updates or changes as necessary. All updates with the plan must be shared with all persons on the worksite.

Key points:

1. *The Contractor has control of the Work and therefore must ensure protocols are established, and followed by workers on site.*
2. *Site Specific Safety Plans are to be updated on a regular basis as site conditions change*

3. *The Contractor must respect specific site safety guidance from the provincial/territorial Authority Having Jurisdiction. The Departmental Representative will advise their manager of any circumstances where a contractor argues that a Provincial or Territorial regulator has directly or constructively impeded the Work of a PSPC declared essential contract.*

The **Canadian Construction Association (CCA)** has published a pandemic preparedness guide, which contains standardized protocols for construction sites.

The **Commission des normes, de l'équité, de la santé et de la sécurité du travail (CNESST)** has published the : *Guide pour les chantiers de construction* for construction in the Province of Québec.

Suggested requirements to be incorporated into the Site Specific Safety Plans are included in Appendix A

For more information on the responsibilities of PSPC employees, please see the:

- Treasury Board Directive on Occupational Health and Safety
- PSPC Departmental Policy on Occupational Health & Safety
- PSPC Departmental Directive on Construction Occupational Health & Safety
- PSPC Departmental Directive on Occupational Health & Safety – Hazard Prevention Program

3.1.2 Travel for Work and Site Visits

If it is determined that an employee is required to travel for work during the COVID-19 pandemic, including site visits, approval must be obtained by the appropriate authority designated for the region (i.e. Regional Director). Additionally, the employee must be aware of the restrictions of the Provincial regulator concerning public health emergencies declared within the jurisdiction or any specific provincial jurisdictions. Links to the most up-to-date information for each province can be found in Appendix A.

As a physical distancing measure, the number of PSPC employees in attendance at one time to conduct / observe site reviews required for quality and quantity control should be restricted. To minimize the number of PSPC attendees, site reviews required for quality and quantity control should be conducted by designated individuals (consultant, for example) who can effectively determine if the work meets the necessary requirements of quality and quantity; certification requirements must continue to rely on those with delegated authority. It is not recommended to have any client representatives or any other persons that are not absolutely required for the purpose of the inspection. The use of technology is encouraged. For those persons on site, the use of photos or video streaming, to allow for inclusion of other members of the team, are suggested alternatives.

Prior to any visit, PSPC employees shall ensure they are in good health and should carry out any self-assessment deemed necessary for the site's location to reveal signs and symptoms. Results of this self-assessment (absent any confidential medical information) should be provided to the PSPC supervisor or manager prior to travel. We invite readers to consult the Appendix A for provincial guidance.

For added safety, the following guidelines should be considered:

- Take a personal vehicle instead of a rental vehicle
- If multiple people have to travel, take separate vehicles so not to be in close quarters
- Carry either wipes, sanitizer or appropriate cleaning solution to be able to clean hands and surfaces before and after touching
- Employees' travel shall be tracked and monitored by the PSPC staff manager.
- Manager should be aware of travel itinerary and employee should make regular check-ins consistent with the policy on working alone.

- Employee should carry their PSPC employee ID, and Public Service Health Care card and be aware of phone numbers for provincial health authorities, public safety, HRG, etc.
- Employees should use their Government of Canada Travel Card for greater/better insurance coverage.

3.1.3 Personal Protective Equipment (PPE) & Mitigation Techniques

Typical PPE (e.g. boots, vest, safety glasses) must be worn at all times on the job site, without exception. In light of COVID-19 additional PPE may be required, such as, bio-hazard suits, latex / vinyl gloves, masks, goggles, and face shields, if appropriate to the job site. Any PPE required as per current COVID-19 protocols should be used as recommended and with the appropriate level of training to ensure its proper use.

4 Site Issues

4.1 Building Inspections by Authorities Having Jurisdiction during Construction

The COVID-19 pandemic may impact the timing of inspections and availability of inspectors for projects, which could ultimately affect construction progress. Inspections of on-going construction are required by third parties during construction for both regulatory and commercial reasons. Environmental and occupational health & safety are but two examples of regulatory inspections. Utilities such as electrical power suppliers, water and waste water agencies, etc. are examples of obligatory commercial inspections. In Provinces where the building code statutes are binding on the Crown, the Consultant provides compliance certification and the municipality that would provide such services to the general public do not apply

Constructors are obligated to facilitate such inspections as part of their services and therefore Canada is not liable for a compensable delay should such inspections be postponed. Coordination of required building inspections is the responsibility of the Contractor. Any changes to the schedule should be communicated by the Contractor and captured by the Departmental Representative, in communication with the client's Project Leader / Sponsor as required.

In the event that an inspector requires a more detailed review that involves deconstruction or any additional costs, such cost must be borne by the Contractor. Appropriate information, in writing, and photo evidence are highly suggested.

4.2 Consultant / Contractor Initiated Refusal to Attend Site/Work Stoppage

It is important to understand that the effects related to COVID-19 may impact a project's workforce and/or professionals. For example, due to the health risks associated with COVID-19, there could be a reluctance to working on site or a complete stoppage of the work, i.e. refusal to attend site. In order to effectively manage these events, the following recommendations have been provided for reference; upon notification of refusal to attend site the Departmental Representative shall:

- Verify the validity of the Notice with the Contractor.
- Clarify whether the issue is a 'Right to Refuse' matter pursuant to OH&S legislation, or regulatory 'stop work order', or Contractor initiated delay, or Contractor abandonment of Contract. Collect documentary evidence as appropriate from Contractor.
- Notify the PSPC unit manager, the claims manager, Contracting Officer, Regional Manager and client service manager to review circumstances.
- Advise the Client's Project Leader / Sponsor.
- Issue a response letter/e-mail using the Example Letter in Appendix B when a contractor refuses to attend the jobsite. This letter is intended to remind the contractor of their responsibilities and invites them to contact PSPC for further detail.

5 Procurement Considerations

5.1 General

5.1.1 Procedures

- All usual procurement approval processes continue to be required.
- All usual procurement regulations, policies and procedures remain in full effect.
- All usual workflows (e.g. document routing) remain the same.

5.1.2 Processing Times

- Employees are dealing with technological challenges as well as increased demand for procurement services during these unprecedented times.
- While every effort will be made to maintain service standards, actual response times may vary more than usual.
- Departmental Representatives should allow extra time for processing of short forms and change orders.
- Departmental Representatives should allow longer lead times for the posting of solicitations, since modifications to existing templates and additional approvals may be required.

5.2 Pre-Solicitation (Defining Upcoming Requirements)

- Departmental Representatives should advise the Contracting Authority immediately if the Construction is related to the COVID-19 response effort.
- Departmental Representative should determine if the Work is considered essential or non-essential.
- While construction work on federal government property falls under federal jurisdiction (with the exception of Health & Safety and Environmental matters), for projects where Canada does not consider the Work essential, it is up to Contractors to decide whether or not to comply with provincial shut-downs of non-essential businesses. Lists of provincial exceptions are provided in Appendix A
- Departmental Representatives should consider whether or not any modifications to drawings and specifications are required as a result of the COVID-19 pandemic impacts.
- Departmental Representatives should consider whether or not the Work can be carried out safely during the COVID-19 pandemic.

5.3 Solicitation Process

Applies to RFP (Request for Proposal), ITT (Invitation to Tender), RFSA (Request for Supply Arrangement) and RFSO (Request for Standing Offer)

5.3.1 New Solicitations

- Priority will be given to solicitations for Work that has either been deemed an essential service to the federal government, or an essential service within the province of the Work.
- Public health measures including physical distancing are of the highest priority. Therefore, the posting of new solicitations should not yet be looked at as a means to stimulate the economy. In due course, the Construction industry will be expected to play an important role in Canada's economic recovery.
- Requirements for non-essential Work may still be posted, but Contracting Authorities and Departmental Representatives should consider risk mitigation strategies if the solicitations will close before the Construction industry is permitted to return to business-as-usual in the province of the Work:
    - Contracting Authorities might consider a longer bid validity period to ensure that there will be adequate time to properly evaluate bids and carry out contract award activities before bids expire.
    - Contracting Authorities might consider specifying a start date for the Work that is later than the Contract Award date.
- Before posting new solicitations, consideration must be given to the following:

- Site visits in the traditional format may go against public health requirements to avoid gathering in groups (see Appendix A for links to provincial websites). Therefore, in situations where a site visit is considered important to Bidders' abilities to respond effectively, the following options for alternative site-visit procedures may be explored:
  - Option 1: If the work site is publicly accessible area, a PSPC officiated site visit may not be necessary. The solicitation shall encourage the bidders to visit the site on their own time
  - Option 2: One-on-one site visits:
    - Bidders interested in participating in the site visit would be required to register with the Contracting Authority in advance by email.
    - The Contracting Authority would assign each bidder a specific time slot.
    - The Departmental Representative would show the site to 1 contractor rep at a time (one-on-one).
    - All bidder questions would be submitted to the Contracting Authority and answered by solicitation amendment/addendum following the site visit.
    - Additional restrictions could include: The Bidder's representative must not have travelled internationally in the past 14 days, must not have symptoms of COVID-19, and must respect physical distancing measures while on site.
  - Option 3: Where it would be effective, virtual site-visits using video conferencing technology may also be considered.
- There will be no in-person public bid openings for 1-envelope ITTs until further notice.
- Bid Receiving Unit procedures may vary during the COVID-19 pandemic and may differ by location. Bid Receiving Units generally remains operational, but Contracting Authorities are requested not to pick up of physical bids in person at some Bid Receiving Units. Arrangements will need to be made after bid-closing.

- Extended Posting Periods for Non-Essential Work:
  - Contracting Authorities and Departmental Representatives should give consideration to posting non-essential Work for extended solicitation periods where it can be accommodated within the project's schedule constraints, for example:
    - To allow industry sufficient time to prepare a bid while dealing with the impacts of COVID-19 on their business.
    - To ensure that the solicitation period allows enough time for alternative site-visit procedures (e.g. one-on-one site visits) to be scheduled and completed before the Q&A period ends, if applicable.
  - Especially in provinces where emergency orders remain in place, Contracting Authorities and Departmental Representatives should be as flexible as possible in considering extending posting periods if there are indications from industry that the time provided is insufficient to properly coordinate and submit bids.
- Depending on the urgency (public safety implications, etc.), solicitations for essential work can proceed with normal solicitation periods, with attentive monitoring of industry feedback to ensure competition.
- Canada will have to be receptive and flexible if there are indications that the timing of the solicitation may result in a low level of industry interest.
  - For example, if there are very few questions received during the solicitation period, there is little or no interest in the site visit, or Canada receives negative feedback from industry (regarding

reduced capacity, etc.), we will need to strongly consider extending the posting period or even cancelling the solicitation before the bid closing date and re-tendering later. In this case, a 15% scope change prior to re-tendering would not apply.

5.3.2 Existing Solicitations (already posted)

- If the solicitation is for non-essential Work, the Contracting Authority should consider extending the closing date to allow industry additional time to respond.
- Further extensions may be required if/when the emergency orders are extended.
- Contracting Authorities should review the solicitation documents to determine if amendments/addendums are required as a result of changes to procurement procedures during the COVID-19 pandemic, such as:
  - To increase the bid validity period to ensure adequate time for bid evaluation and award activities before bids expire.
  - If necessary, to change the start date for the Work to a date later than the Contract Award date.
  - To add new health and safety requirements (see the Defining Upcoming Requirements section for additional information).

5.3.3 Closed Solicitations

- For non-essential work, the Contracting Authority may need to attempt to extend the bid validity period to ensure that evaluation and award procedures can be properly completed before bid expiry. In situations where bids continue to remain valid and Work could not begin upon Contract Award, Contracting Authorities should consider whether it is in Canada's best interests to award the Contract right away or wait for a return to business-as-usual in the province of the Work.
- If a bidder wants to withdraw their bid before contract award (e.g. if they didn't know about some COVID-19 impacts at the time of bid closing), Legal Services must be consulted.

5.4 Contract Administration

5.4.1 Essential Work

- PSPC has deemed certain real property projects to be essential.
- For projects deemed to be essential, a letter will be/has been sent from Real Property Services (RPS) (from the appropriate authorized level) to the Contractor.
- Departmental Representatives are requested to provide a copy of any such letters to the Contracting Authority.
- If any changes are required as a result of COVID-19, refer to Changes Allowed for Direct Costs Related to COVID-19 Impacts and Changes in the Work Related to COVID-19.

5.4.2 Non-Essential Work

- For Work considered non-essential work in the provinces of Ontario and Quebec, the Real Property Contracting Directorate (RPCD) anticipates that Contractors will notify the Departmental Representative and/or Contracting Authority that they intend to stop work as a result of the provincial regulations.
  - Note that GC 1.8 – Laws, permits and taxes requires Contractors to follow all provincial regulations applicable to the performance of the Work.
- If the Contractor indicates an intent to claim for costs related to the shut-down, refer to Changes Allowed for Direct Costs Related to COVID-19 Impacts and Claims for costs related to Suspension of the Work by Canada during the COVID-19 pandemic.

- Upon receipt, the Contracting Authority may use the draft email template "Appendix A - Response to Contractor-Initiated Site Shutdown", modified as needed, to acknowledge receipt.
- Throughout the Work disruption, the Contractor remains solely responsible for construction site safety, including the health and safety of the persons and property on site as well as the protection of persons and the environment adjacent to the site.
    - See also: Extension of Time Requests
- A Work disruption may impact the completion date for the Work. Detailed records should be maintained of all communications with the Contractor pertaining to schedule impacts and the reason(s) for delay(s).
- The Contractor should be advised that they must promptly resume performance of the Work once it is possible to do so in compliance with all federal, provincial and municipal laws and regulations applicable to the performance of the Work.

- In the event that there is a governmental (e.g. Provincial) order to cease Construction Activity, each project team is responsible for a complete and safe shutdown. The Departmental Representative shall issue a letter to the contractor that reminds them of their responsibilities in this circumstance, modified as needed.
- The Departmental Representative shall ensure the following items are discussed and are adhered to:
    - Any temporary elements protecting the site such as fencing, barriers, CCTV (Closed Circuit TV Cameras) or other means, must remain in place and operational to ensure security.
    - Doors are to be locked and keys are to be made available to the appropriate people, or an emergency contact name provided.
    - Site has relevant lighting and signage.
    - Leave site clean and uncluttered, all materials have been appropriately stored.
    - Remove designated substances from site, wherever possible. If it is not possible ensure they are in a sealed area with negative air pressure.
    - Ensure all fire prevention / detection and life safety measures are reinstated. If this is not possible determine an acceptable workaround.
    - Mechanical/Electrical/Server rooms are accessible to technicians.
    - Points of egress are all acceptable or appropriate signage is in place.
    - Ensure that the site is either inspected by an authorized individual (i.e. consultant) or proper photo documentation has been submitted.

5.4.3 Extension of Time Requests

- Contractors should be advised to track the periods and reason(s) of disruption for any Extension of Time request.
- Pursuant to GC 6.5 - Delays and Extension of Time, the Contractor may apply to Canada for an Extension of Time at any point in time before the date first fixed for completion of the Work.
    - Contractors should be asked to consider submitting only one Extension of Time request if possible, once the extent of the disruption is known, to reduce the overall quantity of requests (i.e. once the extent and effects of the disruption is known).
    - If the Contractor indicates that there will be costs associated with their Extension of Time application, refer to Claims for Costs Related to COVID-19.
- Departmental Representatives are advised that they may not grant verbal approvals/site instructions related to Extensions of Time.
- The Contractor should be advised (but is not contractually obligated) to make any Extension of Time application using PWGSC-TPSGC Form 1801 – Extension of Time on Contracts, which can be found at: https://www.tpsgc-pwgsc.gc.ca/app-acq/forms/documents/1801.pdf.
- Upon receipt of a written application for an Extension of Time (i.e., revision of the required date of substantial completion / performance with no cost implications to the Crown) from the Contractor on

the grounds of an alleged cause "beyond the control of the Contractor" the Departmental Representative shall:

- Ensure the application has been received in writing and is in accordance with the Terms of the Contract (including but not limited to written approval of Surety).
- Notify the Project Management unit manager, Claims Manager or representative, and Contracting Officer.
- While many impacts related to COVID-19 are likely to be beyond the control of the Contractor, assess whether the alleged causes conform to the four-point test of:
  - beyond the reasonable control of the Contractor;
  - could not reasonably have been foreseen;
  - could not reasonably have been prevented by means reasonably available to the Contractor; and
  - occurred without the Contractor's fault or neglect.
- If an excusable delay is appropriate, verify that the Contractor's Time Impact Analysis (TIA) has established an appropriate duration in order to recommend the Contractor's application for Extension of Time to the Contracting Officer for approval and issue to Contractor
- An Example Letter has been prepared to Notify the Client / Project Leader of the circumstances regarding the request for the extension of time and is located in Appendix D
- Several example letters in response to the Contractors request for an extension of time have been prepared to address various circumstances:
  - response to Contractor that gives notice of stopping the work without explicitly giving notice of intent to claim
  - response to Contractor that gives notice of delay and explicit notice of intent to claim

5.4.4 Suspension of Work (aka issuing a "Stop Work Order")

- RPCD does not recommend the use of GC 7.2 Suspension of Work in most cases.
- There is no separate provision in our standard construction contracts related to stop-work orders.
- If Canada issues a Suspension of Work Notice, Canada will be responsible for the Contractor's extra costs during the period of the suspension.
- If the suspension lasts more than 60 days, the Contractor will have the ability to negotiate terms and conditions related to resuming the work. If Canada and the Contractor can't reach an agreement, the suspension becomes a termination, which can result in Canada being responsible for paying termination costs as well as possible delays while the Work is re-tendered and a new Contractor is found.
- Since no one knows the precise duration of the impacts of the COVID-19 pandemic, RPCD advises that this option should only be considered in exceptional circumstances.
- If a Departmental Representative becomes aware of a situation where a 3rd party (such as client department or security firm) is preventing a Contractor from accessing the site, the Departmental Representative shall:
  - Ensure the order has been received is in the prescribed format deemed valid and in proper order with respect to the contract.
  - Confirm the date of the order and to whom it was issued.
  - Notify the Project Management unit manager, Claims Manager, and Contracting Officer.
  - Assess whether the order compels full or partial cessation of the Work and for what duration.
  - Notify the Client / Project Leader/Sponsor
  - Issue a response letter to the Authority denying access using the template, modified as needed, found in Appendix C

- Solicit confirmation from Legal Services as to the legality of the order.
- If the order is legally confirmed, and the Work is expected to eventually resume, the Departmental Representative shall discuss with the Contracting Authority whether the issuance of a Suspension Notice pursuant to the terms of the Contract is appropriate. If the order is legally confirmed, but the Work will not resume at a later date, recommend to the Contracting Authority to Terminate the Contract pursuant to the terms of Contract.
- Advise the Contractor that they are required to take steps to minimize their costs during any period of suspension.

5.4.5 Changes Allowed for Direct Costs Related to COVID-19 Impacts

- Due to the unprecedented nature of the current situation, contractors may incur additional expenses as a direct result of the COVID -19 pandemic. In light of this, Canada will amend certain types of contracts to permit the payment of certain additional direct costs borne by the contractor in order to respond to the emergency orders issued by the Health Authorities in the Province or Territory of work.

- This process is applicable to eligible stipulated price contracts and construction management contracts, and will be in effect until March 31, 2021. Eligible contracts are those contracts in effect or where bids were tendered prior to April 01, 2020.

- This process shall not duplicate any other portion of the work where costs associated with COVID-19 have already been deemed to be accounted for, i.e. a previous change order.

- Compensation for the additional direct costs shall follow the established regional change order process, following a request for a change from the contractor for such compensation, which may also be in the form of a request for an extension of time.

- NOTE: This amendment does not contain provisions for loss of productivity incurred by contractors.

- The following items are the Eligible Direct Cost Items to be considered for a change order to the contract:
  - *Additional Personal Protective Equipment supplied to workers, as ordered by Provincial/Territorial Health Officials, to safely carry out their duties.*
  - *The provision of additional site trailers and comfort stations, and their respective cleaning and maintenance, as ordered by Provincial/Territorial Health Officials to allow for adequate social distancing and personal hygiene at the work site.*
  - *The Labour, Plant, and Material associated with the Demobilization and Remobilization of the worksite due to compliance of Provincial construction shutdown and re-opening orders (This applies to Quebec and Ontario work sites affected by emergency orders enacted inarch and April 2020 respectively.).*
  - *PSPC approved Material substitutions to account for supply chain limitations*
  - *Premiums for alternate travel requirements to comply with Provincial /Territorial Authorities emergency requirements, including premiums for charter or direct flights, and allowances for the period of self-isolation for out of province workers to be eligible to begin working.*
  - *Extensions for existing equipment rentals related to requests for Extension of Time.*
  - *Additional Bonding and Insurance costs related to the Extension of Time. (Note: This is considered to be included as part of the Contractor's Allowance when changes are processed following GC 6.4.1)*
  - *Additional direct supervision as ordered by Provincial/Territorial Health Authorities.*
  - *Other reasonable direct costs as determined by Canada in its sole discretion incurred due to compliance with Provincial/Territorial Health Authorities direct emergency orders.*

- Determination of the Price of the Change Orders shall be in accordance with GC6.4, Determination of Price.

  - All change orders for work that has been completed for the Eligible Direct Cost Items shall be processed in the same fashion as GC6.4.2, Price Determination Following Completion of Changes.
  - Change orders for the Eligible Direct Cost Items that are deemed necessary but have not yet been implemented may be processed in the fashion of GC6.4.1, Price Determination Prior to Undertaking Changes.

- The Departmental representative shall ensure:
  - Contractors provide proof of compliance with the emergency orders of the Province/Territory of Work as well as proof of cost/purchase as applicable.
  - Contractors provide adequately detailed schedules and Time Impact Analyses to substantiate Extension of Time durations.
  - Only those items identified as Eligible Direct Cost Items shall form part of the contract amendment.
  - The cost of changes as a direct result of the COVID-19 Pandemic shall be reported (in a report format specified by the PMSL Reporting Unit).
  - There is adequate project funding available for the change order.
  - A Note to File is prepared to explain the change.

5.4.6 Claims for costs related to Suspension of the Work by Canada during the COVID-19 pandemic

- In certain cases, Canada has suspended the work of the Contractor. In these cases, Canada will pay the extra costs reasonably incurred by the Contractor as a result of the suspension, determined in accordance with GC6.4, Determination of Price.

- Upon receipt of a written ***Notice of Intention to Claim for that Extra Expense or Loss or Damage*** from the Contractor, the Departmental Representative shall: (i.e., prior to the actual date of *Substantial Completion / Performance*)
  - Acknowledge receipt of the claim
  - Notify the PSPC unit manager, the Regional Claims Manager/Representative, Contracting Officer, Regional Manager and Client Service Manager as appropriate to review circumstances.
  - Evaluate the claim in consultation with the Regional Claims Manager/Representative and Contracting Officer to ensure conformance with the contract requirements and verify the cost of entitlement.
  - Process the claim and advise all stakeholders of the outcome.
  - Record and report the Covid-19 Direct cost change order in accordance to the following instructions. **<INSERT DIRECTION/PROCEDURAL MATERIAL FROM PMSL Reporting>**

5.4.6.1 Regional Claims Representatives

Regional Claims Representatives/Managers may also be a helpful resource in the provision of advice and guidance. Please consult Appendix A for contact information.

5.4.7 Other Changes in the Work Related to COVID-19

- If the Departmental Representative determines that changes are reasonable and necessary as a result of COVID-19, Canada could agree to pay for the associated costs through the normal, properly approved short form and change order process. Departmental Representatives should assess the need for the following on a contract-by-contract basis:
    - Schedule Acceleration: In cases where an Extension of Time has been granted to a Contractor but the new Completion Date would have an unacceptable operational impact, the Departmental Representative could decide that it would be preferable to recover time at an additional expense. For example, by agreeing to pay:
        - Extra costs incurred by the Contractor to reduce materials lead times by using an alternative materials Supplier, where the Supplier carried in the bid can't deliver required materials on time as result of COVID-19.
        - The costs of working a second shift, overtime costs, etc.
- Departmental Representatives should consult with the RPCD Contracting Authority if they are unsure about how to handle a particular situation or expense.

5.4.8 Payment

In situations where notary offices are closed and local construction associations do not make this service available to members, Contractors may be unable to have Statutory Declaration forms notarized. In this case, Departmental Representatives may temporarily accept the Contractor's signature on the form.

5.4.9 Restarting a Construction Site that has been shut down or inactive

For construction sites that have been shut down or inactive for a period of time, there are a number of items to consider before the project team resumes the project.

Recommended steps for the Departmental Representative to consider prior to reinstating an inactive construction site:

- Review any communications immediately prior to the shut down – letters, correspondence, etc. – as well as any communications that occurred throughout the shutdown.
- Review condition of work or progress of project prior to shut down, and site should be reviewed for any changes that may have occurred during shut down – site conditions, vandalism, etc. to address any variances
- Review any direction provided from Procurement for application to their contract
- Discuss your construction project and situation with PSPC experts such as the Claims Manager, Procurement, Construction Safety Advisor, DOJ for consideration prior to re-opening the construction site
- Discuss with the Consultant and the Contractor plans for a date to reinstate the construction site
- Prepare for a project team meeting prior to work reinstated on site – consider the items from the pre-construction site meeting agenda which could be prudent to discuss
- Request, in advance, an updated SSSP and project schedule from the Contractor to review at the project team meeting
- Invite appropriate stakeholders for the project team meeting

Appendix A – Helpful references, timelines and resources

Canadian COVID-19 Timeline

Dates	Event
January 25	Canada's first case of COVID-19 was confirmed in Ontario
January 30	WHO declares COVID-19 to be a public health emergency of international concern
March 11	WHO declares COVID-19 to be a pandemic
March 16	PEI declares public health emergency
March 17	Ontario & Alberta declare state of emergency
March 18	Saskatchewan declares state of emergency Newfoundland declares public health emergency Nunavut declares public health emergency
March 19	British Columbia declares state of emergency NWT declares public health emergency New Brunswick declares state of emergency
March 20	Manitoba declares state of emergency
March 22	Nova Scotia declares state of emergency
March 25	Quebec declares state of emergency and construction shutdown
March 27	NWT declares state of emergency Yukon declares state of emergency
April 4	Ontario constructions shutdown
May 11	Quebec re-starts construction
May 18	Quebec police checkpoints lifted at the Gatineau-Ottawa border

May 19	Ontario re-starts construction
July 3	Borders within the Atlantic Provinces re-open for travel

Government of Canada Publications

- Canada's COVID-19 general information:https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection.html
- COVID-19 information for Government of Canada employees: https://www.canada.ca/en/government/publicservice/covid-19.html
- Occupational Health and Safety Directive: https://www.njc-cnm.gc.ca/directive/d7/en
- Designated Departmental Occupational Health and Safety Coordinators: https://www.njc-cnm.gc.ca/s76/d612/en

Provincial health and construction association COVID-19 information:

Province	Health	Provincial Construction Specific Orders	Construction Association Website
British Columbia	https://www2.gov.bc.ca/gov/content/safety/emergency-preparedness-response-recovery/covid-19-provincial-support	https://www2.gov.bc.ca/assets/gov/health/about-bc-s-health-care-system/office-of-the-provincial-health-officer/covid-19/covid-19-pho-guidance-construction-sites.pdf	https://www.bccassn.com/covid-19/default
Alberta	https://www.alberta.ca/covid-19-information.aspx		http://www.youracsa.ca/covid-19-information/
Saskatchewan	https://www.saskatchewan.ca/government/health-care-administration-and-provider-resources/treatment-procedures-and-guidelines/emerging-public-health-issues/2019-novel-coronavirus		http://www.scsaonline.ca/resources/covid-19-coronoavirus
Manitoba	https://www.gov.mb.ca/covid19/index.html	https://mbtrades.ca/covid-19/	https://www.constructionsafety.ca/covid19-and-construction/
Ontario	https://covid-19.ontario.ca/	https://www.ontario.ca/page/construction-site-health-and-safety-during-covid-19	https://www.ontario.ca/page/construction-site-health-and-safety-during-covid-19
Quebec	https://www.quebec.ca/en/health/health-issues/a-z/2019-coronavirus/	https://www.quebec.ca/en/employment/reopening-construction-during-covid-19-pandemic/	https://www.acq.org/coronavirus/
Nova Scotia	https://novascotia.ca/coronavirus/	https://constructionsafetyns.ca/covid/	https://www.cans.ns.ca/cans-covid-19-information-centre/
New Brunswick	https://www2.gnb.ca/content/gnb/en/departments/ocmoh/cdc/content/respiratory_diseases/coronavirus.html		http://nbcsa.ca/covid-19/

Prince Edward Island	https://www.princeedwardisland.ca/en/topic/covid-19		https://www.capei.ca/home
Newfoundland and Labrador	https://www.gov.nl.ca/covid-19/	https://www.gov.nl.ca/covid-19/files/Construction-and-COVID.pdf	https://nlca.ca/critical-information-covid-19/
Nunavut	https://www.gov.nu.ca/health/information/covid-19-novel-coronavirus		https://nnca.ca/
Yukon	https://yukon.ca/covid-19		https://www.yukoncontractors.ca/
Northwest Territories	https://www.gov.nt.ca/en/covid-19-coronavirus-disease		https://nnca.ca/

Recommended Site Specific Safety Plan Additional Requirements.

Note: These items are not a prescriptive requirement, rather a suggestion on the items to be included at minimum in the Contractor Site Specific Safety Plan

Recommended Site Specific Safety Plan to incorporate:

a) Communication and Awareness – signage reflecting the requirements and maintenance of health and safety protocols and updates as they occur
b) Recommended practices for reducing the risk of transmission
c) Posters for hand hygiene/hand washing/protection of others
d) Self-Screening Protocols
e) Fit for Duty/Worker Prescreening Protocols

IMPORTANT: Fit for Duty includes "**YOU or Anyone in your Household**"

f) Social/Personal Distancing Protocols
g) Personal Hygiene Stations (hand wash stations/hand sanitization stations)
h) Enhanced Cleaning Protocols/Worksite Cleaning Guidelines
i) Reporting processes and procedures to follow if feeling ill while at the job site
j) PPE Requirements for Workers
k) Prevention Measures to be taken by workers
l) Protocols on management of a reported case of COVID-19 at the job site
m) Access to/from construction site
n) Limiting and removing internal touch areas
o) Compartmentalization
p) Site Operation Procedures
q) Daily Audit Protocols

Construction Association Publications:

The Canadian Construction Association and its partners have published the *COVID-19 Standardized Protocols for All Canadian Construction Sites* and offers a variety of additional information and resources. For the latest versions, visit https://www.cca-acc.com/covid-19-resources/

Regional claims representative or manager

Region	Name	Telephone	Email
Atlantic	Peter Adams	902-293-4829	peter.adams@pwgsc-tpsgc.gc.ca
Québec	André Leguerrier	514-641-0729	andre.leguerrier@tpsgc-pwgsc.gc.ca
Ontario	Ilke Ayan Anand Shukla	416-455-0709 437-993-5138	ilke.ayan@pwgsc-tpsgc.gc.ca Anand.shukla@tpsgc-pwgsc.gc.ca
NCA	Jean-Claude Grant	819-912-5439	jean-claude.grant@tpsgc-pwgsc.gc.ca
Western	Brian Creighton	780-940-2267	brian.creighton@pwgsc-tpsgc.gc.ca
Pacific	Alex Taheri	604-666-9374	alex.taheri@pwgsc-tpsgc.gc.ca
SPIB	Claudio Calderon	613-277-0026	claudio.calderon@tpsgc-pwgsc.gc.ca

The following example letters are available for your use as required for your project situation. Ensure the facts and letter are reviewed in accordance with protocols prior to issuing the edited letter. Click on the hyperlink to access the template(s) in GCDocs.

Appendix B – Site Issues Example Letters

Response to Contractor-Initiated Site Shutdown

Draft Email Template

https://gcdocs.gc.ca/tpsgc-pwgsc/llisapi.dll?func=ll&objaction=overview&objid=256137298

<Cc: Departmental Representative Name>

Subject: Re: XX

Dear <Contractor Representative>,

This email is to confirm that Canada has received your notice, dated <April XX, 2020>, stating that <Contractor name> intends to stop work on the <Project Title> Project.

Canada considers the health and safety of its Contractors, their employees, subcontractors and the general public to be of the highest importance. Canada would like to remind <Contractor name> that throughout the Work disruption, it remains solely responsible for construction safety, including the health and safety of the persons and property on site as well as the protection of persons and the environment adjacent to the site.

If <Contractor Name> anticipates that this Work disruption will impact the completion date for the Work, please report this to the Departmental Representative and Contracting Authority as soon as possible. Canada recommends that you closely monitor project schedule impacts and maintain detailed records of the reason(s) for any and all delay(s).

Pursuant to GC 6.5 - Delays and Extension of Time, the Contractor may apply to Canada for an Extension of Time at any point in time before the date first fixed for completion of the Work (XX weeks from Contract Award). The preferred format for making an Extension of Time application is PWGSC-TPSGC Form 1801 – Extension of Time on Contracts, which can be found at: https://www.tpsgc-pwgsc.gc.ca/app-acq/forms/documents/1801.pdf

If such an application is received, Canada may grant an Extension of Time if Canada determines that causes beyond the control of the Contractor have delayed completion of the Work.

<need to add optional wording for how to deal with request for costs to be covered>

<Contractor Name> must promptly resume performance of the Work once it is possible to do so in compliance with all federal, provincial and municipal laws and regulations applicable to the performance of the Work, pursuant to GC 1.8 – Laws, permits and taxes.

Canada remains committed to its relationship with <Contractor Name> and looks forward to the eventual successful completion of the project.

Sincerely,

< Signature>

Site Closure from Building Owner, Landlord or other 3rd party (OGD)

https://gcdocs.gc.ca/tpsgc-pwgsc/llisapi.dll?func=ll&objaction=overview&objid=256106975

[Letter template to Contractor that has been denied access to their jobsite by a landlord, building owner, OGD]

[Insert Day, Month & Year] File: [Insert Project Number]

[Insert Contractor's Name]

[Insert Street & Suite]

[Insert City, Province & Postal Code]

Dear _____:

Subject: [Provide Project Title, Contract Name and Number] – Site Access Denied or Stop Work Order

I write today to acknowledge that Public Services & Procurement Canada (PSPC) has been advised by [Client Department Name] [Regulator's Name acting under Statute Name] that PSPC and our contractors have been denied access to [name the site/location/contract place of work]. PSPC is currently investigating the validity, nature and limits of this order and will work with its contractors to ensure the health and safety of stakeholders including building occupants, PSPC staff and contractors alike. We remain ready to work with you to implement necessary steps as required and will adhere to the request of the client or order of the regulator.

Upon PSPC' verification of the order, PSPC will issue Contract suspension orders in accordance with contract terms As a result of the denied access all relevant contractors will be ordered to suspend activity on site until advised otherwise.

While PSPC is not currently aware of any requests for compensation at the moment, we advise that it is highly probable that compensatory claims and applications for *Extension of Time* from one or more contractors will be forth coming Additionally, if the period of suspension of contract extends beyond 60 days, it is likely that some contractors may opt out of continuing their Contract, thus resulting in unfavorable financial and time impacts to the project.

The undersigned will make [Client Department Name] aware when it becomes aware of more relevant information and it looks forward to a rapid lifting of any denial of site access or stop work order.

Please let us know if you have any questions, concerns or wish to speak further on this matter.

Yours truly,

_____

[insert Departmental Representative's name]

Departmental Representative

c.c. Contracting Officer

PM Unit Manager

Claims Manager

Government Closure of Site

https://gcdocs.gc.ca/tpsgc-pwgsc/llisapi.dll?func=ll&objaction=overview&objid=256093632

[Insert Day, Month & Year] File: [Insert Project Number]

[Insert Contractor's Name]
[Insert Street & Suite]
[Insert City, Province & Postal Code]

Dear_____:

Subject: [Provide Project Title, Contract Name and Number] – Notice of Suspension
Pursuant to the terms of Contract and due to circumstances related to the current COVID-19 pandemic, Canada gives notice that the [all][part] of the Work of the subject contract is suspended from [insert date, month year] to [insert date, month year][an indefinite period until further Notice]. No part of the Work, Plant or materials will be removed from the place of the Work without the prior written consent of Canada.

Due to the nature of this matter, a copy of this letter will be forwarded to the contract Surety for their information.

Yours truly,

_____
[insert Departmental Representative's name]
Departmental Representative

c.c. Contracting Officer
PM Unit Manager
Claims Manager

6 Appendix C – Sample response to contractors regarding claims and extension of time

Legend
Text in blue = to be edited/deleted by the contracting officer
Text in fuchsia = Notes to the contracting officer (to be deleted)

<Insert personalized greeting>

Canada appreciates your efforts to ensure the health and safety of your workforce while also protecting the interests of the project throughout the COVID-19 pandemic.

It is also important for Canada and its Contractors to continue to keep construction projects on track. Without compromising the health and safety of workers, we expect <Contractor Name> to take all necessary measures to mitigate, as much as possible under the circumstances, delays and disruptions to the project. Additionally, as the Contractor in charge of the Work, the building site, the subcontractors and the property under your control, <Contractor Name> is responsible for mitigating losses and maintaining an efficient management of the costs, the delays and the next steps to ensure the delivery of the project.

Delays related to COVID-19

In relation to this situation, you may refer to GC6.5 – Delays and Extension of Time *<Optional Wording 1: Use the following wording only if the completion date hasn't already passed>* <,which may allow you to submit an application for an Extension of Time to complete the Work, subject to the approval of Canada. A form that may be used for this application is available at: https://www.tpsgc-pwgsc.gc.ca/app-acq/forms/documents/1801.pdf. However, please note that despite the existence of a section on the form that enables the person completing it to indicate "There will be additional costs as a result of this extension" (with "Yes" or "No" checkboxes), this should not be construed as an invitation to claim costs that are not otherwise payable by Canada under the Contract. Such application for an Extension of Time should contain sufficient details and comply with the general conditions of the Contract. Any cumulative delay prior to the situation caused by COVID-19, if any, will have to be the subject of a separate extension application. Please note that, in accordance with GC6.5 paragraph 2, the application must be accompanied by the written consent of the bonding company whose bond forms part of the Contract Security>.

Optional Wording 2: Use the following paragraph if the contractor is requesting costs related to COVID-19:

Costs related to COVID-19

- <We also understand that <Contractor Name> intends to request compensation under the Contract for expenses related to the COVID-19 pandemic. Please note that due to the unprecedented nature of the current situation, contractors may incur additional expenses as a direct result of the COVID -19 pandemic. In light of this, Canada will amend certain types of contracts to permit the payment of certain additional direct costs borne by the contractor in order to respond to the emergency orders

issued by the Health Authorities in the Province or Territory of work. The following items are eligible to be considered for a change order to the contract:

- *Additional Personal Protective Equipment supplied to workers, as ordered by Provincial/Territorial Health Officials, to safely carry out their duties.*
- *The provision of additional site trailers and comfort stations, and their respective cleaning and maintenance, as ordered by Provincial/Territorial Health Officials to allow for adequate social distancing and personal hygiene at the work site.*
- *The Labour, Plant, and Material associated with the Demobilization and Remobilization of the worksite due to compliance of Provincial construction shutdown and re-opening orders (This applies to Quebec and Ontario work sites affected by emergency orders enacted inarch and April 2020 respectively.).*
- *PSPC approved Material substitutions to account for supply chain limitations*
- *Premiums for alternate travel requirements to comply with Provincial /Territorial Authorities emergency requirements, including premiums for charter or direct flights, and allowances for the period of self-isolation for out of province workers to be eligible to begin working.*
- *Extensions for existing equipment rentals related to requests for Extension of Time.*
- *Additional Bonding and Insurance costs related to the Extension of Time. (Note: This is considered to be included as part of the Contractor's Allowance when changes are processed following GC 6.4.1)*
- *Additional direct supervision as ordered by Provincial/Territorial Health Authorities.*
- *Other reasonable direct costs as determined by Canada in its sole discretion incurred due to compliance with Provincial/Territorial Health Authorities direct emergency orders.*

<Contractor Name> is reminded to maintain detailed records of all expenses incurred, including those expenses incurred as a result of the COVID-19 pandemic, such as employee time sheets, paycheques, collective agreement rate tables, itemized invoices and proof of payments for subcontractors, as well as itemized receipts for materials, equipment/plant rentals and all other expenses. These records should clearly indicate the applicable dates and portion of the Work to which the expenses apply.>

Optional Wording 3: Use if following paragraph if Canada specifically required the Contractor to suspend performance of the Work

Costs Related to Suspension

<That said, in relation to the period that Canada required <Contractor Name> to suspend performance of the Work (from <date> to <date>), <Contractor Name> is entitled to be paid the extra costs that it necessarily incurred as a result of the Suspension of Work, determined in accordance with GC6.4 - Determination of Price. Please refer to GC6.4.2 - Price Determination Following Completion of Changes for a complete list of the costs that Canada will consider. >

Finally, if you have not done so already, you may wish to review your eligibility for Government of Canada and provincial relief programs, such as:

- Canada Emergency Wage Subsidy (CEWS), which covers up to 75% of employee wages for employers with large decreases in revenue;
- The Temporary 10% Wage Subsidy;
- Credit solutions under the Business Credit Availability Program (BCAP) or other programs; and
- Provincial relief measures.

We will keep you apprised of any new developments and remain available to discuss, should you have any questions. We look forward to continuing to work with <Contractor Name> towards the successful completion of the project.

Sincerely,

<Contracting Authority Signature Block>