Annex A. Remedial Action Plan

SNC-Lavalin Inc.
#301 - 3795 Carey Road
Victoria, British Columbia, Canada V8Z 6T8
250.385.5028 604.515.5150
snclavalin.com

July 8, 2021 Project: 626692

Public Services and Procurement Canada – Pacific Region
401 – 1230 Government Street
Victoria, BC V8W 3X4

ATTENTION: Robert Price

REFERENCE: **Remedial Action Plan – CFB Esquimalt NMC Bunker, Nanaimo, BC**
Project No. R.116936.001

Introduction

At the request of Public Services and Procurement Canada (PSPC) on behalf of the Department of National Defence (DND), SNC-Lavalin Inc. (SNC-Lavalin) has prepared this remedial action plan for implementation of the planned remediation at the Canadian Forces Base (CFB) Esquimalt Nanaimo Military Camp (NMC) Bunker (the "Site"), Nanaimo, BC.

A work plan and cost estimate was provided to PSPC in a letter dated June 10, 2021. This work was completed under PSPC Contaminated Sites Remediation Services Contract No. EZ897-192499/003/VAN (CTA) and Task Authorization No. 700592454. The site location and site plan are included as Drawings 626692-401 and 626692-402, respectively.

Background

In 2006, Hemmera completed a Phase I Environmental Site Assessment[1] (ESA) report for the Site which identified five areas of potential environmental concern (APECs) associated with the former bunker operations present on Site. Hemmera was provided Volume 1 and Volume 2 of the Nanaimo Decommissioning Report[2]. Note that Volume 2 of the report has not been provided to SNC-Lavalin for review; however, Hemmera reported Volume 2 information stating that the bunker is constructed with reinforced concrete and has a wall thickness of approximately 38 cm and a roof thickness of approximately 1.2 metres including 61 cm of reinforced concrete overlain by clay soil.

[1] Hemmera. *Phase I Environmental Site Assessment, Site Disposal Option Analysis, DND Bunker Site, Former Nanaimo, Military Camp Site, Nanaimo, BC – DRAFT*. March 2006.
[2] Defence Construction Canada – Environmental Services Division. *Nanaimo Bunker Decommissioning Volume 1: Project Report*, April 1999.

In 2015, SNC-Lavalin completed a Phase II ESA[3] to confirm or refute the presence of soil and/or groundwater contamination in the areas associated with the identified APECs. Soil and groundwater samples were analyzed for the associated regulated potential contaminants of concern (PCOCs) at all of the APECs. The federal agricultural land use (AL) guidelines were the primary criteria used to evaluate analytical results for soil and groundwater samples collected at the Site based on the agricultural zoning of the property. Analytical results identified concentrations of select petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs) and metals in soil and groundwater greater than the applicable guidelines associated with the former mechanical room, former fuel above ground storage tank (AST) and former electrical substation. As such, these three APECs were retained as areas of environmental concern (AECs) for the Site:

1: Mechanical Room;

2: Former Fuel Aboveground Storage Tank; and

3: Former Electrical Substation.

The Phase II ESA recommended additional soil and groundwater investigation to delineate the identified contaminants of concern (COCs). The concentrations of the remaining PCOCs in soil and groundwater analyzed in the remaining APECs were within the applicable standards/guidelines for the Site. The assessment of soil vapour was outside of the scope of work of the Phase II ESA.

A Decommissioning Cost Options Analysis[4] was prepared in 2018 detailing the estimated costs for three decommissioning options of the site bunker including a liability estimate associated with the identified soil and groundwater contamination. The two retained options were the complete removal of the bunker and the infilling of the bunker. During this program, samples of the exterior bunker roof and wall coating were collected for the confirmation of asbestos containing material (ACM). The sample representative of the roof coating was non-asbestos and the black wall coating was 5% chrysotile.

An updated National Contaminated Sites Classification System Scoring (NCSCS) was provided in a letter[5] dated March 29, 2019. It was understood that the future land use for the Site was to be Commercial Land use. Therefore, the NCSCS letter included a comparison of the historical analytical results to the federal guidelines based on Commercial Land Use. It is understood that the current land use for the Site is Industrial Land Use with the future land using being Residential.

[3] SNC-Lavalin Inc. *Phase II Environmental Site Assessment, Nanaimo Bunker and Former Military Camp, Nanaimo, BC*. March 31, 2015.
[4] SNC-Lavalin Inc. *DRAFT Nanaimo Bunker Decommissioning Costs Options Analysis, Former Military Camp, Nanaimo, BC*, March 7, 2018.
[5] SNC-Lavalin Inc. *National Contaminated Sites Classification System Scoring, Former Military Camp, Nanaimo, BC*, March 29, 2019.

In 2020 and 2021, SNC-Lavalin completed two Supplemental Site Investigations (SSI)[6,7] to delineate the previously identified PAHs, VOC and metals impacts in soil and groundwater which supported the completion of an updated remediation options analysis (ROA). No soil vapour exceedances of *Contaminated Sites Regulation*[8] (CSR) vapour standards were identified during the SSI.

Based on the information presented in this report, the following key conclusions can be derived with respect to the investigation completed at the Site:

- **AEC 1:** Soil and groundwater contamination has been delineated laterally and vertically except for delineation to the west, due to the presence of the bunker.
- **AEC 2 and AEC 3:** Soil contamination at these two AEC has been vertically and laterally delineated.
- **AEC 4**: Site-wide dissolved metals identified in groundwater were attributed to regional background concentrations; therefore, AEC 4 was not carried forward as a final AEC.

Based on a comparison to the current land use and federal guidelines and current results, the three identified AECs and associated COCs are summarized in the table below.

Table A: Summary of on-Site AECs and Regulated Analytical Parameters

AEC ID	Descriptions	COCs	
		Soil	Groundwater
1	Mechanical Room (decommissioned bunker)	E, X, NAP, PHE, IACR, TCE, Pb	E, NAP, PHE, ANT, FLU, PYR, B(a)A, B(a)P, c12-DCE, TCE
2	Former fuel AST	F2, NAP, PHE, IACR, Cu	-
3	Former electrical substation (3 transformers)	IACR	-

Notes:

AEC	Area of environmental concern		
COC	Contaminant of concern		
"-"	No COCs identified in the specified media/AEC		
E	Ethylbenzene	B(a)A	Benz(a)anthracene
X	Xylene	B(a)P	Benzo(a)pyrene
F2	Hydrocarbon fraction F2	IACR	Index of Additive Cancer Risk
NAP	Naphthalene	Cu	Copper
ANT	Anthracene	Pb	Lead
PHE	Phenanthrene	c12-DCE	Dichloroethylene 1,2 - cis
FLU	Fluoranthene	TCE	Trichloroethylene
PYR	Pyrene		

[6] SNC-Lavalin Inc. *Supplemental Site Investigation and Remedial Options Analysis, Nanaimo Military Camp Bunker, BC*, March 31, 2020.
[7] SNC-Lavalin Inc. *Supplemental Site Investigation and Remedial Options Analysis, Nanaimo Military Camp Bunker, BC*, March 31, 2021.
[8] *Contaminated Sites Regulation* (CSR), B.C. Reg. 375/96, including amendments up to B.C. Reg. 161/2020, February 1, 2021.

Soil vapour sampling at the Site was completed in December 2020 and March 2021 with measured concentrations and estimations of outdoor and indoor air concentrations all reported to be less than the applicable CSR vapour standards.

Purpose

The goal of remediation at the Site is to reduce future liability related to environmental conditions and support future divestment of the property. A remedial excavation of the contaminated soils identified in the 2021 SSI will be completed with the aim to achieve confirmatory results that satisfy the appropriate federal guidelines for the Site.

Regulatory Framework

The concentrations of the COCs in the collected confirmatory soil samples will be compared to both federal guidelines and provincial standards as follows:

- *Canadian Environmental Quality Guidelines* (CEQG), Canadian Council of Ministers of the Environment (CCME), Winnipeg, MB, including updates to 2020.
- *Canada Wide Standards for Petroleum Hydrocarbons in Soil* (CWS), Canadian Council of Ministers of the Environment (CCME), Winnipeg, MB, January 2008.
- *Contaminated Sites Regulation* (CSR), B.C. Reg. 375/96, includes amendments up to B.C. Reg. 131/2020, February 1, 2021; and
- *Hazardous Waste Regulation* (HWR), B.C. Reg. 63/88, including amendments up to B.C. Reg. 243/2016, November 1, 2017.

The Site is located on federal property and is operated under federal jurisdiction. The overall land use of the Site is considered to be industrial with Industrial Land Use (IL) guidelines being the primary criteria used to evaluate analytical results for soil collected at the Site. Analytical results will also be compared to the federal Residential Land Use (RL) and provincial CSR Residential Low Density (RLLD) and IL standards, for comparison purposes.

The federal guidelines include:

- CEQG IL soil quality guidelines.
- CWS IL soil quality guidelines.

The CCME CEQG guidelines were used to evaluate analytical results for specific parameters analyzed in soil samples collected from the Site. The CCME CWS were used to assess gross petroleum hydrocarbon concentrations in analyzed samples. As a conservative estimate, concentrations of hydrocarbon parameters for surface and subsurface soil have been compared to the most stringent of the coarse-grained and fine-grained CWS standards and CEQG guidelines.

Soil guidelines are protective of potable water, human soil ingestion, ecological soil contact, ecological soil and food ingestion, nutrient and energy cycling, and freshwater aquatic life. There is one drinking

water well within 1 km of the Site. In addition, the Colliery Dam Park Reservoir is located approximately 100 m south of the Site boundaries, and the Chase River is connected to that system. As such, the site-specific exposure pathways for the protection of potable water and freshwater aquatic life are considered to be applicable to the Site.

Concentrations of PAHs in soil samples were compared to the CCME CEQG IL guidelines and take into account the protection of both human and environmental health. The carcinogenic effects and the non-carcinogenic effect on human health are calculated based on the CCME Fact Sheet "Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health", 2010 and are included in the summary analytical tables. The soil quality guidelines (SQG) for the protection of environmental health are used for comparison of concentrations of individual PAHs.

Site Details

Site Characteristics

The Site is bounded by the Nanaimo Parkway to the west, Nanaimo Lakes Road to the south and the former Nanaimo Military Camp (NMC) to the north and east. Site access is through the entrance on the south side of the Site along Nanaimo Lakes Road as presented on Drawing 626692-403.

The bunker is located on the western side of the Site. Key characteristics of the bunker are provided below.

- Decommissioning was completed in 1997 including the removal of all equipment from within the bunker, all roof-top structures, cutting and capping of all service lines and infilling of the entrances.
- Area of the bunker is 5,690 m^2 over two floors.
- ACM (wallboards, tiles and pipe laggings) and lead based paint is present within the bunker[9].
- ACM was identified on the exterior wall coating material.

Site Stratigraphy

The stratigraphy at the Site consists of a fill layer present along the east side of the bunker to a depth of 6.1 m below ground surface at BMW15-02 and underlain by dense silt and/or sand layers with varying amounts of gravels encountered up to a depth of 9.1 m bgs. Metal and wood debris were identified at the base of this fill layer. Elsewhere on Site, shallow fill to a depth up to 2.1 m bgs was identified.

[9] Defence Construction Canada. *Nanaimo Bunker Decommissioning, Volume 1: Project Report,* April 1999.

Hydrogeology

The depth to groundwater at the Site varies seasonally at the Site as presented in the table below for the proposed excavation areas.

Table B: Groundwater Depths Within Excavation Areas

Excavation	Depth of Excavation	Depth to Groundwater (m bgs)	
		Maximum	Minimum
1A	6.4 m at MW15-02	6.04 (Sep. 2020)	5.17 (Feb. 2020)
1B	3.5 m at MW20-08	3.00 (Sep. 2020)	Surface (Nov. 2020)
2	2 m at MW15-06	1.24 (Sep. 2020)	0.93 (Nov. 2020)
3	2 m at MW15-04	1.14 (Sep. 2020)	0.29 (Nov. 2020)

Summary of Contaminated Areas

Based on previous investigations, the estimated areas and volumes of contaminated soils is summarized in the following table with the extents presented on Drawing 626692-403. At Excavation 1A, there is a slope angled up to the west towards the top of the bunker. Monitoring well MW15-02 is installed approximately one third up the slope. From surface to 3.0 m bgs at MW15-02, the material is considered suspect quality overburden. This material is to be stockpiled to allow for further characterization prior to reuse as backfill or for disposal off site.

Table C: Contaminated Areas Summary

Excavation	Depth of Excavation			Area of Excavation (m^2)	Volume of Excavation		
	Suspect Quality Overburden (m)	Contaminated Soil > CSR IL (m)	Contaminated Soil > CCME IL (m)		Suspect Quality Overburden (m^3)	Contaminated Soil > CCME IL (m^3)	Contaminated Soil > CSR IL (m^3)
1A	0 m to 3.0 m at MW15-02	3.0 to 5.0 m at MW15-02	5.0 m to 6.4 m at MW15-02	775	2,325	1,000	1,500
1B	N/A	3.5 m	N/A	150	N/A	400	N/A
2	N/A	2 m	N/A	100	N/A	150	N/A
3	N/A	2 m	N/A	100	N/A	150	N/A
Total					2,325	1,700	1,500

It is assumed that the excavations will be sloped at 1:1 with the following exceptions:

- Excavation 1A: West side is to be vertical along the side of the bunker.
- Excavation 1B: East and west sides to be near vertical along the property line and the base of the slope, respectively.

Technical Constraints

Overall, the contamination in the soil is accessible for removal. Excavation 1A is adjacent to the bunker with ACM material present along the exterior of the bunker. In addition, there is an upward slope of approximately 4:1 at this excavation area. The depth of excavation is based on the surface grade at MW15-02 which is located approximately 2 m west of the base of the slope.

For Excavation 1B, near vertical slopes will be required on the west and east sides. As a result, backfilling immediately after excavation and / or the use of slot cuts may be necessary. A geotechnical engineer, provided by the contractor, will be required to provide input into the vertical excavation walls near the property line and the bunker.

The groundwater table is variable across the Site and fluctuates seasonally. Therefore, dewatering during the excavations may be necessary.

It should be noted that the planned excavation limits may not result in clean confirmatory soil results resulting in the possibility of additional excavation being required to achieve clean limits. The requirement for additional excavation will be dependant on the confirmatory soil sample results.

Remediation Action Plan

The remediation will involve the excavation of contaminated soil for transport and disposal at an approved facility.

Environmental Assessment

As part of PSPC's due diligence during construction phase of the project, an Environmental Impact Assessment was completed using the Maritime Forces Pacific (MARPAC) Annex DE1A evaluation form, meeting the requirements of the Canadian Impact Assessment Act (IAA). The DE1A form includes the following:

- Summary of the project physical activities associated with the work;
- Summary of the environmental settings and any features that are within and adjacent to the project / physical activity footprint;
- Checklist of project/physical activities compared to IAA requirements associated with activities;
- Review of applicability of the abbreviate report criteria (ARC);
- Review of standard mitigation measures for routine activities/effects;
- Evaluation of physical activity checklist; and
- Summary of environmental impact assessment evaluation results.

The results of the Annex DE1A evaluation form confirms that completion of an Environmental Effects Determination is not required for the project.

Archaeological Program

The presence of archaeological significant artifacts are possible in areas of native soil at the Site. A risk risk-management strategy for the project with limited First Nation consultation will be prepared. Archaeological awareness training will be required for contractors and consultants working at the Site.

Confirmation of Site Requirements

Confirmation of Site requirements applicable to the remedial works will be completed prior to start of work. These requirements include (but are not limited to) the following:

- Timing requirements for work;
- Access to and use for staging on the NMC;
- Review of regulatory approvals;
- Geotechnical requirements, including sloping and backfilling;
- Site restoration design; and
- Site protection requirements.

Preparation of Tender Documents

This includes preparation of work scope, specifications, restrictions, and limitations to provide to prospective contractors as needed so they can submit a sound bid. Preparation of tender documents is anticipated to be completed in July 2021.

Contractor Selection

This will include meeting with prospective contractors at the Site to confirm expectations and constraints, reviewing submitted contractor bids, and negotiating mutually agreeable work budgets, scopes and schedules. Contractor selection is anticipated to be in mid to end of August 2021.

Health and Safety and Site Expectations

This includes identification of Prime Contractor, preparation of health and safety plans, confirmation of communication hierarchies, and a kick-off meeting to confirm scope of work, Site rules and expectations. This task is anticipated to occur at the beginning of October 2021, prior to start of construction works.

Site Preparation

It is anticipated that the contractor will mobilize to the Site in late September 2021. Site preparation includes site activities conducted prior to the start of excavation work to ensure the work will proceed smoothly, including (but not limited to) the following:

- Utility locates and any required protection, re-routing or removal of utilities prior to ground disturbance;
- Detailed survey of pre-project area conditions;
- Preparation of spaces for Site support, such as office trailers, portable washrooms, lay-down areas, worker parking, and equipment refueling;
- Set up temporary fencing around work Site;
- Initiation of erosion and sediment control measures;
- Preparation of soil staging area;
- Deployment of water treatment system, if necessary;
- Identification and implementation of on- and off-site traffic control requirements;
- Identification and implementation of Site security requirements; and
- Development of a quality assurance plan for all construction tasks.

Excavation and Restoration

Excavation Approach

The excavation sequence should be designed to allow for multiple tasks to be completed at the same time, where possible, and to limit the exposure of excavation equipment to contaminated media. Sequencing will be at the discretion of the contractor. It is recommended that Excavation 1A be conducted first to ensure the highest risk areas are removed and allow for characterization of the suspect quality overburden including topsoil. The Contractor will be responsible for the survey to confirm that the depths / extent of excavation have reached the prescribed limits.

All contaminated soil removed within the specified extents will be either hot-loaded or stockpiled without further characterization for subsequent transport to the off-site facility. The exception to this is the suspect quality material at Excavation 1A which requires characterization prior to off-site disposal or reuse on Site.

Environmental Monitoring

An environmental consultant will provide environmental monitoring during all Site activities to ensure compliance with the IAA. An Environmental Protection Plan (EPP) will be developed by the Contractor that addresses potential sources of environmental impacts due to construction work and identifies standard work practices and Site-specific mitigation practices to address and minimize these impacts. The EPP should include a detailed plan for spill response and other plans or mitigation measures recommended in the EED report. Environmental monitoring will be conducted to ensure compliance with the contractor's EPP.

The remediation contractor will keep all traffic routes outside the Site clean (e.g., through the use of a street sweeper or other approved means). Debris generated during cleaning activities will be placed into the stockpile area (if present).

Due to its proximity to surface waters, effective erosion and sediment control will be paramount. Runoff water may be collected and stored on Site for testing prior to release or disposal.

Excavation Sampling

An environmental consultant will be on Site for the duration of the remedial excavation to observe and record remedial activities. Final remediation limits at the bottom of each excavation will be confirmed by sampling on a grid of approximately 10 m. Samples in excavation walls will be collected on a horizontal grid of 10 m and 1 m vertically from a depth consistent with the removed zone of contamination. The environmental consultant will survey sample locations using appropriate survey gear (e.g., total station or Trimble GPS) or hand measurements.

The surficial soil from Excavation 1A is not considered to be sufficiently characterized. Therefore, this soil should be stockpiled on Site (or in a designated stockpile area adjacent to the Site) and tested prior to treatment or disposal. Excavated material to be further characterized should be stockpiled into 250 m^3 stockpiles of material suspected to be of consistent quality. The environmental consultant will investigate the quality of stockpiles material and provide a summary to the remediation contractor in support of treatment or disposal requirements. Stockpiles for disposal will be addressed in a stepwise manner as follows:

- Stockpiles will be managed and samples collected and analyzed in conformance with the B.C. Ministry of Environment and Climate Change Strategy (ENV) Technical Guidance 1[10] (TG1).
- Analytical results will first be compared to CCME IL guidelines for possible re-use on the Site if less than the standards.
- If analytical results are greater than CCME IL guidelines, then the samples will be compared to the ENV CSR standards for possible subsequent disposal.

Structures and Utilities

It is assumed that sub-grade utilities, if present in excavation areas, will be cut-off, removed, and/or re-routed prior to commencement of ground disturbance activities.

Water Management

Groundwater monitoring wells on Site suggest that water is likely to be present within the excavations, especially if the work is conducted during the wet season. Water in the excavation should be pumped through a treatment system designed for VOC/PHC and into aboveground tanks and sampled for COCs and other constituents, as required, prior to discharge or disposal. An in-flow meter or other approved method would be required to track the volume of discharge water.

Backfilling

Following completion of remedial excavation activities in each area, the excavations will be backfilled with geotechnically suitable material and compacted. Backfill material must be shown to meet CCME Agricultural Guidelines. Crushed gravel must also be shown to meet acid rock drainage requirements. Prior to import

[10] BC Ministry of Environment and Climate Change Strategy, *Technical Guidance Document 1: Site Characterization and Confirmation Testing,* January 2009.

and placement, demonstration of compliance to these guidelines will be required from the Contractor for all material supplied for backfill.

Surface Restoration

Restoration of the Site will be to pre-excavation conditions, or as directed by PSPC in a Restoration Plan.

At the conclusion of the remedial activities, at a minimum the remediation contractor will:

- Restore the Site to meet general pre-excavation conditions.
- Clean all work areas to the satisfaction of PSPC.
- Remove all environmental controls (e.g., erosion and sediment controls).
- Complete an as-built survey following Site restoration including (but not limited to) final Site grade.
- Within 10 working days of the completion of the remedial activities, request a closeout meeting.

Environmental Controls

Environmental controls will be required during all Site activities, including:

- Minimization of air emissions;
- Protection of surface water quality; and
- Minimization of health and safety risks.

The contractor will be required to prepare and submit an Environmental Protection Plan (EPP) that outlines the measures to be taken to prevent impacts to the environment and human health and safety. The EMP will be required to consider the health and safety of the surrounding community during the construction programs. The EPP will incorporate the PSPC Risk Management Form. As a due diligence control, documentation under the IAA will be completed prior to start of remedial construction.

The Site is located in an area where it is accessible by the surrounding community and other members of the public. It is expected that as part of the EPP and Health and Safety Plan (HASP), security control measures based on the tender specification requirements will be outlined, including fencing and public Site access constraints. Public consultation will be conducted under the direction of PSPC, as required, prior to start of construction work (e.g., archaeological assessment; environmental conditions such as dust and odour).

Emergency Spill Response

The construction contractor will prepare an Emergency Spill Prevention and Response Plan as an adjunct to the EPP. The plan should include the following:

- Identification of potentially hazardous materials in use on the Site;
- Material Safety Data Sheet for hazardous materials;
- Measures to mitigate the release of hazardous materials to the environment;
- Communication hierarchy for reporting of hazardous material releases; and
- Response measures to remove or contain the hazardous materials upon release.

Notice to Reader

This report has been prepared by SNC-Lavalin Inc. (SNC-Lavalin) for Canada, who has been party to the development of the scope of work for this project and understands its limitations[11]. Copyright of this report vests with Her Majesty the Queen in Right of Canada. This report was prepared in accordance with a services contract between SNC-Lavalin and Canada, including General Conditions 2035 of the Standard Acquisition Clauses and Conditions (SACC) Manual.

This report is intended to provide information to Canada to assist it in making business decisions. SNC-Lavalin is not a party to the various considerations underlying the business decisions, and does not make recommendations regarding such business decisions.

The findings, conclusions and recommendations in this report have been developed in a manner consistent with the level of skill normally exercised by environmental professionals currently practising under similar conditions in the area. The findings contained in this report are based, in part, upon information provided by others. If any of the information is inaccurate, modifications to the findings, conclusions and recommendations may be necessary.

The findings, conclusions and recommendations presented by SNC-Lavalin in this report reflect SNC-Lavalin's best judgement based on the site conditions at the time of the site inspection on the date(s) set out in this report and on information available at the time of preparation of this report. They have been prepared for specific application to this site and are based, in part, upon visual observation of the site, subsurface investigation at discrete locations and depths, and specific analysis of specific materials as described in this report during a specific time interval. Substances other than those described may exist within the site, reported substance parameters may exist in areas of the site not investigated, and concentrations of substances greater or less than those reported may exist between sample locations.

The findings and conclusions of this report are valid only as of the date of this report. If site conditions change, new information is discovered, or unexpected site conditions are encountered in future work, including excavations, borings, or other studies, the findings, conclusions and/or recommendations of this report should be re-evaluated. It is recommended that users of this report should engage a suitably qualified professional to assist in interpreting the significance, if any, of the findings.

[11] © Her Majesty the Queen in Right of Canada (2021).

Closure

We trust this information is satisfactory for your present needs. Please call the undersigned if you require additional information.

Ian Mace, MEng, P.Eng.
Senior Project Manager
Environment
Engineering, Design & Project Management

Doug McMillan, MSc, P.Ag.
Operations Manager / Senior Project Manager
Environment
Engineering, Design & Project Management

IM/rb
P:\CP\PWGSC\626692 - BUNKER SITE\5.0 DEL\5.5 OTHER\20210708_626692_LTR_BUNKER_RAP_FINAL.DOCX
enc.

Drawings

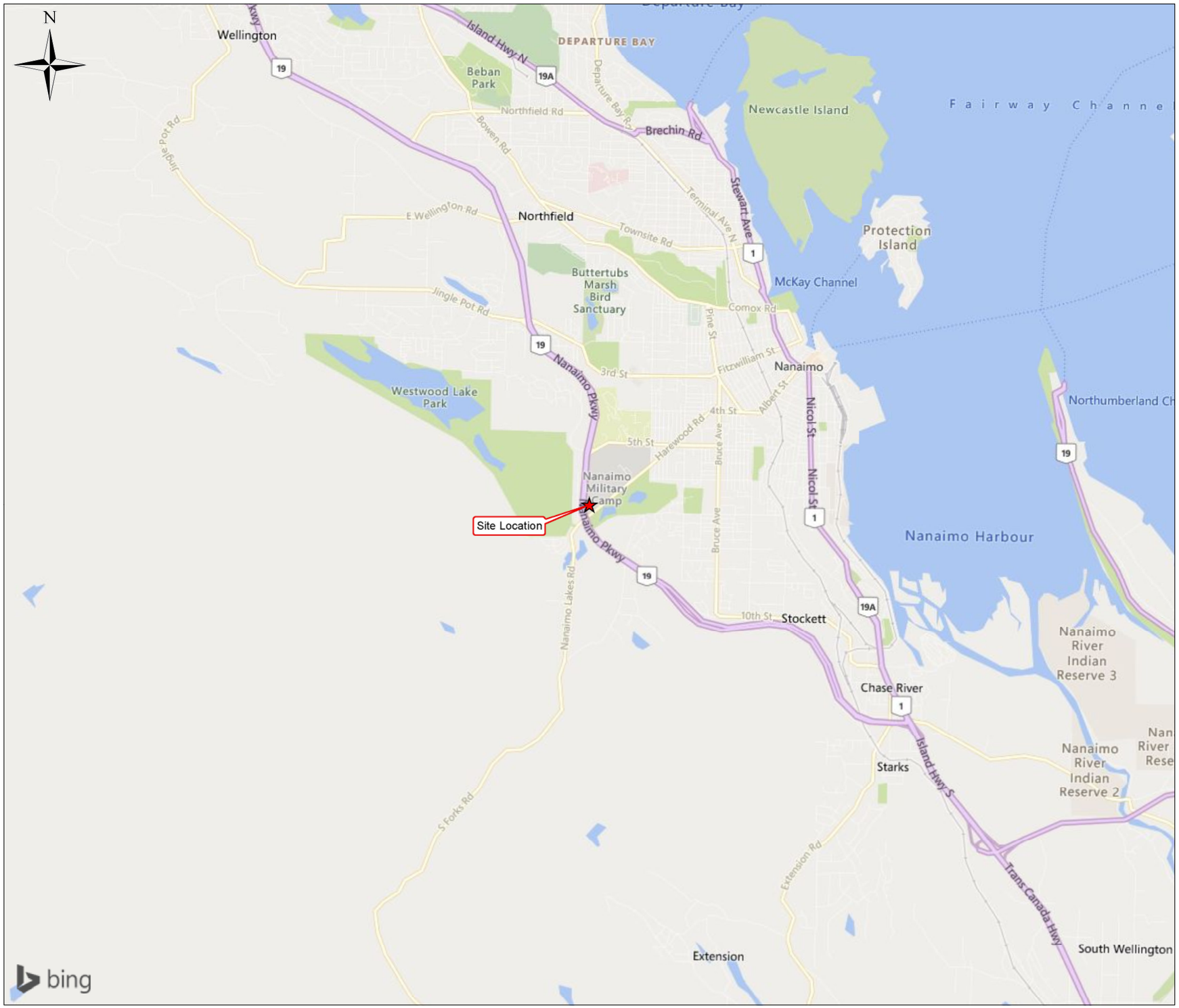
- 626692-401 Location Plan
- 626692-402 Site Plan
- 626692-403 Site Layout
- 626692-404 Proposed Extents of Remedial Excavation

Attachment

1: Photo Log

Drawings

- 626692-401 Location Plan
- 626692-402 Site Plan
- 626692-403 Site Layout
- 626692-404 Proposed Extents of Remedial Excavation



LEGEND

★ Site Location

NOTES

1. Original in colour.
2. Numerical scale reflects full-size print. Print scaling will distort this scale, however scale bar will remain accurate.
3. Intended for illustration purposes, accuracy has not been verified for construction or navigation purposes.

REFERENCES

0-

0 0.5 1 2 3 Kilometers

SNC·LAVALIN

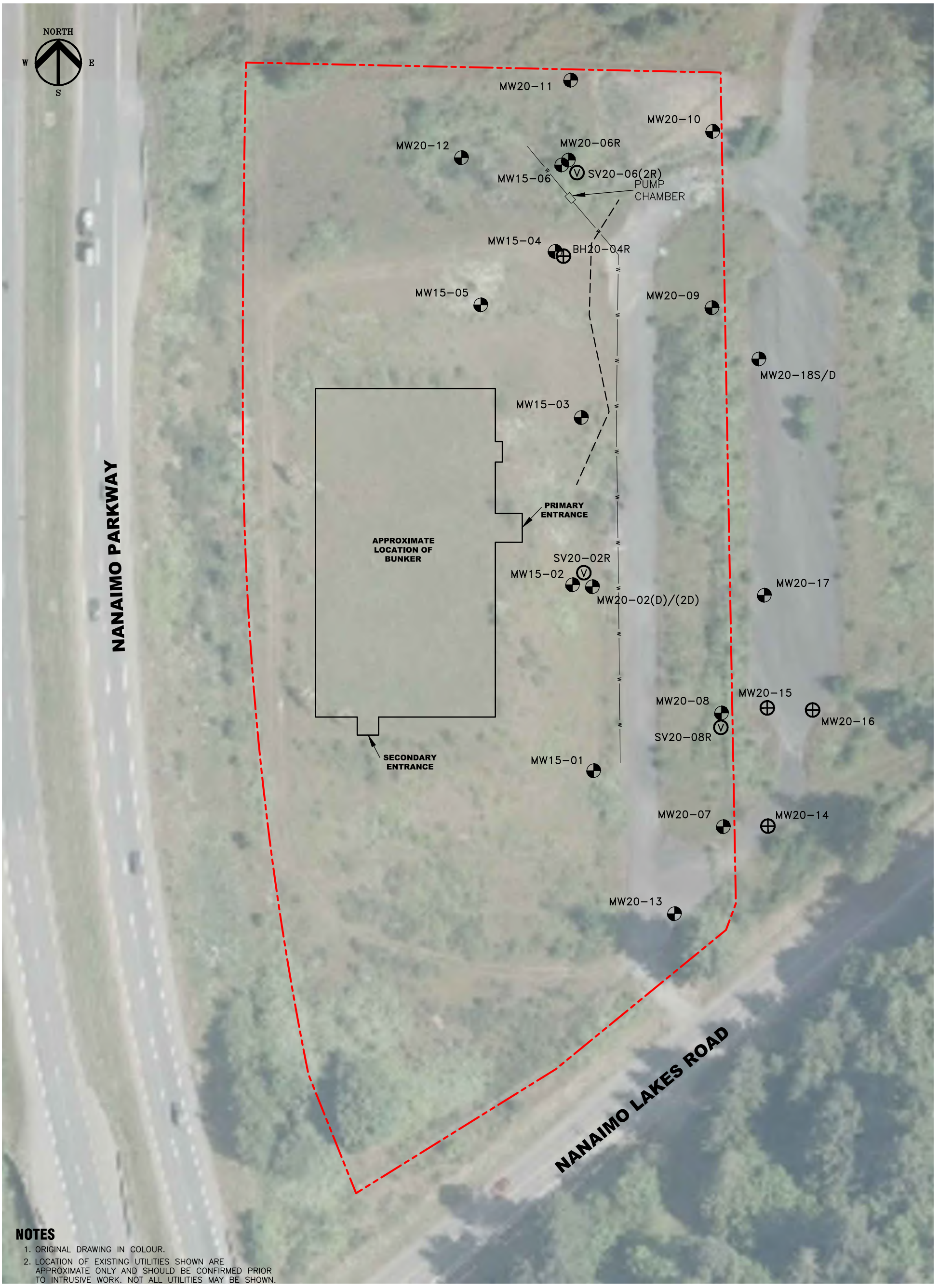
CLIENT NAME:	PROJECT LOCATION:
Public Services and Procurement Canada	Nanaimo Bunker, Nanaimo, B.C.

Location Plan

BY:	SCALE:	DATE:	REF No:	REV:
AM	1:50,000	2021-06-18	626692-401	0
CHK'D: DG	PROJ COORD SYS: NAD 1983 UTM Zone 10N			

P:\Current Projects\PWGSC\626692 - Bunker Site\4.0 Execution\4.5 GIS and Drawings\GIS\MapSeries\626692-201 Loc Plan.mxd

P:\Current Projects\Spectra Energy\508272_Hixon\Geomatics\Map Series\626692-201 Loc Plan.pdf



NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. LOCATION OF EXISTING UTILITIES SHOWN ARE APPROXIMATE ONLY AND SHOULD BE CONFIRMED PRIOR TO INTRUSIVE WORK. NOT ALL UTILITIES MAY BE SHOWN.

LEGEND

0 10 30 METRES

- SUBJECT PROPERTY LIMITS
- SITE FEATURES
- w WATER LINE
- COMMUNICATION LINE
- BOREHOLE
- MONITORING WELL
- VAPOUR WELL

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	Feb 1978	NANAIMO BUNKER 2nd FLOOR PLAN

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
1	2021–07–09	ISSUED TO CLIENT	PRT	DM
0	2021–06–29	ISSUED AS DRAFT	PRT	IM

SNC·LAVALIN

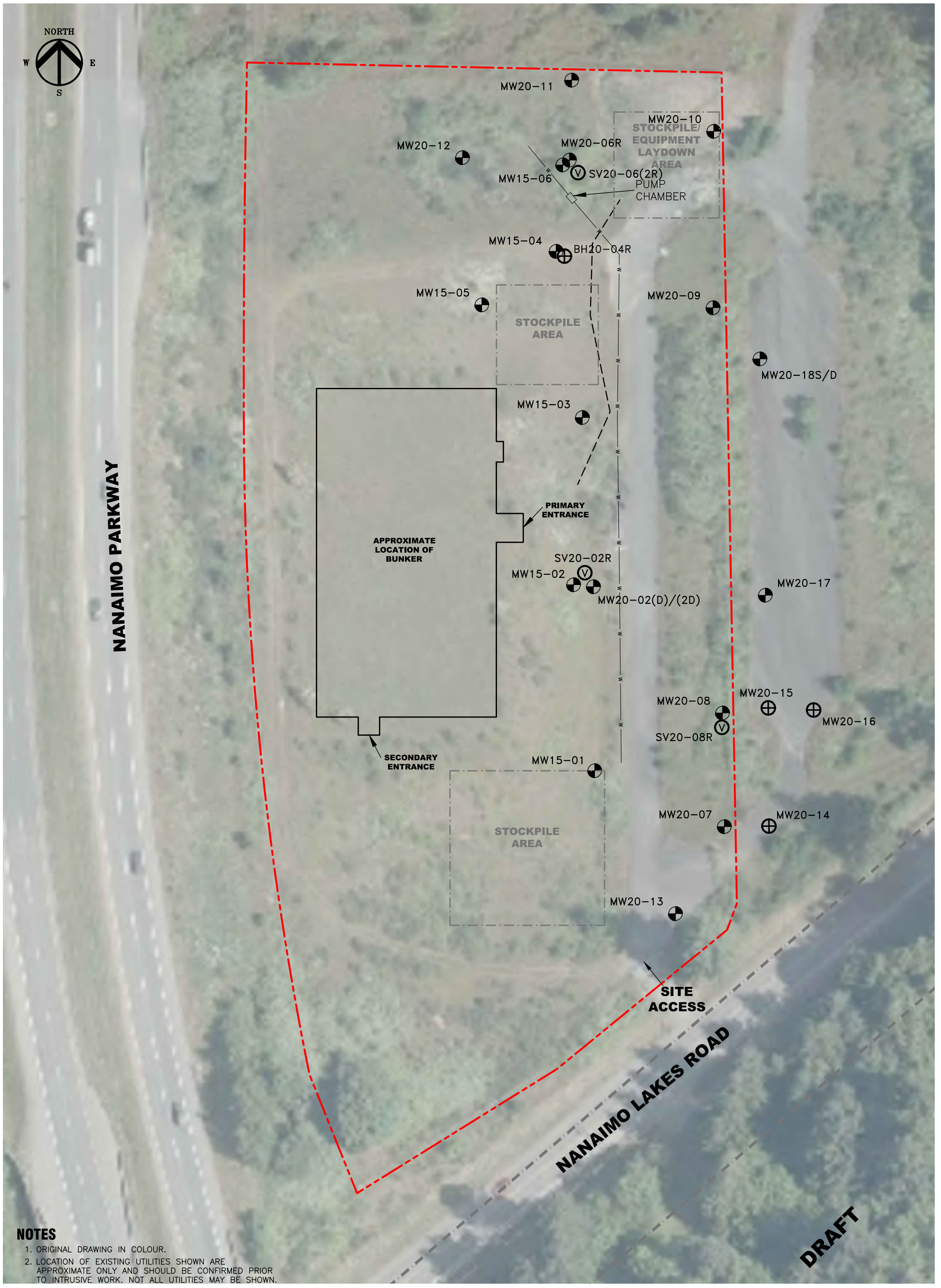
CLIENT NAME: PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT LOCATION: NANAIMO BUNKER, NANAIMO, B.C.

TITLE: **SITE PLAN**

DWN BY: PRT	SCALE: 1:750	DATE: 2021–06–17	DWG No: REV.: 1
CHK'D: IM	PLOT: 20210709.1321	CADFILE: 626692R08	**626692-402**

PATH: \\SLI2606\PROJECTS\CURRENT PROJECTS\PWGSC\626692 – BUNKER SITE\4.0 EXECUTION\4.5 GIS AND DRAWINGS\CAD\626692R08.DWG



NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. LOCATION OF EXISTING UTILITIES SHOWN ARE APPROXIMATE ONLY AND SHOULD BE CONFIRMED PRIOR TO INTRUSIVE WORK. NOT ALL UTILITIES MAY BE SHOWN.

LEGEND

0 10 30 METRES

- SUBJECT PROPERTY LIMITS
- SITE FEATURES
- w WATER LINE
- COMMUNICATION LINE
- BOREHOLE
- MONITORING WELL
- VAPOUR WELL

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	Feb 1978	NANAIMO BUNKER 2nd FLOOR PLAN

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
1	2021–07–09	ISSUED TO CLIENT	PRT	DM
0	2021–06–29	ISSUED AS DRAFT	PRT	IM

SNC·LAVALIN

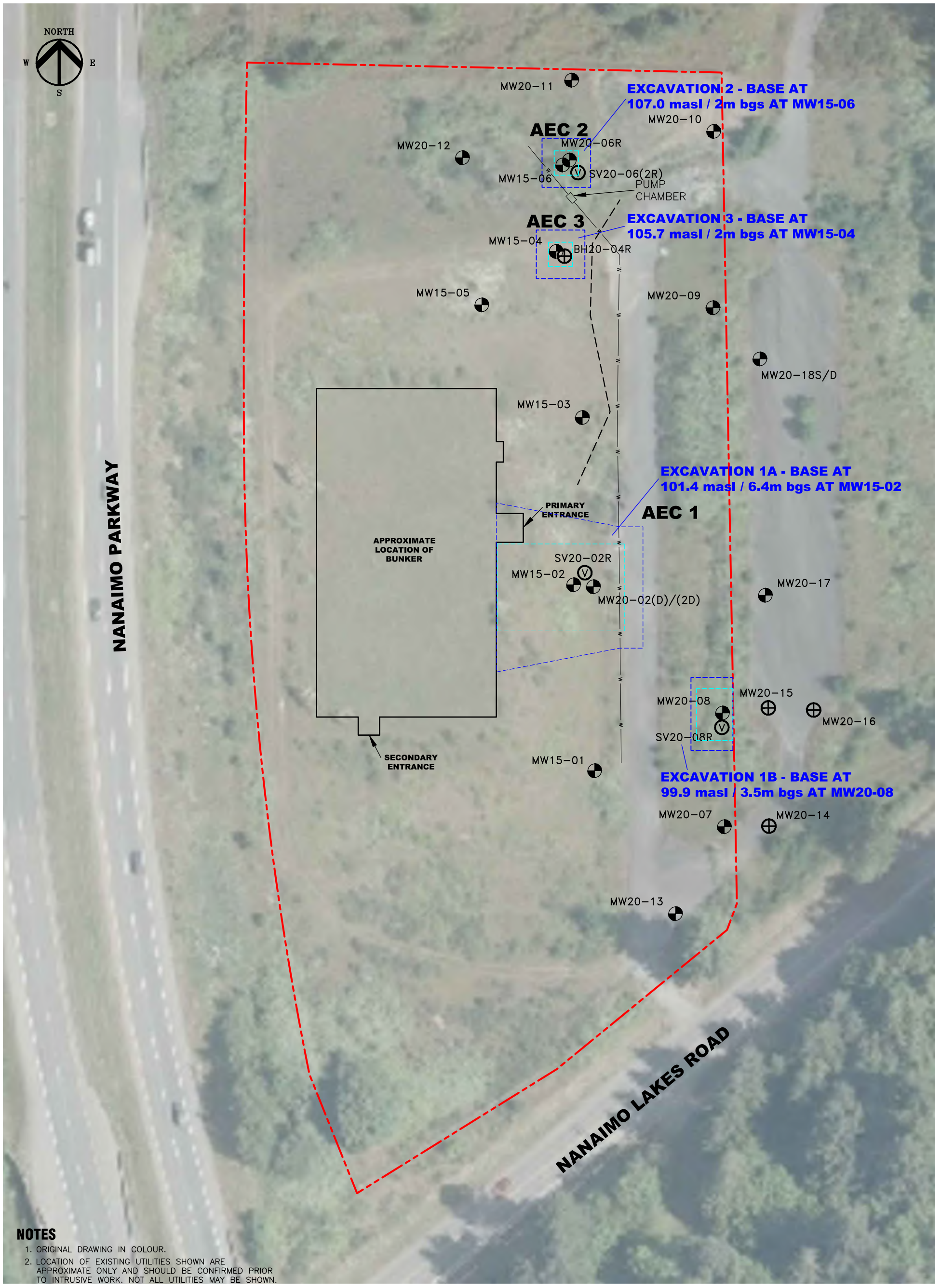
CLIENT NAME: PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT LOCATION: NANAIMO BUNKER, NANAIMO, B.C.

TITLE: **SITE LAYOUT**

DWN BY: PRT	SCALE: 1:750	DATE: 2021–06–17	DWG No: REV.: 1
CHK'D: IM	PLOT: 20210709.1321	CADFILE: 626692R08	626692-403

PATH: \\SLI2606\PROJECTS\CURRENT PROJECTS\PWGSC\626692 – BUNKER SITE\4.0 EXECUTION\4.5 GIS AND DRAWINGS\CAD\626692R08.DWG



NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. LOCATION OF EXISTING UTILITIES SHOWN ARE APPROXIMATE ONLY AND SHOULD BE CONFIRMED PRIOR TO INTRUSIVE WORK. NOT ALL UTILITIES MAY BE SHOWN.

LEGEND

0 10 30 METRES

- SUBJECT PROPERTY LIMITS
- SITE FEATURES
- w WATER LINE
- COMMUNICATION LINE
- BOREHOLE
- MONITORING WELL
- APPROXIMATE TOP OF LIMITS OF EXCAVATION
- APPROXIMATE BASE OF EXCAVATION

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	Feb 1978	NANAIMO BUNKER 2nd FLOOR PLAN

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
1	2021–07–09	ISSUED TO CLIENT	PRT	DM
0	2021–06–29	ISSUED AS DRAFT	PRT	IM

SNC·LAVALIN

CLIENT NAME: PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT LOCATION: NANAIMO BUNKER, NANAIMO, B.C.

TITLE:

PROPOSED EXTENT OF REMEDIAL EXCAVATIONS

DWN BY: PRT	SCALE: 1:750	DATE: 2021–06–17	DWG No:	REV.: 1
CHK'D: IM	PLOT: 20210709.1322	CADFILE: 626692R08	626692-404	

PATH: \\SLI2606\PROJECTS\CURRENT PROJECTS\PWGSC\626692 – BUNKER SITE\4.0 EXECUTION\4.5 GIS AND DRAWINGS\CAD\626692R08.DWG

Attachment 1

Photo Log

Photograph 1: Access from Nanaimo Lakes Road, facing north.

Photograph 2: Potential stockpile area south of bunker, facing west.

Photograph 3: Excavation 1a, facing southwest.

Photograph 4: Excavation 1a, facing south.

Photograph 5: Excavation 1b, facing east down the slope with fenceline beyond the monitoring well.

Photograph 6: View of road on east side of the Site, facing north.

Photograph 7: View of Excavation 3, facing northwest.

Photograph 8: View of Excavation 2 area, facing southeast.

Annex B. Site Photographs

Photograph 1: Access from Nanaimo Lakes Road, facing north.

Photograph 2: Potential stockpile area south of bunker, facing west.

Photograph 3: Excavation 1a, facing southwest.

Photograph 4: Excavation 1a, facing south.

Photograph 5: Excavation 1b, facing east down the slope with fenceline beyond the monitoring well.

Photograph 6: View of road on east side of the Site, facing north.

Photograph 7: View of Excavation 3, facing northwest.

Photograph 8: View of Excavation 2 area, facing southeast.

Annex C. Environmental Data

- Soil Analytical Data
- Groundwater Analytical Data

TABLE 1: Summary of Analytical Results for Soil - Hydrocarbons

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Depth Interval (m)	Field Screen[a] (ppm)	Monocyclic Aromatic Hydrocarbons					Gross Parameters			Petroleum Hydrocarbon Fractions				Methyl Tert-butyl Ether [MTBE] µg/g
					Benzene µg/g	Ethylbenzene µg/g	Toluene µg/g	Xylenes µg/g	Styrene µg/g	VPHs µg/g	LEPHs[d] µg/g	HEPHs[d] µg/g	F1-BTEX µg/g	F2 (>C10-C16) µg/g	F3 (>C16-C34) µg/g	F4 (>C34-C50) µg/g	
BH15-01	BH15-01-02	2015 03 02	0.6 - 0.8	10	-	-	-	-	-	-	< 20	< 20	-	< 20	< 20	< 20	-
	BH15-01-04	2015 03 02	2.0 - 2.3	0	-	-	-	-	-	-	< 20	< 20	-	< 20	< 20	< 20	-
	BH15-01-07	2015 03 02	4.3 - 4.6	10	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	< 0.1
	BH15-01-10	2015 03 02	5.9 - 6.1	0	-	-	-	-	-	-	< 20	< 20	-	< 20	< 20	< 20	-
BH15-02	BH15-02-02	2015 03 02	0.8 - 0.9	0	-	-	-	-	-	-	< 20	< 20	-	< 20	< 20	< 20	-
	BH15-02-07	2015 03 02	4.3 - 4.6	10	-	-	-	-	-	-	< 20	< 20	-	< 20	< 20	< 20	-
	BH15-02-08	Duplicate	4.3 - 4.6	10	-	-	-	-	-	-	< 20	< 20	-	< 20	< 20	< 20	-
	QA/QC RPD%				-	-	-	-	-	-	*	*	-	*	*	*	-
	BH15-02-09	2015 03 02	5.0 - 5.3	0	-	-	-	-	-	-	< 20	< 20	-	< 20	< 20	< 20	-
	BH15-02-10	2015 03 02	5.6 - 5.9	65	< 0.005	***0.39***	< 0.05	***2.53***	< 0.05	14	< 20	123	< 10	< 20	112	21	< 0.1
	BH15-02-12	2015 03 02	6.4 - 6.7	10	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	< 0.1
BH20-02D	BH20-02D-06	2020 02 27	3.2 - 3.4	140	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
	BH20-02D-10	2020 02 27	6.4 - 6.5	30	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
	BH20-02D-12	2020 02 27	7.9 - 8.1	630	< 0.005	< 0.01	< 0.05	< 0.05	-	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
BH15-03	BH15-03-02	2015 03 02	0.6 - 0.8	5	-	-	-	-	-	-	< 20	< 20	-	< 20	< 20	< 20	-
	BH15-03-05	2015 03 02	2.9 - 3.0	15	-	-	-	-	-	-	< 20	86	-	< 20	91	33	-
	BH15-03-06	2015 03 02	3.7 - 3.8	0	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	< 0.1
	BH15-03-09	2015 03 02	5.2 - 5.3	5	-	-	-	-	-	-	< 20	< 20	-	< 20	< 20	< 20	-
BH15-04	BH15-04-01	2015 03 02	0.2 - 0.3	0	-	-	-	-	-	-	< 20	92	-	< 20	107	42	-
	BH15-04-02	2015 03 02	1.4 - 1.5	10	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	< 0.1
	BH15-04-04	2015 03 02	2.9 - 3.0	10	-	-	-	-	-	-	< 20	< 20	-	< 20	< 20	< 20	-
BH20-04R	BH20-04R-02	2020 02 27	0.8 - 0.9	75	-	-	-	-	-	-	< 20	< 20	-	< 20	< 20	< 20	-
	BH20-04R-04	2020 02 27	2.1 - 2.4	100	< 0.005	< 0.01	< 0.05	< 0.05	-	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
	BH20-04R-05	Duplicate	2.1 - 2.4	100	< 0.005	< 0.01	< 0.05	< 0.05	-	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
	QA/QC RPD%				*	*	*	*	-	*	*	*	*	*	*	*	-
BH15-05	BH15-05-02	2015 03 03	0.6 - 0.8	20	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	< 0.1
	BH15-05-04	2015 03 03	2.1 - 2.3	25	-	-	-	-	-	-	< 20	< 20	-	< 20	< 20	< 20	-
	BH15-05-09	2015 03 03	4.4 - 4.6	5	-	-	-	-	-	-	< 20	< 20	-	< 20	< 20	< 20	-
BH15-06	BH15-06-02	2015 03 03	0.9 - 1.1	45	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	97	< 10	< 20	76	29	< 0.1
	BH15-06-03	2015 03 03	1.2 - 1.4	140	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	609	153	< 10	***452***	**385**	< 20	< 0.1
	BH15-06-04	Duplicate	1.2 - 1.4	140	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	740	194	< 10	***507***	**440**	< 20	< 0.1
	QA/QC RPD%				*	*	*	*	*	*	19	24	*	11	13	*	*
	BH15-06-05	2015 03 03	2.0 - 2.3	25	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	< 0.1
	BH15-06-07	2015 03 03	3.7 - 3.8	0	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	< 0.1
BH20-06R	BH20-06R-04	2020 02 27	2.3 - 2.6	340	< 0.005	< 0.01	< 0.05	< 0.05	-	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
BH20-07	BH20-07-04	2020 02 26	2.3 - 2.4	80	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
	BH20-07-08	2020 02 26	5.6 - 5.8	220	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
BH20-08	BH20-08-02	2020 02 26	0.8 - 0.9	25	-	-	-	-	-	-	< 20	88	-	< 20	81	39	-
	BH20-08-04	2020 02 26	2.3 - 2.4	35	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
	BH20-08-07	2020 02 26	4.7 - 4.9	610	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
BH20-09	BH20-09-03	2020 02 26	1.4 - 1.5	20	< 0.005	< 0.01	< 0.05	< 0.05	-	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
	BH20-09-04	2020 02 26	2.1 - 2.3	80	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
BH20-10	BH20-10-02	2020 02 26	0.9 - 1.1	140	< 0.005	< 0.01	< 0.05	< 0.05	-	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
	BH20-10-03	2020 02 26	1.7 - 1.8	90	< 0.005	< 0.01	< 0.05	< 0.05	-	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
BH20-11	BH20-11-02	2020 02 27	0.8 - 0.9	190	< 0.005	< 0.01	< 0.05	< 0.05	-	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
	BH20-11-03	2020 02 27	1.1 - 1.4	90	< 0.005	< 0.01	< 0.05	< 0.05	-	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
	BH20-11-05	2020 02 27	2.1 - 2.3	600	< 0.005	< 0.01	< 0.05	< 0.05	-	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
BH20-12	BH20-12-03	2020 02 27	1.1 - 1.4	15	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
	BH20-12-04	Duplicate	1.1 - 1.4	15	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	< 10	< 20	< 20	< 10	< 20	< 20	< 20	-
	QA/QC RPD%				*	*	*	*	*	*	*	*	*	*	*	*	-
BH20-17	BH20-17-05	2020 12 08	2.6 - 2.9	55	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	-	-	-	-	-	-	-	< 0.1
	BH20-17-06	Duplicate	2.6 - 2.9	55	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	-	-	-	-	-	-	-	< 0.1
	QA/QC RPD%				*	*	*	*	*	-	-	-	-	-	-	-	*
	BH20-17-08	2020 12 08	4.1 - 4.4	510	< 0.005	< 0.01	< 0.05	< 0.05	< 0.05	-	-	-	-	-	-	-	< 0.1
Federal Guideline																	
CCME CEQG Residential Surface (RL Surface)[b]					0.0068[e]	0.018	0.08	2.4	5	n/a	n/a	n/a	30	150	300	2,800	n/a
CCME CEQG Residential Subsoil (RL Subsoil)[b]					0.0068[e]	0.018	0.08	2.4	5	n/a	n/a	n/a	30	150	2,500	10,000	n/a
CCME CEQG Industrial Surface (IL Surface)[b]					0.0068[e]	0.018	0.08	2.4	50	n/a	n/a	n/a	170	230	1,700	3,300	n/a
CCME CEQG Industrial Subsoil (IL Subsoil)[b]					0.0068[e]	0.018	0.08	2.4	50	n/a	n/a	n/a	170	230	3,500	10,000	n/a
BC Standard																	
CSR Low Density Residential Land Use (RLLD)[c]					0.035	15	0.5	6.5	5	200	1,000	1,000	n/a	n/a	n/a	n/a	4,000
CSR Industrial Land Use (IL)[c]					0.035	15	0.5	6.5	50	200	2,000	5,000	n/a	n/a	n/a	n/a	20,000

Associated AGAT file(s): 15V950154, 15V950578, 20V579494, 20V688152.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than CCME CEQG Residential (RL) Guideline
ITALIC	Concentration greater than CCME CEQG Industrial (IL) Guideline
UNDERLINE	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
SHADED	Concentration greater than CSR Industrial Land Use (IL) Standard

[a] Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.
[b] Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Vapour Inhalation (indoor, basement), Vapour Inhalation (indoor, slab-on-grade), Protection of Potable Groundwater, Historical Guideline, Soil General.
[c] The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).
[d] Where no LEPH and HEPH are available, EPH has been compared to LEPH and HEPH standards, which are conservative comparisons.
[e] Guidelines use 10-5 incremental risk.

TABLE 2: Summary of Analytical Results for Soil - Polycyclic Aromatic Hydrocarbons

Sample Location		BH15-01	BH15-02		BH20-02D			BH15-03	BH15-04	BH20-04R				BH15-05	BH15-06				BH15-06			BH20-06R	Federal Guideline		BC Standard	
Sample ID		BH15-01-07	BH15-02-10	BH15-02-12	BH20-02D-06	BH20-02D-10	BH20-02D-12	BH15-03-06	BH15-04-02	BH20-04R-02	BH20-04R-04	BH20-04R-05	QA/QC	BH15-05-02	BH15-06-02	BH15-06-03	BH15-06-04	QA/QC	BH15-06-05	BH15-06-07	BH20-06R-04	CCME CEQG Residential (RL)[c]	CCME CEQG Industrial (IL)[c]	CSR Low Density Residential Land Use (RLLD)[d]	CSR Industrial Land Use (IL)[d]
Sample Date (yyyy mm dd)		2015 03 02	2015 03 02	2015 03 02	2020 02 27	2020 02 27	2020 02 27	2015 03 02	2015 03 02	2020 02 27	2020 02 27	Duplicate	RPD %	2015 03 03	2015 03 03	2015 03 03	Duplicate	RPD %	2015 03 03	2015 03 03	2020 02 27				
Depth Interval (m)		4.3 - 4.6	5.6 - 5.9	6.4 - 6.7	3.2 - 3.4	6.4 - 6.5	7.9 - 8.1	3.7 - 3.8	1.4 - 1.5	0.8 - 0.9	2.1 - 2.4	2.1 - 2.4		0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.2 - 1.4		2.0 - 2.3	3.7 - 3.8	2.3 - 2.6				
Field Screen (ppm)[b]		10	65	10	140	30	630	0	10	75	100	100		20	45	140	140		25	0	340				
Parameter	**Units**	**Analytical Results**			**Analytical Results**																				
Polycyclic Aromatic Hydrocarbons																									
Naphthalene	µg/g	< 0.005	***0.017***	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	*	0.007	***0.043***	< 0.05[a]	< 0.05[a]	*	0.006	0.007	< 0.005	0.013	0.013	0.6	20
Methylnaphthalene, 1-	µg/g	< 0.005	0.011	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	*	0.009	0.039	< 0.05	< 0.05	*	0.013	0.015	< 0.005	n/a	n/a	250	1,000
Methylnaphthalene, 2-	µg/g	< 0.005	0.016	< 0.005	< 0.005	< 0.005	< 0.005	0.006	< 0.005	< 0.005	< 0.005	< 0.005	*	0.009	0.048	< 0.05	< 0.05	*	0.01	0.012	< 0.005	n/a	n/a	60	950
Acenaphthylene	µg/g	< 0.005	0.024	< 0.005	0.014	< 0.005	< 0.005	0.006	0.031	0.020	< 0.005	< 0.005	*	0.02	0.216	< 0.05	< 0.05	*	< 0.005	0.005	< 0.005	320	320	n/a	n/a
Acenaphthene	µg/g	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	*	< 0.005	< 0.005	< 0.05	< 0.05	*	< 0.005	< 0.005	< 0.005	0.28	0.28	950	15,000
Fluorene	µg/g	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	*	< 0.02	0.05	< 0.2	< 0.2	*	< 0.02	< 0.02	< 0.02	0.25	0.25	600	9,500
Phenanthrene	µg/g	< 0.02	0.04	< 0.02	0.03	< 0.02	< 0.02	< 0.02	0.02	0.03	< 0.02	< 0.02	*	0.02	***0.51***	***0.2***	< 0.2[a]	*	< 0.02	0.02	< 0.02	0.046	0.046	5	50
Anthracene	µg/g	< 0.004	0.018	< 0.004	0.016	< 0.004	< 0.004	0.004	0.015	0.018	< 0.004	< 0.004	*	0.009	0.172	< 0.04	< 0.04	*	< 0.004	0.005	< 0.004	2.5	32	2.5	30
Fluoranthene	µg/g	< 0.01	0.09	< 0.01	0.09	< 0.01	< 0.01	0.02	0.08	0.13	< 0.01	< 0.01	*	0.05	1.3	0.08	0.01	*	< 0.01	0.01	< 0.01	15.4	180	50	200
Pyrene	µg/g	< 0.01	0.1	< 0.01	0.09	< 0.01	< 0.01	0.02	0.1	0.13	< 0.01	< 0.01	*	0.06	1.2	0.09	0.02	*	0.01	0.02	< 0.01	7.7	100	10	100
Benz(a)anthracene	µg/g	< 0.03	0.06	< 0.03	0.05	< 0.03	< 0.03	< 0.03	0.06	0.08	< 0.03	< 0.03	*	0.04	0.48	0.05	< 0.03	*	< 0.03	< 0.03	< 0.03	1	10	1	10
Chrysene	µg/g	< 0.05	0.06	< 0.05	0.06	< 0.05	< 0.05	< 0.05	0.06	0.09	< 0.05	< 0.05	*	< 0.05	0.53	0.06	< 0.05	*	< 0.05	< 0.05	< 0.05	6.2	n/a	200	4,500
Benzo(b)fluoranthene	µg/g	< 0.05	0.06	< 0.05	0.05	< 0.02	< 0.02	< 0.05	0.07	0.09	< 0.02	< 0.02	*	< 0.05	0.42	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.02	1	10	1	10
Benzo(j)fluoranthene	µg/g	< 0.05	< 0.05	< 0.05	0.04	< 0.02	< 0.02	< 0.05	< 0.05	0.05	< 0.02	< 0.02	*	< 0.05	0.25	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.02	n/a	n/a	1	10
Benzo(b+j)fluoranthene	µg/g	-	-	-	0.09	< 0.05	< 0.05	-	-	0.14	< 0.05	< 0.05	*	-	-	-	-	-	-	-	< 0.05	1	10	1	10
Benzo(k)fluoranthene	µg/g	< 0.05	< 0.05	< 0.05	0.04	< 0.02	< 0.02	< 0.05	< 0.05	0.05	< 0.02	< 0.02	*	< 0.05	0.26	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.02	1	10	1	10
Benzo(a)pyrene	µg/g	< 0.03	0.08	< 0.03	0.08	< 0.03	< 0.03	< 0.03	0.11	0.11	< 0.03	< 0.03	*	0.06	0.57	0.06	< 0.03	*	< 0.03	< 0.03	< 0.03	0.6	72	5	50
Indeno(1,2,3-cd)pyrene	µg/g	< 0.02	0.05	< 0.02	0.05	< 0.02	< 0.02	< 0.02	0.06	0.07	< 0.02	< 0.02	*	0.03	0.3	0.03	< 0.02	*	< 0.02	< 0.02	< 0.02	1	10	1	10
Dibenz(a,h)anthracene	µg/g	< 0.005	0.019	< 0.005	0.017	< 0.005	< 0.005	0.005	0.024	0.026	< 0.005	< 0.005	*	0.014	0.116	0.013	< 0.005	*	< 0.005	< 0.005	< 0.005	1	10	1	10
Benzo(g,h,i)perylene	µg/g	< 0.05	0.05	< 0.05	0.05	< 0.05	< 0.05	< 0.05	0.07	0.08	< 0.05	< 0.05	*	< 0.05	0.28	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	n/a	n/a	n/a	n/a
Quinoline	µg/g	-	-	-	< 0.05	< 0.05	< 0.05	-	-	< 0.05	< 0.05	< 0.05	*	-	-	-	-	-	-	-	< 0.05	n/a	n/a	2.5	10
B(a)P TPE	µg/g	0.028	0.1221	0.028	0.12	< 0.05	< 0.05	0.0305	0.1593	0.17	< 0.05	< 0.05	*	0.089	0.8651	0.08935	0.028	*	0.028	0.028	< 0.05	5.3[e]	5.3[e]	n/a	n/a
IACR	µg/g	0.429	***1.066***	0.429	***1.3***	< 0.6	< 0.6	0.44	***1.238***	***1.9***	< 0.6	< 0.6	*	0.683	***8.154***	0.726	0.429	*	0.429	0.429	< 0.6	1	1	n/a	n/a

Associated AGAT file(s): 15V950154, 15V950578, 20V579494, 20V688152.

All terms defined within the body of SNC-Lavalin's report.

< Denotes concentration less than indicated detection limit or RPD less than indicated value.

- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

BOLD	Concentration greater than CCME CEQG Residential (RL) Guideline
ITALIC	Concentration greater than CCME CEQG Industrial (IL) Guideline
UNDERLINE	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
SHADED	Concentration greater than CSR Industrial Land Use (IL) Standard

[a] Laboratory detection limit exceeds regulatory standard/guideline.

[b] Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

[c] Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Vapour Inhalation (indoor, basement), Vapour Inhalation (indoor, slab-on-grade), Protection of Potable Groundwater, Historical Guideline, Soil General.

[d] The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).

[e] Guidelines use 10-5 incremental risk.

TABLE 2: Summary of Analytical Results for Soil - Polycyclic Aromatic Hydrocarbons

Sample Location		BH20-07		BH20-08			BH20-09		BH20-10		BH20-11			BH20-12			BH20-14				BH20-15		Federal Guideline		BC Standard	
Sample ID		BH20-07-04	BH20-07-08	BH20-08-02	BH20-08-04	BH20-08-07	BH20-09-03	BH20-09-04	BH20-10-02	BH20-10-03	BH20-11-02	BH20-11-03	BH20-11-05	BH20-12-03	BH20-12-04	QA/QC	BH20-14-01	BH20-14-04	BH20-14-05	QA/QC	BH20-15-01	BH20-15-05	CCME CEQG	CCME CEQG	CSR Low Density	CSR Industrial
Sample Date (yyyy mm dd)		2020 02 26	2020 02 26	2020 02 26	2020 02 26	2020 02 26	2020 02 26	2020 02 26	2020 02 26	2020 02 26	2020 02 27	2020 02 27	2020 02 27	2020 02 27	Duplicate	RPD %	2020 12 07	2020 12 07	Duplicate	RPD %	2020 12 07	2020 12 07	Residential	Industrial	Residential	Land Use
Depth Interval (m)		2.3 - 2.4	5.6 - 5.8	0.8 - 0.9	2.3 - 2.4	4.7 - 4.9	1.4 - 1.5	2.1 - 2.3	0.9 - 1.1	1.7 - 1.8	0.8 - 0.9	1.1 - 1.4	2.1 - 2.3	1.1 - 1.4	1.1 - 1.4		0.2 - 0.5	1.7 - 2.0	1.7 - 2.0		0.2 - 0.5	1.8 - 2.1	(RL)[c]	(IL)[c]	Land Use (RLLD)[d]	(IL)[d]
Field Screen (ppm)[b]		80	220	25	35	610	20	80	140	90	190	90	600	15	15		25	40	40		0	280				
Parameter	**Units**	**Analytical Results**																								
Polycyclic Aromatic Hydrocarbons																										
Naphthalene	µg/g	< 0.005	< 0.005	***0.046***	0.007	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	*	0.011	< 0.005	< 0.005	*	< 0.005	< 0.005	0.013	0.013	0.6	20
Methylnaphthalene, 1-	µg/g	< 0.005	< 0.005	0.019	0.007	< 0.005	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	*	0.020	< 0.005	< 0.005	*	< 0.005	< 0.005	n/a	n/a	250	1,000
Methylnaphthalene, 2-	µg/g	< 0.005	< 0.005	0.024	0.006	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	*	0.016	< 0.005	< 0.005	*	< 0.005	< 0.005	n/a	n/a	60	950
Acenaphthylene	µg/g	< 0.005	< 0.005	0.421	0.007	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	*	0.009	< 0.005	< 0.005	*	< 0.005	< 0.005	320	320	n/a	n/a
Acenaphthene	µg/g	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	*	< 0.005	< 0.005	< 0.005	*	< 0.005	< 0.005	0.28	0.28	950	15,000
Fluorene	µg/g	< 0.02	< 0.02	0.03	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	*	< 0.02	< 0.02	< 0.02	*	< 0.02	< 0.02	0.25	0.25	600	9,500
Phenanthrene	µg/g	< 0.02	< 0.02	***0.45***	***0.06***	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	*	0.03	< 0.02	< 0.02	*	< 0.02	< 0.02	0.046	0.046	5	50
Anthracene	µg/g	< 0.004	< 0.004	0.407	0.025	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	0.005	*	0.011	0.006	0.007	*	< 0.004	< 0.004	2.5	32	2.5	30
Fluoranthene	µg/g	< 0.01	< 0.01	1.76	0.11	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.03	*	0.05	0.02	0.03	*	< 0.01	< 0.01	15.4	180	50	200
Pyrene	µg/g	< 0.01	< 0.01	1.83	0.10	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	0.03	*	0.04	0.03	0.03	*	< 0.01	< 0.01	7.7	100	10	100
Benz(a)anthracene	µg/g	< 0.03	< 0.03	**1.43**	0.06	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	*	0.04	< 0.03	< 0.03	*	< 0.03	< 0.03	1	10	1	10
Chrysene	µg/g	< 0.05	< 0.05	1.28	0.06	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	6.2	n/a	200	4,500
Benzo(b)fluoranthene	µg/g	< 0.02	< 0.02	**1.2**	0.04	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.02	*	0.03	< 0.02	< 0.02	*	< 0.02	< 0.02	1	10	1	10
Benzo(j)fluoranthene	µg/g	< 0.02	< 0.02	0.75	0.03	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	*	0.02	< 0.02	< 0.02	*	< 0.02	< 0.02	n/a	n/a	1	10
Benzo(b+j)fluoranthene	µg/g	< 0.05	< 0.05	**1.95**	0.07	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	0.05	< 0.03	< 0.03	*	< 0.03	< 0.03	1	10	1	10
Benzo(k)fluoranthene	µg/g	< 0.02	< 0.02	0.68	0.03	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.02	*	0.03	< 0.02	< 0.02	*	< 0.02	< 0.02	1	10	1	10
Benzo(a)pyrene	µg/g	< 0.03	< 0.03	**1.92**	0.07	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	0.03	*	0.04	< 0.03	< 0.03	*	< 0.03	< 0.03	0.6	72	5	50
Indeno(1,2,3-cd)pyrene	µg/g	< 0.02	< 0.02	**1.8**	0.04	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.03	*	< 0.02	< 0.02	< 0.02	*	< 0.02	< 0.02	1	10	1	10
Dibenz(a,h)anthracene	µg/g	< 0.005	< 0.005	0.460	0.014	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.009	*	0.005	< 0.005	< 0.005	*	< 0.005	< 0.005	1	10	1	10
Benzo(g,h,i)perylene	µg/g	< 0.05	< 0.05	2.07	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	n/a	n/a	n/a	n/a
Quinoline	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	n/a	n/a	2.5	10
B(a)P TPE	µg/g	< 0.05	< 0.05	3.00	0.10	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	0.06	< 0.05	< 0.05	*	< 0.05	< 0.05	5.3[e]	5.3[e]	n/a	n/a
IACR	µg/g	< 0.6	< 0.6	***29.7***	***1.1***	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	*	0.8	< 0.6	< 0.6	*	< 0.6	< 0.6	1	1	n/a	n/a

Associated AGAT file(s): 15V950154, 15V950578, 20V579494, 20V688152.

All terms defined within the body of SNC-Lavalin's report.

< Denotes concentration less than indicated detection limit or RPD less than indicated value.

- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

BOLD	Concentration greater than CCME CEQG Residential (RL) Guideline
ITALIC	Concentration greater than CCME CEQG Industrial (IL) Guideline
UNDERLINE	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
SHADED	Concentration greater than CSR Industrial Land Use (IL) Standard

[a] Laboratory detection limit exceeds regulatory standard/guideline.

[b] Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

[c] Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Vapour Inhalation (indoor, basement), Vapour Inhalation (indoor, slab-on-grade), Protection of Potable Groundwater, Historical Guideline, Soil General.

[d] The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).

[e] Guidelines use 10-5 incremental risk.

TABLE 2: Summary of Analytical Results for Soil - Polycyclic Aromatic Hydrocarbons

Sample Location		BH20-16			BH20-17				Federal Guideline		BC Standard	
Sample ID		BH20-16-01	BH20-16-03	BH20-16-06	BH20-17-05	BH20-17-06	QA/QC	BH20-17-08	CCME CEQG Residential	CCME CEQG Industrial	CSR Low Density Residential	CSR Industrial Land Use
Sample Date (yyyy mm dd)		2020 12 08	2020 12 08	2020 12 08	2020 12 08	Duplicate	RPD %	2020 12 08				
Depth Interval (m)		0.2 - 0.5	1.2 - 1.5	2.1 - 2.4	2.6 - 2.9	2.6 - 2.9		4.1 - 4.4				
Field Screen (ppm)[b]		15	35	30	55	55		510				
Parameter	**Units**	**Analytical Results**										
Polycyclic Aromatic Hydrocarbons												
Naphthalene	µg/g	< 0.005	0.010	< 0.005	< 0.005	< 0.005	*	0.009	0.013	0.013	0.6	20
Methylnaphthalene, 1-	µg/g	< 0.005	0.007	< 0.005	< 0.005	< 0.005	*	0.017	n/a	n/a	250	1,000
Methylnaphthalene, 2-	µg/g	< 0.005	0.005	< 0.005	< 0.005	< 0.005	*	0.013	n/a	n/a	60	950
Acenaphthylene	µg/g	< 0.005	0.014	< 0.005	< 0.005	< 0.005	*	< 0.005	320	320	n/a	n/a
Acenaphthene	µg/g	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	*	< 0.005	0.28	0.28	950	15,000
Fluorene	µg/g	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	*	< 0.02	0.25	0.25	600	9,500
Phenanthrene	µg/g	< 0.02	0.04	< 0.02	< 0.02	< 0.02	*	< 0.02	0.046	0.046	5	50
Anthracene	µg/g	< 0.004	0.016	< 0.004	< 0.004	< 0.004	*	< 0.004	2.5	32	2.5	30
Fluoranthene	µg/g	< 0.01	0.08	< 0.01	< 0.01	< 0.01	*	< 0.01	15.4	180	50	200
Pyrene	µg/g	< 0.01	0.08	< 0.01	< 0.01	< 0.01	*	< 0.01	7.7	100	10	100
Benz(a)anthracene	µg/g	< 0.03	0.05	< 0.03	< 0.03	< 0.03	*	< 0.03	1	10	1	10
Chrysene	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	6.2	n/a	200	4,500
Benzo(b)fluoranthene	µg/g	< 0.02	0.05	< 0.02	< 0.02	< 0.02	*	< 0.02	1	10	1	10
Benzo(j)fluoranthene	µg/g	< 0.02	0.03	< 0.02	< 0.02	< 0.02	*	< 0.02	n/a	n/a	1	10
Benzo(b+j)fluoranthene	µg/g	< 0.03	0.08	< 0.03	< 0.03	< 0.03	*	< 0.03	1	10	1	10
Benzo(k)fluoranthene	µg/g	< 0.02	0.04	< 0.02	< 0.02	< 0.02	*	< 0.02	1	10	1	10
Benzo(a)pyrene	µg/g	< 0.03	0.07	< 0.03	< 0.03	< 0.03	*	< 0.03	0.6	72	5	50
Indeno(1,2,3-cd)pyrene	µg/g	< 0.02	0.03	< 0.02	< 0.02	< 0.02	*	< 0.02	1	10	1	10
Dibenz(a,h)anthracene	µg/g	< 0.005	0.009	< 0.005	< 0.005	< 0.005	*	< 0.005	1	10	1	10
Benzo(g,h,i)perylene	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	n/a	n/a	n/a	n/a
Quinoline	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	n/a	n/a	2.5	10
B(a)P TPE	µg/g	< 0.05	0.10	< 0.05	< 0.05	< 0.05	*	< 0.05	5.3[e]	5.3[e]	n/a	n/a
IACR	µg/g	< 0.6	***1.2***	< 0.6	< 0.6	< 0.6	*	< 0.6	1	1	n/a	n/a

Associated AGAT file(s): 15V950154, 15V950578, 20V579494, 20V688152.

All terms defined within the body of SNC-Lavalin's report.

< Denotes concentration less than indicated detection limit or RPD less than indicated value.

- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

BOLD	Concentration greater than CCME CEQG Residential (RL) Guideline
ITALIC	Concentration greater than CCME CEQG Industrial (IL) Guideline
UNDERLINE	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
SHADED	Concentration greater than CSR Industrial Land Use (IL) Standard

[a] Laboratory detection limit exceeds regulatory standard/guideline.

[b] Field screening results are measured based on a 'dry headspace' method using a combustible gas meter calibrated to a hexane standard.

[c] Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Vapour Inhalation (indoor, basement), Vapour Inhalation (indoor, slab-on-grade), Protection of Potable Groundwater, Historical Guideline, Soil General.

[d] The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).

[e] Guidelines use 10-5 incremental risk.

TABLE 3: Summary of Analytical Results for Soil - Total Metals

Sample Location		BH15-01	BH15-02		BH20-02D			BH15-03	BH15-04	BH20-04R		BH15-05	BH15-06				BH15-06		BH20-06R	Federal Guideline		BC Standard	
Sample ID		BH15-01-07	BH15-02-10	BH15-02-12	BH20-02D-06	BH20-02D-07	BH20-02D-09	BH15-03-06	BH15-04-02	BH20-04R-02	BH20-04R-06	BH15-05-02	BH15-06-02	BH15-06-03	BH15-06-04	QA/QC RPD %	BH15-06-05	BH15-06-07	BH20-06R-01	CCME CEQG Residential (RL)[a]	CCME CEQG Industrial (IL)[a]	CSR Low Density Residential Land Use (RLLD)[b]	CSR Industrial Land Use (IL)[b]
Sample Date (yyyy mm dd)		2015 03 02	2015 03 02	2015 03 02	2020 02 27	2020 02 27	2020 02 27	2015 03 02	2015 03 02	2020 02 27	2020 02 27	2015 03 03	2015 03 03	2015 03 03	Duplicate		2015 03 03	2015 03 03	2020 02 27				
Depth Interval (m)		4.3 - 4.6	5.6 - 5.9	6.4 - 6.7	3.2 - 3.4	4.1 - 4.3	5.6 - 5.8	3.7 - 3.8	1.4 - 1.5	0.8 - 0.9	3.4 - 3.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.2 - 1.4		2.0 - 2.3	3.7 - 3.8	0.1 - 0.3				
Parameter	**Units**	**Analytical Results**																					
Physical Parameters																							
pH	pH	7.1	***8.8***	7.2	7.4	***11.6***	***8.3***	7.2	7	***8.1***	***8.8***	6.3	6.2	***5.8***	***5.8***	0	7.9	***8.2***	6.2	6 - 8	6 - 8	n/a	n/a
Total Metals																							
Aluminum	µg/g	-	-	-	20,200	18,600	15,900	-	-	37,700	23,700	-	-	-	-	-	-	-	27,400	n/a	n/a	40,000	250,000
Antimony	µg/g	< 0.1	8	0.1	0.2	2.7	0.1	0.2	< 0.1	0.2	0.2	0.2	0.4	0.1	0.1	*	< 0.1	0.1	0.2	20	40	20	40
Arsenic	µg/g	3.9	3.8	4.1	4.2	3.9	3.5	4.3	4	4.8	5.0	4.9	6.6	4.5	4.4	2	4.9	6	4.7	12	12	10	10
Barium	µg/g	42.6	46.9	48.1	46.8	157	49.0	40.7	60.3	100	78.5	69.6	140	88	93.3	6	49.3	54.9	80.9	500	2,000	350	350
Beryllium	µg/g											0.3	0.5	0.3	0.3	*			0.3	4	8	1 (pH <6.5)	1 (pH <6.5)
																						4 (pH 6.5-<7.0)	4 (pH 6.5-<7.0)
		0.2		0.2	0.3			0.2	0.2													30 (pH 7.0-<7.5)	30 (pH 7.0-<7.5)
																	0.2					85 (pH >=7.5)	250 (pH 7.5-<8.0)
			0.2			0.2	0.2			0.6	0.3							0.2					350 (pH >=8.0)
Cadmium	µg/g											0.12	0.29	0.05	0.05	0			0.30	10	22	1 (pH <7.0)	1 (pH <7.0)
		0.07		0.07	0.24			0.14	0.05													3 (pH 7.0-<7.5)	3 (pH 7.0-<7.5)
																	0.05					20 (pH >=7.5)	20 (pH 7.5-<8.0)
			0.08			0.27	0.19			0.23	0.21							0.05					50 (pH >=8.0)
Chromium	µg/g	**<u>73</u>**	35	47	40	26	28	29	45	53	45	38	64	62	63	2	36	42	43	65[d]	87	65[c,d]	65[c,d]
Cobalt	µg/g	12.8	12.3	13.9	14.2	9.2	10.1	11.6	12.2	21.6	17.9	14	17.7	15.8	13.9	13	12.9	13.4	15.1	50	300	25	25
Copper	µg/g													53.9	51.7	4				100[d]	100[d]	100 (pH 5.5-<6.0)	100 (pH 5.5-<6.0)
		54.2	57.2	60	62.4	49.6	43.0	47.9	40.8	59.8	67.2	66.1	***107***				48.9	51.7	55.9			150 (pH >=6.0)	300 (pH >=6.0)
Iron	µg/g	-	-	-	32,200	24,800	29,200	-	-	47,400	39,700	-	-	-	-	-	-	-	36,300	n/a	n/a	70,000[d]	150,000
Lead	µg/g													3.9	2.5	44				140	600	120	150 (pH 5.5-<6.0)
												14.6	26.4						20.3				800 (pH 6.0-<6.5)
		1.5	126	1.8	3.7	***<u>2,090</u>***	1.7	1.7	3.1	12.3	2.9						1.9	2.1					1,000 (pH >=6.5)
Lithium	µg/g	-	-	-	10.2	9.9	8.8	-	-	21.2	17.8	-	-	-	-	-	-	-	12.9	n/a	n/a	30	450
Manganese	µg/g	469	409	591	475	360	303	545	416	796	522	512	741	260	258	1	353	364	611	n/a	n/a	2,000	2,000
Mercury	µg/g	0.03	0.04	0.04	0.02	0.02	0.03	0.02	0.03	0.03	0.04	0.06	0.06	0.05	0.03	*	0.03	0.04	0.05	6.6	50	10	75
Molybdenum	µg/g	2.1	0.3	0.4	0.4	0.7	0.2	0.3	0.8	0.9	0.3	0.5	1.3	1	1	0	0.3	0.3	0.8	10	40	15	15
Nickel	µg/g	43		26.3	29.0			24	22.8		35.1	28.9	35.1	28.9	28.5	1			32.5	50[d]	89	70 (pH <7.5)	70 (pH <7.5)
			24.6			48.1	20.0			41.4							24.9	26.4				150 (pH >=7.5)	250 (pH >=7.5)
Selenium	µg/g	< 0.1	< 0.1	< 0.1	0.4	0.2	0.8	< 0.1	0.1	0.3	0.3	< 0.1	0.1	< 0.1	0.1	*	< 0.1	0.2	0.5	1	2.9	1	1
Silver	µg/g	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	20	40	20	40
Strontium	µg/g	-	-	-	41	95	45	-	-	43	64	-	-	-	-	-	-	-	37	n/a	n/a	9,500	150,000
Thallium	µg/g	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	*	< 0.1	< 0.1	< 0.1	1	1	9	25
Tin	µg/g	< 0.2	0.3	< 0.2	0.5	0.9	0.4	< 0.2	< 0.2	0.7	0.5	0.6	1.3	0.2	0.3	*	< 0.2	< 0.2	0.7	50	300	50	300
Uranium	µg/g	0.2	0.3	0.2	0.3	0.6	0.3	0.3	0.6	0.5	0.3	0.3	0.6	0.7	0.8	*	0.2	0.3	0.4	23	300	30	30
Vanadium	µg/g	97	96	99	112	68	93	86	109	144	114	99	123	122	125	2	95	95	110	200[d]	200[d]	200[d]	200[d]
Zinc	µg/g													35	36	3				250	410	150 (pH <6.0)	150 (pH <6.0)
												73	162						55			250 (pH 6.0-<6.5)	250 (pH 6.0-<6.5)
																						350 (pH 6.5-<7.0)	350 (pH 6.5-<7.0)
		32	51	37	42	70	33	33	32	62	54						39	40				450 (pH >=7.0)	450 (pH >=7.0)

Associated AGAT file(s): 15V950154, 15V950578, 20V579494, 20V688152.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than CCME CEQG Residential (RL) Guideline
ITALIC	Concentration greater than CCME CEQG Industrial (IL) Guideline
<u>UNDERLINE</u>	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
SHADED	Concentration greater than CSR Industrial Land Use (IL) Standard

[a] Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Vapour Inhalation (indoor, basement), Vapour Inhalation (indoor, slab-on-grade), Protection of Potable Groundwater, Historical Guideline, Soil General.
[b] The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).
[c] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[d] BC MoE Regional Background Estimate (Protocol 4 for Contaminated Sites: Determining Background Soil Quality).

TABLE 3: Summary of Analytical Results for Soil - Total Metals

Sample Location		BH20-07	BH20-08	BH20-09		BH20-11	BH20-12			BH20-13		BH20-14				BH20-15		BH20-16		Federal Guideline		BC Standard	
Sample ID		BH20-07-04	BH20-08-02	BH20-09-02	BH20-09-05	BH20-11-03	BH20-12-03	BH20-12-04	QA/QC	BH20-13-01	BH20-13-07	BH20-14-01	BH20-14-04	BH20-14-05	QA/QC	BH20-15-01	BH20-15-05	BH20-16-01	BH20-16-03	CCME CEQG Residential (RL)[a]	CCME CEQG Industrial (IL)[a]	CSR Low Density Residential Land Use (RLLD)[b]	CSR Industrial Land Use (IL)[b]
Sample Date (yyyy mm dd)		2020 02 26	2020 02 26	2020 02 26	2020 02 26	2020 02 27	2020 02 27	Duplicate	RPD %	2020 12 07	2020 12 07	2020 12 07	2020 12 07	Duplicate	RPD %	2020 12 07	2020 12 07	2020 12 08	2020 12 08				
Depth Interval (m)		2.3 - 2.4	0.8 - 0.9	0.8 - 0.9	3.2 - 3.5	1.1 - 1.4	1.1 - 1.4	1.1 - 1.4		0.2 - 0.5	3.7 - 4.0	0.2 - 0.5	1.7 - 2.0	1.7 - 2.0		0.2 - 0.5	1.8 - 2.1	0.2 - 0.5	1.2 - 1.5				
Parameter	**Units**	**Analytical Results**																					
Physical Parameters																							
pH	pH	6.8	6.2	7.0	***8.7***	8.0	7.2	7.1	1	7.2	7.5	6.7	7.2	7.2	0	7.1	7.0	7.2	7.7	6 - 8	6 - 8	n/a	n/a
Total Metals																							
Aluminum	µg/g	18,900	29,800	18,700	20,500	26,100	20,600	22,200	7	19,800	17,300	22,700	26,700	26,200	2	21,600	15,900	22,600	20,600	n/a	n/a	40,000	250,000
Antimony	µg/g	0.1	0.3	0.4	0.2	0.2	0.2	0.2	*	0.2	0.1	0.3	0.1	0.1	*	< 0.1	0.1	< 0.1	0.2	20	40	20	40
Arsenic	µg/g	3.9	4.9	4.3	4.7	7.8	7.2	7.4	3	3.5	3.4	4.2	3.5	2.7	26	2.7	3.0	2.3	3.7	12	12	10	10
Barium	µg/g	37.1	82.6	55.1	58.1	81.3	76.8	60.4	24	51.4	39.2	62.5	48.7	49.1	1	53.0	42.1	60.5	50.7	500	2,000	350	350
Beryllium	µg/g		0.4																	4	8	1 (pH <6.5)	1 (pH <6.5)
		0.2										0.2										4 (pH 6.5-<7.0)	4 (pH 6.5-<7.0)
				0.2			0.3	0.3	*	0.2			0.3	0.2	*	0.2	0.2	0.2				30 (pH 7.0-<7.5)	30 (pH 7.0-<7.5)
											0.2								0.2			85 (pH >=7.5)	250 (pH 7.5-<8.0)
					0.3	0.3																	350 (pH >=8.0)
Cadmium	µg/g	0.23	0.23									0.19								10	22	1 (pH <7.0)	1 (pH <7.0)
				0.24			0.22	0.21	5	0.15			0.20	0.20	0	0.12	0.11	0.12				3 (pH 7.0-<7.5)	3 (pH 7.0-<7.5)
											0.13								0.18			20 (pH >=7.5)	20 (pH 7.5-<8.0)
					0.17	0.20																	50 (pH >=8.0)
Chromium	µg/g	32	45	32	38	56	42	39	7	41	33	37	38	42	10	21	28	25	35	65[d]	87	65[c,d]	65[c,d]
Cobalt	µg/g	14.9	16.5	13.5	14.9	20.2	15.5	14.8	5	13.5	11.8	13.4	16.8	16.8	0	9.2	10.2	10.5	13.2	50	300	25	25
Copper	µg/g																			100[d]	100[d]	100 (pH 5.5-<6.0)	100 (pH 5.5-<6.0)
		80.3	60.9	52.1	59.5	73.8	55.5	55.8	1	55.1	53.9	57.1	75.4	76.4	1	66.7	32.6	69.1	56.1			150 (pH >=6.0)	300 (pH >=6.0)
Iron	µg/g	36,700	40,600	34,700	35,300	45,600	35,000	35,600	2	34,100	31,600	34,700	39,300	38,300	3	24,000	28,600	27,300	34,800	n/a	n/a	70,000[d]	150,000
Lead	µg/g																			140	600	120	150 (pH 5.5-<6.0)
			8.2																				800 (pH 6.0-<6.5)
		2.0		3.9	2.4	3.3	4.1	5.1	22	2.3	1.3	5.0	1.3	1.4	7	1.6	1.5	1.5	2.2				1,000 (pH >=6.5)
Lithium	µg/g	8.5	14.5	9.9	14.4	20.1	11.2	11.0	2	10.0	6.3	11.0	8.7	8.7	0	8.3	6.4	8.4	8.6	n/a	n/a	30	450
Manganese	µg/g	486	667	474	431	599	520	461	12	459	390	477	513	469	9	366	353	384	439	n/a	n/a	2,000	2,000
Mercury	µg/g	0.03	0.02	0.07	0.03	0.03	0.04	0.03	*	0.03	0.02	0.03	0.02	0.24	*	0.04	0.02	0.02	0.03	6.6	50	10	75
Molybdenum	µg/g	0.9	0.5	0.4	0.3	0.6	0.5	0.5	*	0.6	1.0	0.9	0.7	1.0	*	0.3	0.2	1.1	0.3	10	40	15	15
Nickel	µg/g	26.1	32.7	24.8			29.0	28.5	2	25.1		26.2	31.2	33.1	6	18.2	19.3	20.4		50[d]	89	70 (pH <7.5)	70 (pH <7.5)
					30.5	39.8					21.8								25.9			150 (pH >=7.5)	250 (pH >=7.5)
Selenium	µg/g	0.3	0.4	0.2	0.3	< 0.1	0.2	0.4	*	0.3	0.1	0.2	< 0.1	0.2	*	< 0.1	0.1	0.3	< 0.1	1	2.9	1	1
Silver	µg/g	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	< 0.5	20	40	20	40
Strontium	µg/g	25	39	36	56	54	46	44	4	35	30	34	26	26	0	34	29	31	37	n/a	n/a	9,500	150,000
Thallium	µg/g	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	*	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	*	< 0.1	< 0.1	< 0.1	< 0.1	1	1	9	25
Tin	µg/g	0.4	0.8	0.4	0.4	0.5	0.6	0.6	*	0.7	0.5	0.6	0.5	0.5	*	0.3	0.3	0.4	0.4	50	300	50	300
Uranium	µg/g	0.3	0.4	0.3	0.3	0.3	0.5	0.5	*	0.3	< 0.2	0.3	0.2	0.2	*	0.3	0.3	0.3	0.2	23	300	30	30
Vanadium	µg/g	95	117	100	106	126	109	106	3	103	95	99	122	119	2	68	89	76	104	200[d]	200[d]	200[d]	200[d]
Zinc	µg/g																			250	410	150 (pH <6.0)	150 (pH <6.0)
			59																			250 (pH 6.0-<6.5)	250 (pH 6.0-<6.5)
		42										73										350 (pH 6.5-<7.0)	350 (pH 6.5-<7.0)
				44	48	62	47	46	2	39	40		45	48	6	30	28	34	39			450 (pH >=7.0)	450 (pH >=7.0)

Associated AGAT file(s): 15V950154, 15V950578, 20V579494, 20V688152.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than CCME CEQG Residential (RL) Guideline
ITALIC	Concentration greater than CCME CEQG Industrial (IL) Guideline
UNDERLINE	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
SHADED	Concentration greater than CSR Industrial Land Use (IL) Standard

[a] Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Vapour Inhalation (indoor, basement), Vapour Inhalation (indoor, slab-on-grade), Protection of Potable Groundwater, Historical Guideline, Soil General.
[b] The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).
[c] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[d] BC MoE Regional Background Estimate (Protocol 4 for Contaminated Sites: Determining Background Soil Quality).

TABLE 3: Summary of Analytical Results for Soil - Total Metals

Sample Location		BH20-17				Federal Guideline		BC Standard	
Sample ID		BH20-17-01	BH20-17-05	BH20-17-06	QA/QC	CCME CEQG Residential (RL)[a]	CCME CEQG Industrial (IL)[a]	CSR Low Density Residential Land Use (RLLD)[b]	CSR Industrial Land Use (IL)[b]
Sample Date (yyyy mm dd)		2020 12 08	2020 12 08	Duplicate	RPD %				
Depth Interval (m)		0.2 - 0.3	2.6 - 2.9	2.6 - 2.9					
Parameter	**Units**	**Analytical Results**							
Physical Parameters									
pH	pH	7.2	6.7	6.5	3	6 - 8	6 - 8	n/a	n/a
Total Metals									
Aluminum	µg/g	23,500	18,400	21,500	16	n/a	n/a	40,000	250,000
Antimony	µg/g	0.1	0.1	0.1	*	20	40	20	40
Arsenic	µg/g	3.3	2.9	3.7	24	12	12	10	10
Barium	µg/g	64.4	26.9	38.2	35	500	2,000	350	350
Beryllium	µg/g					4	8	1 (pH <6.5)	1 (pH <6.5)
			0.2	0.2	*			4 (pH 6.5-<7.0)	4 (pH 6.5-<7.0)
		0.2						30 (pH 7.0-<7.5)	30 (pH 7.0-<7.5)
								85 (pH >=7.5)	250 (pH 7.5-<8.0)
									350 (pH >=8.0)
Cadmium	µg/g		0.17	0.16	6	10	22	1 (pH <7.0)	1 (pH <7.0)
		0.13						3 (pH 7.0-<7.5)	3 (pH 7.0-<7.5)
								20 (pH >=7.5)	20 (pH 7.5-<8.0)
									50 (pH >=8.0)
Chromium	µg/g	27	30	35	15	65[d]	87	65[c,d]	65[c,d]
Cobalt	µg/g	11.2	10.3	11.4	10	50	300	25	25
Copper	µg/g					100[d]	100[d]	100 (pH 5.5-<6.0)	100 (pH 5.5-<6.0)
		67.3	46.5	55.0	17			150 (pH >=6.0)	300 (pH >=6.0)
Iron	µg/g	29,800	31,700	34,300	8	n/a	n/a	70,000[d]	150,000
Lead	µg/g					140	600	120	150 (pH 5.5-<6.0)
									800 (pH 6.0-<6.5)
		1.7	1.1	1.3	17				1,000 (pH >=6.5)
Lithium	µg/g	8.6	7.6	8.3	9	n/a	n/a	30	450
Manganese	µg/g	439	280	294	5	n/a	n/a	2,000	2,000
Mercury	µg/g	0.03	0.02	0.04	*	6.6	50	10	75
Molybdenum	µg/g	0.8	0.3	0.4	*	10	40	15	15
Nickel	µg/g	21.6	21.9	25.8	16	50[d]	89	70 (pH <7.5)	70 (pH <7.5)
								150 (pH >=7.5)	250 (pH >=7.5)
Selenium	µg/g	< 0.1	0.2	0.3	*	1	2.9	1	1
Silver	µg/g	< 0.5	< 0.5	< 0.5	*	20	40	20	40
Strontium	µg/g	31	23	26	12	n/a	n/a	9,500	150,000
Thallium	µg/g	< 0.1	< 0.1	< 0.1	*	1	1	9	25
Tin	µg/g	0.3	0.3	0.3	*	50	300	50	300
Uranium	µg/g	0.3	0.2	0.3	*	23	300	30	30
Vanadium	µg/g	83	103	116	12	200[d]	200[d]	200[d]	200[d]
Zinc	µg/g					250	410	150 (pH <6.0)	150 (pH <6.0)
								250 (pH 6.0-<6.5)	250 (pH 6.0-<6.5)
			28	31	10			350 (pH 6.5-<7.0)	350 (pH 6.5-<7.0)
		35						450 (pH >=7.0)	450 (pH >=7.0)

Associated AGAT file(s): 15V950154, 15V950578, 20V579494, 20V688152.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than CCME CEQG Residential (RL) Guideline
ITALIC	Concentration greater than CCME CEQG Industrial (IL) Guideline
UNDERLINE	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
SHADED	Concentration greater than CSR Industrial Land Use (IL) Standard

[a] Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Vapour Inhalation (indoor, basement), Vapour Inhalation (indoor, slab-on-grade), Protection of Potable Groundwater, Historical Guideline, Soil General.
[b] The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).
[c] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[d] BC MoE Regional Background Estimate (Protocol 4 for Contaminated Sites: Determining Background Soil Quality).

TABLE 4: Summary of Analytical Results for Soil - Volatile Organic Compounds

Sample Location		BH15-01	BH15-02	BH20-02D		BH15-03	BH20-07		BH20-08		BH20-09	BH20-12			BH20-17				Federal Guideline		BC Standard	
Sample ID		BH15-01-07	BH15-02-10	BH20-02D-06	BH20-02D-10	BH15-03-06	BH20-07-04	BH20-07-08	BH20-08-04	BH20-08-07	BH20-09-04	BH20-12-03	BH20-12-04	QA/QC	BH20-17-05	BH20-17-06	QA/QC	BH20-17-08	CCME CEQG	CCME CEQG	CSR	CSR
Sample Date (yyyy mm dd)		2015 03 02	2015 03 02	2020 02 27	2020 02 27	2015 03 02	2020 02 26	2020 02 26	2020 02 26	2020 02 26	2020 02 26	2020 02 27	Duplicate	RPD %	2020 12 08	Duplicate	RPD %	2020 12 08	Residential	Industrial	Low Density Residential	Industrial Land Use
Depth Interval (m)		4.3 - 4.6	5.6 - 5.9	3.2 - 3.4	6.4 - 6.5	3.7 - 3.8	2.3 - 2.4	5.6 - 5.8	2.3 - 2.4	4.7 - 4.9	2.1 - 2.3	1.1 - 1.4	1.1 - 1.4		2.6 - 2.9	2.6 - 2.9		4.1 - 4.4	(RL)[a]	(IL)[a]	Land Use (RLLD)[b]	(IL)[b]
Parameter	**Units**	**Analytical Results**																				
Volatile Organic Compounds																						
Acetone	µg/g	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	*	< 0.5	n/a	n/a	15,000	200,000
Bromodichloromethane [BDCM]	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	n/a	n/a	100	550
Bromoform	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	n/a	n/a	300	4,000
Bromomethane	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.5	< 0.5	*	< 0.5	n/a	n/a	20	300
Carbon Tetrachloride	µg/g	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	*	< 0.02	< 0.02	*	< 0.02	5	50	5	50
Chlorobenzene	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	1	10	1	10
Chloroethane	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	n/a	n/a	n/a	n/a
Chloroform	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	5	50	5	50
Chloromethane	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.1	< 0.1	*	< 0.1	n/a	n/a	n/a	n/a
Dibromochloromethane [DBCM]	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	n/a	n/a	85	400
Dibromoethane, 1,2-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	n/a	n/a	3.5	15
Dichlorobenzene, 1,2-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	1	10	1	10
Dichlorobenzene, 1,3-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	1	10	1	10
Dichlorobenzene, 1,4-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	1	10	1	10
Dichloroethane, 1,1-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	5	50	5	50
Dichloroethane, 1,2-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	5	50	5	50
Dichloroethylene, 1,1-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	5	50	5	50
Dichloroethylene, 1,2-cis-	µg/g	< 0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	5	50	5	50
Dichloroethylene, 1,2-trans-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	5	50	5	50
Dichloromethane	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	5	50	5	50
Dichloropropane, 1,2-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	5	50	5	50
Dichloropropane, 1,3-	µg/g	-	-	< 0.05	< 0.05	-	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	n/a	n/a	300	4,500
Dichloropropene, 1,3-cis-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	n/a	n/a	5	50
Dichloropropene, 1,3-trans-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	n/a	n/a	5	50
Methyl Ethyl Ketone [MEK]	µg/g	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	*	< 0.5	n/a	n/a	9,500	150,000
Methyl Isobutyl Ketone [MIBK]	µg/g	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	*	< 0.5	n/a	n/a	n/a	n/a
Tetrachloroethane, 1,1,1,2-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	n/a	n/a	250	1,500
Tetrachloroethane, 1,1,2,2-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	5	50	35	150
Tetrachloroethylene	µg/g	< 0.05	**0.5**	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	0.2	0.6	2.5	2.5
Trichlorobenzene, 1,2,4-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	2	10	2	10
Trichloroethane, 1,1,1-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	5	50	5	50
Trichloroethane, 1,1,2-	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	5	50	5	50
Trichloroethylene	µg/g	< 0.01	***0.02***	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	< 0.01	< 0.01	*	< 0.01	0.01	0.01	0.3	0.3
Trichlorofluoromethane	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	n/a	n/a	4,500	70,000
Vinyl Chloride	µg/g	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05	< 0.05	*	< 0.05	n/a	n/a	0.95	45

Associated AGAT file(s): 15V950154, 20V579494, 20V688152.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than CCME CEQG Residential (RL) Guideline
ITALIC	Concentration greater than CCME CEQG Industrial (IL) Guideline
UNDERLINE	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
SHADED	Concentration greater than CSR Industrial Land Use (IL) Standard

[a] Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Vapour Inhalation (indoor, basement), Vapour Inhalation (indoor, slab-on-grade), Protection of Potable Groundwater, Historical Guideline, Soil General.
[b] The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).

TABLE 5: Summary of Analytical Results for Soil - PCBs

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Depth Interval (m)	Field Screen[a] (ppm)	PCBs			
					Aroclor 1242 µg/g	Aroclor 1254 µg/g	Aroclor 1260 µg/g	Polychlorinated Biphenyls, Total [PCBs] µg/g
BH15-04	BH15-04-01	2015 03 02	0.2 - 0.3	0	< 0.05	< 0.05	< 0.05	< 0.05
	BH15-04-02	2015 03 02	1.4 - 1.5	10	< 0.05	< 0.05	< 0.05	< 0.05
Federal Guideline								
CCME CEQG Residential (RL)[a]					n/a	n/a	n/a	1.3[c]
CCME CEQG Industrial (IL)[a]					n/a	n/a	n/a	33
BC Standard								
CSR Low Density Residential Land Use (RLLD)[b]					n/a	n/a	n/a	1.5
CSR Industrial Land Use (IL)[b]					n/a	n/a	n/a	35

Associated AGAT file(s): 15V950154.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than CCME CEQG Residential (RL) Guideline
ITALIC	Concentration greater than CCME CEQG Industrial (IL) Guideline
UNDERLINE	Concentration greater than CSR Low Density Residential Land Use (RLLD) standard
SHADED	Concentration greater than CSR Industrial Land Use (IL) Standard

[a] Pathways Included: Eco Soil Contact, Management Limit, Nutrient and energy-cycling check, Offsite Migration, Protection of Groundwater for Freshwater Aquatic Life, Direct Contact (particulate inhalation), Soil Dermal Contact, Soil Ingestion, Vapour Inhalation (indoor, basement), Vapour Inhalation (indoor, slab-on-grade), Protection of Potable Groundwater, Historical Guideline, Soil General.
[b] The site-specific factors used for determining the matrix standards for this site include: intake of contaminated soil, groundwater used for drinking water, toxicity to soil invertebrates and plants, and groundwater flow to surface water used by freshwater aquatic life (whichever is most stringent).
[c] Guideline includes most stringent soil and food ingestion guideline (see factsheet for more details).

TABLE 6: Summary of Analytical Results for Soil - Leachable Polycyclic Aromatic Hydrocarbons

Sample Location		BH20-04R	BC Standard
Sample ID		BH20-04R-02	HWR Leachate
Sample Date (yyyy mm dd)		2020 02 27	Quality Standards
Parameter	Units	Analytical Results	(HWLQ)
TCLP Polycyclic Aromatic Hydrocarbons			
Benzo(a)pyrene	µg/L	< 1	1

Associated AGAT file(s): 20V579494.

All terms defined within the body of SNC-Lavalin's report.

< Denotes concentration less than indicated detection limit or RPD less than indicated value.

- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

BOLD Concentration greater than HWR Leachate Quality Standards (HWLQ) Standard

TABLE 7: Summary of Analytical Results for Soil - Leachable Metals

Sample Location		BH20-02D	BC Standard
Sample ID		BH20-02D-07	HWR Leachate Quality Standards (HWLQ)
Sample Date (yyyy mm dd)		2020 02 27	
Parameter	**Units**	**Analytical Results**	
TCLP Metals			
Lead	µg/L	< 10	5,000

Associated AGAT file(s): 20V579494.

All terms defined within the body of SNC-Lavalin's report.

< Denotes concentration less than indicated detection limit or RPD less than indicated value.

- Denotes analysis not conducted.

n/a Denotes no applicable standard/guideline.

QA/QC RPD Denotes quality assurance/quality control relative percent difference

* RPDs are not calculated where one or more concentrations are less than five times RDL.

RDL Denotes reported detection limit.

BOLD Concentration greater than HWR Leachate Quality Standards (HWLQ) Standard

TABLE 8: Summary of Analytical Results for Groundwater - Hydrocarbons

Sample Location	Sample ID	Sample Date (yyyy mm dd)	Monocyclic Aromatic Hydrocarbons					Gross Parameters					Petroleum Hydrocarbon Fractions				Methyl Tert-butyl Ether [MTBE] µg/L
			Benzene µg/L	Ethylbenzene µg/L	Toluene µg/L	Xylenes µg/L	Styrene µg/L	VHw6-10 µg/L	VPHw µg/L	EPHw10-19 µg/L	LEPHw µg/L	EPH (C19-C32) µg/L	F1-BTEX µg/L	F2 (>C10-C16) µg/L	F3 (>C16-C34) µg/L	F4 (>C34-C50) µg/L	
MW15-01	MW15-01-150311	2015 03 11/12	< 0.5	< 0.5	< 0.5	< 1	< 0.5	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 1
	MW15-01-200212/13	2020 02 12/13	< 0.5	< 0.5	< 0.5	< 1	< 0.5	< 100	< 100	< 200	< 200	< 200	< 100	< 200	-	-	-
	MW15-01-20200923	2020 09 23	< 0.5	< 0.5	< 0.5	< 0.7	< 0.5	-	-	< 200	< 200	< 200	< 100	< 200	< 200	< 200	< 1
MW15-02	MW15-02-150311	2015 03 11/12	< 0.5	**20.1**	0.5	**38**	< 0.5	< 100	< 100	180	180	390	200	< 100	400	< 100	< 1
	MW15-A-150311	Duplicate	< 0.5	**19.6**	0.5	**35**	< 0.5	< 100	< 100	170	170	300	200	< 100	500	< 100	< 1
	QA/QC RPD%		*	3	*	8	*	*	*	*	*	*	*	*	*	*	*
	MW15-02-200212/13	2020 02 12/13	< 0.5	**6.9**	< 0.5	17	< 0.5	< 100	< 100	< 200	< 200	< 200	< 100	< 200	-	-	-
	MW15-02-20200923	2020 09 23	< 0.5	**5.0**	< 0.5	9	< 0.5	-	-	< 200	< 200	390	< 100	< 200	480	< 200	< 1
	MW15-02-201116/17	2020 11 16/17	< 0.5	**2.4**	< 0.5	3.7	< 0.5	< 100	< 100	< 200	< 200	-	< 100	< 200	-	-	< 1
MW20-02(D)	MW20-02(D)-200302/03	2020 03 02/03	< 0.5	**2.2**	0.6	9	< 0.5	< 100	< 100	< 200	< 200	< 200	< 100	< 200	-	-	-
	MW20-A-200302/03	Duplicate	< 0.5	**2.5**	0.6	10	< 0.5	< 100	< 100	< 200	< 200	< 200	< 100	< 200	-	-	-
	QA/QC RPD%		*	*	*	11	*	*	*	*	*	*	*	*	-	-	-
	MW20-02(D)-20200923	2020 09 23	< 0.5	0.5	< 0.5	< 0.7	< 0.5	-	-	< 200	< 200	< 200	< 100	< 200	< 200	< 200	< 1
	MW20-02(D)-201116/17	2020 11 16/17	< 0.5	< 0.5	< 0.5	0.9	< 0.5	< 100	< 100	< 200	< 200	-	< 100	< 200	-	-	< 1
MW20-02(2D)	MW20-02(2D)-200302/03	2020 03 02/03	< 0.5	< 0.5	< 0.5	< 1	< 0.5	< 100	< 100	< 200	< 200	< 200	< 100	< 200	-	-	-
	MW20-02(2D)-20200923	2020 09 23	< 0.5	< 0.5	< 0.5	< 0.7	< 0.5	-	-	< 200	< 200	< 200	< 100	< 200	< 200	< 200	< 1
	MW20-A-20200923	Duplicate	< 0.5	< 0.5	< 0.5	< 0.7	< 0.5	-	-	< 200	< 200	< 200	< 100	< 200	< 200	< 200	< 1
	QA/QC RPD%		*	*	*	*	*	-	-	*	*	*	*	*	*	*	*
	MW20-02(2D)-201116/17	2020 11 16/17	< 0.5	< 0.5	< 0.5	< 0.7	< 0.5	< 100	< 100	< 200	< 200	-	< 100	< 200	-	-	< 1
	MW20-A-201116/17	Duplicate	< 0.5	< 0.5	< 0.5	< 0.7	< 0.5	< 100	< 100	< 200	< 200	-	< 100	< 200	-	-	< 1
	QA/QC RPD%		*	*	*	*	*	*	*	*	*	-	*	*	-	-	*
MW15-03	MW15-03-150311	2015 03 11/12	< 0.5	< 0.5	< 0.5	< 1	< 0.5	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 1
	MW15-03-20200922/23	2020 09 22/23	< 0.5	< 0.5	< 0.5	< 0.7	< 0.5	-	-	< 200	< 200	< 200	< 100	< 200	< 200	< 200	< 1
MW15-04	MW15-04-150311	2015 03 11/12	< 0.5	< 0.5	< 0.5	< 1	< 0.5	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 1
MW15-05	MW15-05-150311	2015 03 11/12	< 0.5	< 0.5	< 0.5	< 1	< 0.5	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 1
MW15-06	MW15-06-200212/13	2020 02 12/13	< 0.5	< 0.5	< 0.5	< 1	< 0.5	< 100	< 100	< 200	< 200	< 200	< 100	< 200	-	-	-
	MW20-A-200212	Duplicate	< 0.5	< 0.5	< 0.5	< 1	< 0.5	< 100	< 100	< 200	< 200	< 200	< 100	< 200	-	-	-
	QA/QC RPD%		*	*	*	*	*	*	*	*	*	*	*	*	-	-	-
MW20-07	MW20-07-200302/03	2020 03 02/03	< 0.5	< 0.5	< 0.5	< 1	< 0.5	< 100	< 100	< 200	< 200	< 200	< 100	< 200	-	-	-
MW20-08	MW20-08-200302/03	2020 03 02/03	< 0.5	< 0.5	< 0.5	< 1	< 0.5	< 100	< 100	< 200	< 200	< 200	< 100	< 200	-	-	-
	MW20-08-20200923	2020 09 23	< 0.5	< 0.5	< 0.5	< 0.7	< 0.5	-	-	< 200	< 200	< 200	< 100	< 200	< 200	< 200	< 1
MW20-09	MW20-09-200302/03	2020 03 02/03	< 0.5	< 0.5	< 0.5	< 1	-	< 100	< 100	< 200	< 200	< 200	< 100	< 200	-	-	-
MW20-10	MW20-10-200302	2020 03 02	< 0.5	< 0.5	< 0.5	< 1	-	< 100	< 100	-	-	-	< 100	-	-	-	-
MW20-11	MW20-11-200303	2020 03 02	< 0.5	< 0.5	< 0.5	< 1	-	< 100	< 100	-	-	-	< 100	-	-	-	-
MW20-12	MW20-12-200302/03	2020 03 02/03	< 0.5	< 0.5	< 0.5	< 1	-	< 100	< 100	< 200	< 200	< 200	< 100	< 200	-	-	-
MW20-17	MW20-17-201221	2020 12 21	< 0.5	< 0.5	< 0.5	< 1	-	< 100	< 100	-	-	-	< 100	-	-	-	-
Federal Guideline																	
Canadian Drinking Water Quality Guidelines (CDWQG)[c]			5	1.6	24	20	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	15
FIGWQG Tier 2 Residential Land Use (RL)[a]			140	16,000	83	3,900	72	n/a	n/a	n/a	n/a	n/a	810	1,300	n/a	n/a	340
FIGWQG Tier 2 Industrial Land Use (IL)[a]			690	41,000	83	18,000	72	n/a	n/a	n/a	n/a	n/a	9,100	1,300	n/a	n/a	4,300
BC Standard																	
CSR Drinking Water (DW)			5	140	60	90	800	15,000[c]	n/a	5,000[c]	n/a	n/a	n/a	n/a	n/a	n/a	95
CSR Aquatic Life (AW)[b]			400	2,000	5	300	720	15,000[c]	1,500	5,000[c]	500	n/a	n/a	n/a	n/a	n/a	34,000

Associated AGAT file(s): 15V953496, 20V574597, 20V581132, 20V655154, 20V679305, 20V694422.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[b] Standard to protect freshwater aquatic life.
[c] Applicable at all sites irrespective of water use.

TABLE 9: Summary of Analytical Results for Groundwater - Polycyclic Aromatic Hydrocarbons

Sample Location		MW15-01			MW15-02					Federal Guideline			BC Standard	
Sample ID		MW15-01-150312	MW15-01-200213	MW15-01-20200923	MW15-02-150312	MW15-A-150312	MW15-02-200213	MW15-02-20200923	MW15-02-201117	Canadian Drinking Water Quality Guidelines (CDWQG)	FIGWQG Tier 2 Residential Land Use (RL)[b]	FIGWQG Tier 2 Industrial Land Use (IL)[b]	CSR Drinking Water (DW)	CSR Aquatic Life (AW)[c]
Sample Date (yyyy mm dd)		2015 03 12	2020 02 13	2020 09 23	2015 03 12	2015 03 12	2020 02 13	2020 09 23	2020 11 17					
Parameter	**Units**	**Analytical Results**												
Polycyclic Aromatic Hydrocarbons														
Naphthalene	µg/L	< 0.05	< 0.05	< 0.05	*2.36*	*2*	*2.76*	*2.68*	0.79	n/a	1.1	1.1	80	10
Methylnaphthalene, 1-	µg/L	-	< 0.05	< 0.05	-	-	0.65	0.90	0.48	n/a	180	180	5.5	n/a
Methylnaphthalene, 2-	µg/L	-	< 0.05	< 0.05	-	-	0.34	0.60	0.20	n/a	180	180	15	n/a
Acenaphthylene	µg/L	< 0.02	< 0.02	< 0.02	0.05	0.05	< 0.02	0.03	< 0.02	n/a	46	46	n/a	n/a
Acenaphthene	µg/L	< 0.02	< 0.02	< 0.02	0.29	0.25	0.17	0.30	0.19	n/a	5.8	5.8	250	60
Fluorene	µg/L	< 0.02	< 0.02	< 0.02	0.28	0.27	0.09	0.25	0.17	n/a	3	3	150	120
Phenanthrene	µg/L	< 0.04	< 0.04	< 0.04	*0.48*	*0.47*	0.20	*0.63*	0.32	n/a	0.4	0.4	n/a	3
Anthracene	µg/L	< 0.01	< 0.01	< 0.01	*0.07*	*0.07*	*0.04*	*0.08*	*0.06*	n/a	0.012	0.012	1,000	1
Acridine	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	< 0.05	n/a	0.05	0.05	n/a	0.5
Fluoranthene	µg/L	< 0.02	< 0.02	< 0.02	*0.15*	*0.15*	0.04	*0.19*	*0.05*	n/a	0.04	0.04	150	2
Pyrene	µg/L	< 0.02	< 0.02	< 0.02	*0.17*	*0.17*	*0.04*	*0.21*	*0.06*	n/a	0.025	0.025	100	0.2
Benz(a)anthracene	µg/L	< 0.01	< 0.01	< 0.01	*0.06*	*0.06*	< 0.01	*0.06*	*0.02*	n/a	0.018	0.018	0.07	1
Chrysene	µg/L	< 0.01	< 0.01	< 0.01	0.07	0.06	< 0.01	0.08	0.03	n/a	1.4	1.4	7	1
Benzo(b)fluoranthene	µg/L	< 0.01	< 0.01	< 0.01	0.05	0.04	< 0.01	0.04	0.02	n/a	0.48	0.48	0.07	n/a
Benzo(j)fluoranthene	µg/L	< 0.01	< 0.01	< 0.01	0.03	0.03	< 0.01	0.03	0.01	n/a	0.48	0.48	0.07	n/a
Benzo(b+j)fluoranthene	µg/L	< 0.01	< 0.01	< 0.01	0.08	0.07	< 0.01	0.07	0.03	n/a	0.48	0.48	0.07	n/a
Benzo(k)fluoranthene	µg/L	< 0.01	< 0.01	< 0.01	0.03	0.03	< 0.01	0.03	0.02	n/a	0.48	0.48	n/a	n/a
Benzo(a)pyrene	µg/L	< 0.01	< 0.01	< 0.01	***0.08***	***0.07***	< 0.01	***0.06***	*0.03*	0.04	0.015	0.015	0.01	0.1
Indeno(1,2,3-cd)pyrene	µg/L	< 0.01	< 0.01	< 0.01	0.04	0.04	< 0.01	0.03	0.02	n/a	0.21	0.21	n/a	n/a
Dibenz(a,h)anthracene	µg/L	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01	0.01	< 0.01	n/a	0.26	0.26	0.01	n/a
Benzo(g,h,i)perylene	µg/L	< 0.01	< 0.01	< 0.01	0.04	0.04	< 0.01	0.04	0.02	n/a	0.17	0.17	n/a	n/a
Quinoline	µg/L	< 0.1[a]	< 0.05	< 0.05	< 0.1[a]	< 0.1[a]	< 0.05	< 0.05	< 0.05	n/a	3.4	3.4	0.05	34

Associated AGAT file(s): 15V953496, 20V574597, 20V581132, 20V655154, 20V679305, 21V702176.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Laboratory detection limit exceeds regulatory standard/guideline.
[b] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[c] Standard to protect freshwater aquatic life.

TABLE 9: Summary of Analytical Results for Groundwater - Polycyclic Aromatic Hydrocarbons

Sample Location		MW20-02(D)					MW20-02(2D)				Federal Guideline			BC Standard	
Sample ID		MW20-02(D)-200303	MW20-A-200303	QA/QC	MW20-02(D)-20200923	MW20-02(D)-201117	MW20-02(2D)-200303	MW20-02(2D)-20200923	MW20-A-20200923	QA/QC	Canadian Drinking Water Quality Guidelines (CDWQG)	FIGWQG Tier 2 Residential Land Use (RL)[b]	FIGWQG Tier 2 Industrial Land Use (IL)[b]	CSR Drinking Water (DW)	CSR Aquatic Life (AW)[c]
Sample Date (yyyy mm dd)		2020 03 03	Duplicate	RPD %	2020 09 23	2020 11 17	2020 03 03	2020 09 23	Dupilcate	RPD %					
Parameter	**Units**	**Analytical Results**													
Polycyclic Aromatic Hydrocarbons															
Naphthalene	µg/L	*5.14*	*4.96*	4	*1.11*	0.38	0.08	< 0.05	< 0.05	*	n/a	1.1	1.1	80	10
Methylnaphthalene, 1-	µg/L	1.06	0.98	8	0.45	0.12	< 0.05	< 0.05	< 0.05	*	n/a	180	180	5.5	n/a
Methylnaphthalene, 2-	µg/L	0.60	0.54	11	0.23	< 0.05	< 0.05	< 0.05	< 0.05	*	n/a	180	180	15	n/a
Acenaphthylene	µg/L	0.03	0.03	*	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	*	n/a	46	46	n/a	n/a
Acenaphthene	µg/L	0.23	0.21	9	0.13	0.06	< 0.02	< 0.02	< 0.02	*	n/a	5.8	5.8	250	60
Fluorene	µg/L	0.13	0.13	0	0.09	0.04	< 0.02	< 0.02	< 0.02	*	n/a	3	3	150	120
Phenanthrene	µg/L	0.08	0.10	*	0.16	< 0.04	< 0.04	< 0.04	< 0.04	*	n/a	0.4	0.4	n/a	3
Anthracene	µg/L	*0.03*	*0.02*	*	*0.03*	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.012	0.012	1,000	1
Acridine	µg/L	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	n/a	0.05	0.05	n/a	0.5
Fluoranthene	µg/L	0.03	0.03	*	*0.07*	< 0.02	< 0.02	< 0.02	< 0.02	*	n/a	0.04	0.04	150	2
Pyrene	µg/L	*0.03*	*0.03*	*	*0.07*	< 0.02	< 0.02	< 0.02	< 0.02	*	n/a	0.025	0.025	100	0.2
Benz(a)anthracene	µg/L	< 0.01	0.01	*	*0.02*	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.018	0.018	0.07	1
Chrysene	µg/L	0.01	0.01	*	0.03	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	1.4	1.4	7	1
Benzo(b)fluoranthene	µg/L	0.01	0.02	*	0.02	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.48	0.48	0.07	n/a
Benzo(j)fluoranthene	µg/L	0.01	0.02	*	0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.48	0.48	0.07	n/a
Benzo(b+j)fluoranthene	µg/L	0.02	0.04	*	0.03	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.48	0.48	0.07	n/a
Benzo(k)fluoranthene	µg/L	0.01	0.01	*	0.02	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.48	0.48	n/a	n/a
Benzo(a)pyrene	µg/L	*0.02*	*0.02*	*	*0.02*	< 0.01	< 0.01	< 0.01	< 0.01	*	0.04	0.015	0.015	0.01	0.1
Indeno(1,2,3-cd)pyrene	µg/L	0.01	0.01	*	0.02	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.21	0.21	n/a	n/a
Dibenz(a,h)anthracene	µg/L	< 0.01	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.26	0.26	0.01	n/a
Benzo(g,h,i)perylene	µg/L	0.01	0.01	*	0.02	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.17	0.17	n/a	n/a
Quinoline	µg/L	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	n/a	3.4	3.4	0.05	34

Associated AGAT file(s): 15V953496, 20V574597, 20V581132, 20V655154, 20V679305, 21V702176.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Laboratory detection limit exceeds regulatory standard/guideline.
[b] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[c] Standard to protect freshwater aquatic life.

TABLE 9: Summary of Analytical Results for Groundwater - Polycyclic Aromatic Hydrocarbons

Sample Location		MW20-02(2D)			MW15-03		MW15-04	MW15-05	MW15-06			Federal Guideline			BC Standard	
Sample ID		MW20-02(2D)-2020 11 17	MW20-A-201117 Duplicate	QA/QC RPD %	MW15-03-150312	MW15-03-20200923	MW15-04-150312	MW15-05-150312	MW15-06-200213	MW20-A-200213 Duplicate	QA/QC RPD %	Canadian Drinking Water Quality Guidelines (CDWQG)	FIGWQG Tier 2 Residential Land Use (RL)[b]	FIGWQG Tier 2 Industrial Land Use (IL)[b]	CSR Drinking Water (DW)	CSR Aquatic Life (AW)[c]
Sample Date (yyyy mm dd)					2015 03 12	2020 09 23	2015 03 12	2015 03 12	2020 02 13							
Parameter	**Units**	**Analytical Results**			**Analytical Results**											
Polycyclic Aromatic Hydrocarbons																
Naphthalene	µg/L	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	n/a	1.1	1.1	80	10
Methylnaphthalene, 1-	µg/L	< 0.05	< 0.05	*	-	< 0.05	-	-	< 0.05	< 0.05	*	n/a	180	180	5.5	n/a
Methylnaphthalene, 2-	µg/L	< 0.05	< 0.05	*	-	< 0.05	-	-	< 0.05	< 0.05	*	n/a	180	180	15	n/a
Acenaphthylene	µg/L	< 0.02	< 0.02	*	< 0.02	< 0.02	0.02	< 0.02	< 0.02	< 0.02	*	n/a	46	46	n/a	n/a
Acenaphthene	µg/L	< 0.02	< 0.02	*	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	*	n/a	5.8	5.8	250	60
Fluorene	µg/L	< 0.02	< 0.02	*	< 0.02	< 0.02	0.03	< 0.02	< 0.02	< 0.02	*	n/a	3	3	150	120
Phenanthrene	µg/L	< 0.04	< 0.04	*	< 0.04	< 0.04	0.06	< 0.04	< 0.04	< 0.04	*	n/a	0.4	0.4	n/a	3
Anthracene	µg/L	< 0.01	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.012	0.012	1,000	1
Acridine	µg/L	< 0.05	< 0.05	*	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	n/a	0.05	0.05	n/a	0.5
Fluoranthene	µg/L	< 0.02	< 0.02	*	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	*	n/a	0.04	0.04	150	2
Pyrene	µg/L	< 0.02	< 0.02	*	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	*	n/a	0.025	0.025	100	0.2
Benz(a)anthracene	µg/L	< 0.01	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.018	0.018	0.07	1
Chrysene	µg/L	< 0.01	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	1.4	1.4	7	1
Benzo(b)fluoranthene	µg/L	< 0.01	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.48	0.48	0.07	n/a
Benzo(j)fluoranthene	µg/L	< 0.01	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.48	0.48	0.07	n/a
Benzo(b+j)fluoranthene	µg/L	< 0.01	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.48	0.48	0.07	n/a
Benzo(k)fluoranthene	µg/L	< 0.01	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.48	0.48	n/a	n/a
Benzo(a)pyrene	µg/L	< 0.01	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	0.04	0.015	0.015	0.01	0.1
Indeno(1,2,3-cd)pyrene	µg/L	< 0.01	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.21	0.21	n/a	n/a
Dibenz(a,h)anthracene	µg/L	< 0.01	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.26	0.26	0.01	n/a
Benzo(g,h,i)perylene	µg/L	< 0.01	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	0.17	0.17	n/a	n/a
Quinoline	µg/L	< 0.05	< 0.05	*	< 0.1[a]	< 0.05	< 0.1[a]	< 0.1[a]	< 0.05	< 0.05	*	n/a	3.4	3.4	0.05	34

Associated AGAT file(s): 15V953496, 20V574597, 20V581132, 20V655154, 20V679305, 21V702176.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Laboratory detection limit exceeds regulatory standard/guideline.
[b] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[c] Standard to protect freshwater aquatic life.

TABLE 9: Summary of Analytical Results for Groundwater - Polycyclic Aromatic Hydrocarbons

Sample Location		MW20-07	MW20-08		MW20-09	MW20-12	MW20-17	Federal Guideline			BC Standard	
Sample ID		MW20-07-200303	MW20-08-200303	MW20-08-20200923	MW20-09-200303	MW20-12-200303	MW20-17-210119	Canadian Drinking Water Quality Guidelines (CDWQG)	FIGWQG Tier 2 Residential Land Use (RL)[b]	FIGWQG Tier 2 Industrial Land Use (IL)[b]	CSR Drinking Water (DW)	CSR Aquatic Life (AW)[c]
Sample Date (yyyy mm dd)		2020 03 03	2020 03 03	2020 09 23	2020 03 03	2020 03 03	2021 01 19					
Parameter	**Units**	**Analytical Results**										
Polycyclic Aromatic Hydrocarbons												
Naphthalene	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	n/a	1.1	1.1	80	10
Methylnaphthalene, 1-	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	n/a	180	180	5.5	n/a
Methylnaphthalene, 2-	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	n/a	180	180	15	n/a
Acenaphthylene	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	n/a	46	46	n/a	n/a
Acenaphthene	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	n/a	5.8	5.8	250	60
Fluorene	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	n/a	3	3	150	120
Phenanthrene	µg/L	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	n/a	0.4	0.4	n/a	3
Anthracene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	n/a	0.012	0.012	1,000	1
Acridine	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	n/a	0.05	0.05	n/a	0.5
Fluoranthene	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	n/a	0.04	0.04	150	2
Pyrene	µg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	n/a	0.025	0.025	100	0.2
Benz(a)anthracene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	n/a	0.018	0.018	0.07	1
Chrysene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	n/a	1.4	1.4	7	1
Benzo(b)fluoranthene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	n/a	0.48	0.48	0.07	n/a
Benzo(j)fluoranthene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	n/a	0.48	0.48	0.07	n/a
Benzo(b+j)fluoranthene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	n/a	0.48	0.48	0.07	n/a
Benzo(k)fluoranthene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	n/a	0.48	0.48	n/a	n/a
Benzo(a)pyrene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.04	0.015	0.015	0.01	0.1
Indeno(1,2,3-cd)pyrene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	n/a	0.21	0.21	n/a	n/a
Dibenz(a,h)anthracene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	n/a	0.26	0.26	0.01	n/a
Benzo(g,h,i)perylene	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	n/a	0.17	0.17	n/a	n/a
Quinoline	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	n/a	3.4	3.4	0.05	34

Associated AGAT file(s): 15V953496, 20V574597, 20V581132, 20V655154, 20V679305, 21V702176.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Laboratory detection limit exceeds regulatory standard/guideline.
[b] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[c] Standard to protect freshwater aquatic life.

TABLE 10: Summary of Analytical Results for Groundwater - Dissolved Metals

Sample Location		MW15-01				MW15-02						MW20-02(D)			Federal Guideline			BC Standard	
Sample ID		MW15-01-150311	MW15-01-200212	MW15-01-20200923	MW15-01-201117	MW15-02-150311	MW15-A-150311	QA/QC	MW15-02-200212	MW15-02-20200923	MW15-02-201117	MW20-02(D)-200302	MW20-A-200302	QA/QC	Canadian Drinking Water Quality Guidelines (CDWQG)	FIGWQG Tier 2 Residential Land Use (RL)[a]	FIGWQG Tier 2 Industrial Land Use (IL)[a]	CSR Drinking Water (DW)	CSR Aquatic Life (AW)[b]
Sample Date (yyyy mm dd)		2015 03 11	2020 02 12	2020 09 23	2020 11 17	2015 03 11	Duplicate	RPD %	2020 02 12	2020 09 23	2020 11 17	2020 03 02	Duplicate	RPD %					
Parameter	Units	Analytical Results				Analytical Results													
Physical Parameters																			
pH (field)	pH	8.5	8.63	***6.7***	***6.16***	***10.9***	***10.9***	*	***10.64***	***11.5***	***11.96***	***11.52***	***11.52***	0	7.0 - 10.5	6.5 - 9	6.5 - 9	n/a	n/a
Hardness	mg/L	110	133	114	118	172	173	1	140	161	114	55	58	5	n/a	n/a	n/a	n/a	n/a
Geochemical Indicators																			
Dissolved Aluminum	µg/L	5	< 2	< 2	< 2	***1,560***	***1,860***	18	***866***	***1,770***	***1,590***	***3,120***	***3,410***	9	100	5 - 100[g]	5 - 100[g]	9,500	n/a
Dissolved Calcium	mg/L	30.2	34.3	29.5	30.6	68.8	69.2	1	54.4	64.4	45.7	21.9	23.1	5	n/a	n/a	n/a	n/a	n/a
Dissolved Iron	µg/L	< 10	< 10	16	< 10	< 10	< 10	*	14	51	14	21	21	*	300	300	300	n/a	n/a
Dissolved Magnesium	mg/L	8.5	11.4	9.78	10.1	0.123	0.121	*	1.03	0.119	0.092	0.077	0.074	*	n/a	n/a	n/a	n/a	n/a
Dissolved Manganese	µg/L	**130**	< 1	< 1	< 1	< 1	< 1	*	5	5	1	1	< 1	*	20	n/a	n/a	n/a	n/a
Dissolved Potassium	mg/L	-	0.183	0.136	0.125	-	-	-	11.4	8	10.1	3.81	4.17	9	n/a	n/a	n/a	n/a	n/a
Dissolved Sodium	mg/L	7.79	8.44	6.52	7.01	29.8	30.7	3	73.4	37	43	62.7	66.1	5	200	n/a	n/a	200	n/a
Dissolved Metals																			
Antimony	µg/L	< 0.2	< 0.2	< 0.2	< 0.2	2.3	2.3	0	4.3	2.1	**8.2**	2.2	2.1	5	6	2,000	2,000	6	90
Arsenic	µg/L	0.1	< 0.1	< 0.1	< 0.1	1.9	1.8	5	1.9	1.3	1.9	***8.6***	***8.3***	4	10	5	5	10	50
Barium	µg/L	2.1	1.5	1.9	2.0	8.7	8.8	1	13.3	17.1	19.2	5.4	5.2	4	2,000	2,900	2,900	1,000	10,000
Beryllium	µg/L	< 0.01	< 0.01	< 0.01	0.06	< 0.01	< 0.01	*	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	n/a	5.3	5.3	8	1.5
Boron	µg/L	18	17	15	10	64	62	3	205	87	85	33	34	3	5,000	1,500	1,500	5,000	12,000
Cadmium	µg/L														7	0.04 - 0.37[f]	0.04 - 0.37[f]	5	0.5 (H 0-<30)
												< 0.01	< 0.01	*					1.5 (H >30-<90)
		0.03	< 0.01	< 0.01	< 0.01				< 0.01		< 0.01								2.5 (H >90-<150)
						< 0.01	< 0.01	*		< 0.01									3.5 (H >150-<210)
																			4 (H >=210)
Chromium	µg/L	< 0.5	0.7	< 0.5	0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	50	8.9	8.9	50[d]	10[d]
Cobalt	µg/L	0.42	< 0.05	< 0.05	< 0.05	0.11	0.1	*	0.32	0.10	0.12	0.30	0.23	*	n/a	n/a	n/a	20[e]	40
Copper	µg/L														1,000	2 - 4[f]	2 - 4[f]	1,500	20 (H <50)
												14.8	***17.2***	15					30 (H >50-<75)
																			40 (H >75-<100)
		0.8		0.3	0.4						***8.2***								50 (H >100-<125)
			< 0.2						***13.6***										60 (H >125-<150)
						< 0.2	< 0.2	*		1.4									70 (H >150-<175)
																			80 (H >175-<200)
																			90 (H >=200)
Lead	µg/L														5	1 - 7[f]	1 - 7[f]	10	40 (H<50)
												0.21	0.18	*					50 (H 50-<100)
		< 0.05	< 0.05	< 0.05	< 0.05	0.22	0.24	*	3.91	3.87	***13.9***								60 (H 100-<200)
																			110 (H 200-<300)
																			160 (H>=300)
Lithium	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	n/a	n/a	n/a	8	n/a
Mercury	µg/L	< 0.01	< 0.01	< 0.01	-	0.02	0.02	*	< 0.01	0.01	-	< 0.01	< 0.01	*	1	0.026	0.026	1	0.25
Molybdenum	µg/L	0.23	0.19	0.08	0.09	1.63	1.58	3	3.34	2.44	4.03	20.8	22.1	6	n/a	73	73	250	10,000
Nickel	µg/L											15.2	16.0	5	n/a	25 - 150[f]	25 - 150[f]	80	250 (H 0-<60)
		3.3		< 0.2	< 0.2						10.8								650 (H 60-<120)
			0.3			6.1	6	2	15.8	7.7									1,100 (H 120-<180)
																			1,500 (H >=180)
Selenium	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	***2.8***	***2.9***	4	50	1	1	10	20
Silver	µg/L											< 0.02	< 0.02	*	n/a	0.25	0.25	20	0.5 (H <=100)
		< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	*	< 0.02	< 0.02	< 0.02								15 (H >100)
Strontium	µg/L	-	85.6	-	72.6	-	-	-	192	-	193	59.6	58.0	3	n/a	n/a	n/a	2,500	n/a
Thallium	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	< 0.01	< 0.01	0.02	< 0.01	< 0.01	*	n/a	0.8	0.8	n/a	3
Tin	µg/L	-	0.06	-	0.07	-	-	-	< 0.05	-	0.20	0.16	0.18	*	n/a	n/a	n/a	2,500	n/a
Titanium	µg/L	1.4	1.8	1.2	0.8	1.2	1.3	*	1.6	2.1	< 0.5	0.5	0.5	*	n/a	100	100	n/a	1,000
Uranium	µg/L	0.02	0.02	< 0.01	< 0.01	< 0.01	< 0.01	*	0.07	0.01	< 0.01	0.02	0.01	*	20	15	15	20	85
Vanadium	µg/L	0.8	0.9	1.0	< 0.5	9.9	10	1	19.0	25.7	116	65.1	70.4	8	n/a	n/a	n/a	20	n/a
Zinc	µg/L											< 2	< 2	*	5,000	30	30	3,000	75 (H 0-<90)
																			150 (H 90-<100)
		< 2	< 2	3	< 2	< 2	< 2	*	< 2	2	< 2								900 (H 100-<200)
																			1,650 (H 200-<300)
																			2,400 (H 300-<400)

Associated AGAT file(s): 15V953496, 20V574597, 20V581132, 20V655154, 20V679305, 20V694422.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[b] Standard to protect freshwater aquatic life.
[c] Field pH not measured but assumed to be ≥ 6.5 based on other pH values.
[d] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[e] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[f] Guideline is hardness dependent.
[g] Guideline is pH dependent.

TABLE 10: Summary of Analytical Results for Groundwater - Dissolved Metals

Sample Location		MW20-02(D)		MW20-02(2D)							MW15-03			Federal Guideline			BC Standard	
Sample ID		MW20-02(D)-2020 09 23	MW20-02(D)-2020 11 16	MW20-02(2D)-2020 03 02	MW20-02(2D)-2020 09 23	MW20-A-20200923 Duplicate	QA/QC RPD %	MW20-02(2D)-2020 11 16	MW20-A-201116 Duplicate	QA/QC RPD %	MW15-03-150311 2015 03 11	MW15-03-20200922 2020 09 22	MW15-03-201117 2020 11 17	Canadian Drinking Water Quality Guidelines (CDWQG)	FIGWQG Tier 2 Residential Land Use (RL)[a]	FIGWQG Tier 2 Industrial Land Use (IL)[a]	CSR Drinking Water (DW)	CSR Aquatic Life (AW)[b]
Sample Date (yyyy mm dd)																		
Parameter	Units	Analytical Results																
Physical Parameters																		
pH (field)	pH	***10.2***	8.84	***9.17***	***6.5***	***6.5***	-	7.58	7.58	0	7.6	***6.4***	***5.95***	7.0 - 10.5	6.5 - 9	6.5 - 9	n/a	n/a
Hardness	mg/L	46.7	163	308	352	353	0	310	311	0	125	50.5	96.4	n/a	n/a	n/a	n/a	n/a
Geochemical Indicators																		
Dissolved Aluminum	µg/L	***668***	47	7	< 2	< 2	*	5	< 2	*	6	< 2	< 2	100	5 - 100[g]	5 - 100[g]	9,500	n/a
Dissolved Calcium	mg/L	18.7	53.9	84.6	95.6	95.6	0	82.5	82.6	0	41.8	14.8	29.3	n/a	n/a	n/a	n/a	n/a
Dissolved Iron	µg/L	22	< 10	< 10	< 10	< 10	*	139	140	1	< 10	< 10	< 10	300	300	300	n/a	n/a
Dissolved Magnesium	mg/L	< 0.05	6.9	23.6	27.6	27.7	0	25.3	25.5	1	5.01	3.3	5.65	n/a	n/a	n/a	n/a	n/a
Dissolved Manganese	µg/L	2	**315**	**266**	**2,160**	**2,150**	0	**1,160**	**1,160**	0	**108**	< 1	1	20	n/a	n/a	n/a	n/a
Dissolved Potassium	mg/L	3.01	3.55	2.45	1.51	1.56	3	1.31	1.33	2	-	0.319	0.533	n/a	n/a	n/a	n/a	n/a
Dissolved Sodium	mg/L	44.1	32.3	44.8	32.6	32.7	0	27.7	27.4	1	9.65	14.8	4.5	200	n/a	n/a	200	n/a
Dissolved Metals																		
Antimony	µg/L	1.5	0.7	0.5	0.5	0.4	*	0.4	0.3	*	< 0.2	< 0.2	< 0.2	6	2,000	2,000	6	90
Arsenic	µg/L	***14.9***	2.8	1.0	***5.5***	***6.4***	15	4.0	2.3	54	0.4	< 0.1	0.1	10	5	5	10	50
Barium	µg/L	5.2	24.1	62.2	68.7	68.8	0	83.4	80.9	3	20.8	4.7	6.6	2,000	2,900	2,900	1,000	10,000
Beryllium	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	*	0.08	0.03	*	< 0.01	< 0.01	0.02	n/a	5.3	5.3	8	1.5
Boron	µg/L	28	29	89	48	48	0	55	57	4	19	14	19	5,000	1,500	1,500	5,000	12,000
Cadmium	µg/L													7	0.04 - 0.37[f]	0.04 - 0.37[f]	5	0.5 (H 0-<30)
		0.02										< 0.01						1.5 (H >30-<90)
											0.02		< 0.01					2.5 (H >90-<150)
			< 0.01															3.5 (H >150-<210)
				< 0.01	0.05	0.06	18	< 0.01	< 0.01	*								4 (H >=210)
Chromium	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	50	8.9	8.9	50[d]	10[d]
Cobalt	µg/L	0.21	0.77	1.11	5.28	5.28	0	1.38	1.29	7	0.11	< 0.05	< 0.05	n/a	n/a	n/a	20[e]	40
Copper	µg/L	***3.8***												1,000	2 - 4[f]	2 - 4[f]	1,500	20 (H <50)
												0.2						30 (H >50-<75)
													1.4					40 (H >75-<100)
																		50 (H >100-<125)
											0.9							60 (H >125-<150)
			1.2															70 (H >150-<175)
																		80 (H >175-<200)
				0.7	< 0.2	0.3	*	0.5	0.2	*								90 (H >=200)
Lead	µg/L	< 0.05												5	1 - 7[f]	1 - 7[f]	10	40 (H<50)
												0.07	< 0.05					50 (H 50-<100)
			< 0.05								< 0.05							60 (H 100-<200)
																		110 (H 200-<300)
				< 0.05	< 0.05	0.12	*	< 0.05	< 0.05	*								160 (H>=300)
Lithium	µg/L	< 0.5	1.1	7.6	5.5	5.4	2	4.3	4.2	2	1.1	0.6	< 0.5	n/a	n/a	n/a	8	n/a
Mercury	µg/L	0.01	-	< 0.01	< 0.01	< 0.01	*	-	-	-	< 0.01	< 0.01	-	1	0.026	0.026	1	0.25
Molybdenum	µg/L	23.5	6.07	23.4	18.8	19.3	3	8.34	8.60	3	0.23	0.37	< 0.05	n/a	73	73	250	10,000
Nickel	µg/L	6.4										< 0.2		n/a	25 - 150[f]	25 - 150[f]	80	250 (H 0-<60)
													0.3					650 (H 60-<120)
			5.4								0.9							1,100 (H 120-<180)
				2.6	16.4	15.7	4	3.2	2.9	10								1,500 (H >=180)
Selenium	µg/L	***1.1***	< 0.5	***2.2***	0.8	0.9	*	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	50	1	1	10	20
Silver	µg/L	< 0.02				< 0.02	*					< 0.02	< 0.02	n/a	0.25	0.25	20	0.5 (H <=100)
			< 0.02	< 0.02	< 0.02			< 0.02	< 0.02	*	< 0.02							15 (H >100)
Strontium	µg/L	-	200	193	-	-	-	207	204	1	-	-	91.3	n/a	n/a	n/a	2,500	n/a
Thallium	µg/L	0.01	0.03	< 0.01	0.08	0.08	0	0.02	0.01	*	0.01	< 0.01	0.01	n/a	0.8	0.8	n/a	3
Tin	µg/L	-	0.06	0.31	-	-	-	0.18	0.15	*	-	-	< 0.05	n/a	n/a	n/a	2,500	n/a
Titanium	µg/L	1.2	0.8	0.8	1.7	2.0	*	2.2	1.5	*	0.9	1.2	1.4	n/a	100	100	n/a	1,000
Uranium	µg/L	1.08	1.20	2.00	2.44	2.42	1	0.99	1.05	6	0.18	< 0.01	< 0.01	20	15	15	20	85
Vanadium	µg/L	30.5	6.6	< 0.5	1.6	1.5	*	1.8	0.7	*	< 0.5	0.6	< 0.5	n/a	n/a	n/a	20	n/a
Zinc	µg/L	< 1										4		5,000	30	30	3,000	75 (H 0-<90)
													31					150 (H 90-<100)
			< 2								< 2							900 (H 100-<200)
																		1,650 (H 200-<300)
				< 2	1	1	*	< 2	< 2	*								2,400 (H 300-<400)

Associated AGAT file(s): 15V953496, 20V574597, 20V581132, 20V655154, 20V679305, 20V694422.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[b] Standard to protect freshwater aquatic life.
[c] Field pH not measured but assumed to be ≥ 6.5 based on other pH values.
[d] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[e] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[f] Guideline is hardness dependent.
[g] Guideline is pH dependent.

TABLE 10: Summary of Analytical Results for Groundwater - Dissolved Metals

Sample Location		MW15-04			MW15-05			MW15-06					MW20-06R	Federal Guideline			BC Standard	
Sample ID		MW15-04-150311	MW15-04-20200923	MW15-04-201117	MW15-05-150311	MW15-05-20200922	MW15-05-201117	MW15-06-200212	MW20-A-200212	QA/QC	MW15-06-20200923	MW15-06-201116	MW20-06R-200302	Canadian Drinking Water Quality Guidelines (CDWQG)	FIGWQG Tier 2 Residential Land Use (RL)[a]	FIGWQG Tier 2 Industrial Land Use (IL)[a]	CSR Drinking Water (DW)	CSR Aquatic Life (AW)[b]
Sample Date (yyyy mm dd)		2015 03 11	2020 09 23	2020 11 17	2015 03 11	2020 09 22	2020 11 17	2020 02 12	Duplicate	RPD %	2020 09 23	2020 11 16	2020 03 02					
Parameter	Units	Analytical Results																
Physical Parameters																		
pH (field)	pH	-	7.0	***6.27***	8.7	*6.6*	***6.32***	7.57	7.57	0	7.1	*6.94*	*10.06*	7.0 - 10.5	6.5 - 9	6.5 - 9	n/a	n/a
Hardness	mg/L	89	83.2	69.7	160	106	41.9	120	116	3	225	118	95.9	n/a	n/a	n/a	n/a	n/a
Geochemical Indicators																		
Dissolved Aluminum	µg/L	11[c]	5	< 2	8	< 2	*21*	59	71	18	< 2	< 2	25	100	5 - 100[g]	5 - 100[g]	9,500	n/a
Dissolved Calcium	mg/L	30	28.6	22.3	52.4	31.9	12.8	39.9	38.6	3	74.4	39	30.4	n/a	n/a	n/a	n/a	n/a
Dissolved Iron	µg/L	< 10	< 10	30	< 10	< 10	15	94	112	17	< 10	< 10	18	300	300	300	n/a	n/a
Dissolved Magnesium	mg/L	3.42	2.85	3.41	6.96	6.35	2.41	4.94	4.79	3	9.51	5.11	4.86	n/a	n/a	n/a	n/a	n/a
Dissolved Manganese	µg/L	**192**	**85**	**151**	**92**	8	< 1	**68**	**70**	3	**63**	**45**	**49**	20	n/a	n/a	n/a	n/a
Dissolved Potassium	mg/L	-	0.589	0.358	-	0.623	0.31	1.12	1.06	6	1.64	0.859	0.993	n/a	n/a	n/a	n/a	n/a
Dissolved Sodium	mg/L	39.7	8.82	7.54	19	17.7	11.7	13.3	13.1	2	15	7.08	9.73	200	n/a	n/a	200	n/a
Dissolved Metals																		
Antimony	µg/L	< 0.2	< 0.2	< 0.2	0.4	< 0.2	< 0.2	< 0.2	< 0.2	*	< 0.2	< 0.2	< 0.2	6	2,000	2,000	6	90
Arsenic	µg/L	0.6	2.9	0.7	0.6	< 0.1	0.1	0.9	0.9	0	0.5	0.4	2.9	10	5	5	10	50
Barium	µg/L	8.3	4.1	5.0	21.4	24.4	6.1	56.3	58.0	3	126	45.0	17.2	2,000	2,900	2,900	1,000	10,000
Beryllium	µg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	*	< 0.01	0.04	< 0.01	n/a	5.3	5.3	8	1.5
Boron	µg/L	35	35	16	31	13	9	21	20	5	33	11	28	5,000	1,500	1,500	5,000	12,000
Cadmium	µg/L													7	0.04 - 0.37[f]	0.04 - 0.37[f]	5	0.5 (H 0-<30)
		< 0.01	< 0.01	< 0.01			0.01											1.5 (H >30-<90)
						< 0.01		0.03	0.05	*		< 0.01	< 0.01					2.5 (H >90-<150)
					0.01													3.5 (H >150-<210)
											0.07							4 (H >=210)
Chromium	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	50	8.9	8.9	50[d]	10[d]
Cobalt	µg/L	0.47	< 0.05	0.08	0.38	< 0.05	< 0.05	0.11	0.15	*	< 0.05	0.08	0.22	n/a	n/a	n/a	20[e]	40
Copper	µg/L						*2.4*							1,000	2 - 4[f]	2 - 4[f]	1,500	20 (H <50)
				0.9														30 (H >50-<75)
		1.1	0.7										< 0.2					40 (H >75-<100)
						< 0.2		0.7	0.6	*		0.7						50 (H >100-<125)
																		60 (H >125-<150)
					1.3													70 (H >150-<175)
																		80 (H >175-<200)
											0.5							90 (H >=200)
Lead	µg/L						< 0.05							5	1 - 7[f]	1 - 7[f]	10	40 (H<50)
		< 0.05	0.10	< 0.05									< 0.05					50 (H 50-<100)
					< 0.05	< 0.05		0.07	0.09	*		< 0.05						60 (H 100-<200)
											< 0.05							110 (H 200-<300)
																		160 (H>=300)
Lithium	µg/L	< 0.5	< 0.5	< 0.5	1.2	< 0.5	0.5	1.1	1.0	*	1.4	< 0.5	1.7	n/a	n/a	n/a	8	n/a
Mercury	µg/L	< 0.01	< 0.01	-	< 0.01	< 0.01	-	< 0.01	< 0.01	*	< 0.01	-	< 0.01	1	0.026	0.026	1	0.25
Molybdenum	µg/L	3.32	1.04	0.12	2.01	0.21	< 0.05	6.82	6.92	1	4.08	1.26	10.9	n/a	73	73	250	10,000
Nickel	µg/L						0.2							n/a	25 - 150[f]	25 - 150[f]	80	250 (H 0-<60)
		< 0.2	< 0.2	< 0.2		0.2			0.5	*		0.4	1.5					650 (H 60-<120)
					1.1			0.5											1,100 (H 120-<180)
											0.7							1,500 (H >=180)
Selenium	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	0.8	< 0.5	< 0.5	50	1	1	10	20
Silver	µg/L	< 0.02	< 0.02	< 0.02			< 0.02						< 0.02	n/a	0.25	0.25	20	0.5 (H <=100)
					< 0.02	< 0.02		< 0.02	< 0.02	*	< 0.02	< 0.02						15 (H >100)
Strontium	µg/L	-	-	91.1	-	-	46.6	147	149	1	-	106	89.9	n/a	n/a	n/a	2,500	n/a
Thallium	µg/L	< 0.01	< 0.01	0.01	0.02	< 0.01	0.02	< 0.01	< 0.01	*	0.02	< 0.01	< 0.01	n/a	0.8	0.8	n/a	3
Tin	µg/L	-	-	0.06	-	-	< 0.05	< 0.05	< 0.05	*	-	< 0.05	0.14	n/a	n/a	n/a	2,500	n/a
Titanium	µg/L	1.3	1.0	0.6	0.9	1.0	0.9	5.2	5.3	2	1.1	< 0.5	0.8	n/a	100	100	n/a	1,000
Uranium	µg/L	0.51	0.12	0.01	0.99	0.04	< 0.01	0.59	0.60	2	0.85	0.13	0.46	20	15	15	20	85
Vanadium	µg/L	0.7	< 0.5	< 0.5	0.6	< 0.5	< 0.5	0.7	1.0	*	< 0.5	< 0.5	< 0.5	n/a	n/a	n/a	20	n/a
Zinc	µg/L	< 2	< 1	< 2			< 2							5,000	30	30	3,000	75 (H 0-<90)
													< 2					150 (H 90-<100)
					< 2	< 1		5	3	*		< 2						900 (H 100-<200)
											< 1							1,650 (H 200-<300)
																		2,400 (H 300-<400)

Associated AGAT file(s): 15V953496, 20V574597, 20V581132, 20V655154, 20V679305, 20V694422.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[b] Standard to protect freshwater aquatic life.
[c] Field pH not measured but assumed to be ≥ 6.5 based on other pH values.
[d] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[e] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[f] Guideline is hardness dependent.
[g] Guideline is pH dependent.

TABLE 10: Summary of Analytical Results for Groundwater - Dissolved Metals

Sample Location		MW20-07			MW20-08			MW20-09			MW20-10			Federal Guideline			BC Standard	
Sample ID		MW20-07-200302	MW20-07-20200923	MW20-07-201117	MW20-08-200302	MW20-08-20200923	MW20-08-201117	MW20-09-200302	MW20-09-20200923	MW20-09-201116	MW20-10-200303	MW20-10-20200923	MW20-10-201117	Canadian Drinking Water Quality Guidelines (CDWQG)	FIGWQG Tier 2 Residential Land Use (RL)[a]	FIGWQG Tier 2 Industrial Land Use (IL)[a]	CSR Drinking Water (DW)	CSR Aquatic Life (AW)[b]
Sample Date (yyyy mm dd)		2020 03 02	2020 09 23	2020 11 17	2020 03 02	2020 09 23	2020 11 17	2020 03 02	2020 09 23	2020 11 16	2020 03 03	2020 09 23	2020 11 17					
Parameter	Units	Analytical Results																
Physical Parameters																		
pH (field)	pH	*6.64*	*6.9*	***5.9***	*6.93*	***6.4***	*6.65*	8.88	7.4	7.53	*9.32*	8.1	8.06	7.0 - 10.5	6.5 - 9	6.5 - 9	n/a	n/a
Hardness	mg/L	150	121	99.4	57	69.2	60.9	98.1	213	168	60.7	185	207	n/a	n/a	n/a	n/a	n/a
Geochemical Indicators																		
Dissolved Aluminum	µg/L	***2,710***	< 2	< 2	9	10	5	6	***555***	7	19	9	86	100	5 - 100[g]	5 - 100[g]	9,500	n/a
Dissolved Calcium	mg/L	41.8	33.8	27.5	17.9	20.2	20.4	32.5	69.8	55.8	20.1	58.5	66.1	n/a	n/a	n/a	n/a	n/a
Dissolved Iron	µg/L	***3,900***	< 10	< 10	46	< 10	< 10	40	***863***	16	23	< 10	123	300	300	300	n/a	n/a
Dissolved Magnesium	mg/L	11.1	8.88	7.47	2.99	4.56	2.41	4.11	9.34	6.96	2.55	9.41	10.3	n/a	n/a	n/a	n/a	n/a
Dissolved Manganese	µg/L	**677**	**326**	**186**	**66**	7	2	**158**	**1,170**	**388**	20	**596**	**696**	20	n/a	n/a	n/a	n/a
Dissolved Potassium	mg/L	1.68	0.623	0.468	0.522	0.561	0.376	1.02	2.16	1.25	2.63	2.35	2.21	n/a	n/a	n/a	n/a	n/a
Dissolved Sodium	mg/L	39.4	29.6	24.2	29.4	33	22.1	6.72	32.5	8.95	139	51.8	59.1	200	n/a	n/a	200	n/a
Dissolved Metals																		
Antimony	µg/L	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	0.6	0.9	0.7	6	2,000	2,000	6	90
Arsenic	µg/L	1.2	< 0.1	0.1	0.3	< 0.1	< 0.1	0.3	2.8	0.5	1.8	*5.9*	0.2	10	5	5	10	50
Barium	µg/L	55.2	14.8	10.3	6.0	6.0	6.2	24.2	84.8	47.9	21.7	68.8	74.0	2,000	2,900	2,900	1,000	10,000
Beryllium	µg/L	0.05	< 0.01	0.08	< 0.01	< 0.01	0.03	< 0.01	0.02	0.03	0.03	< 0.01	0.03	n/a	5.3	5.3	8	1.5
Boron	µg/L	31	24	17	17	18	12	20	63	19	123	180	197	5,000	1,500	1,500	5,000	12,000
Cadmium	µg/L													7	0.04 - 0.37[f]	0.04 - 0.37[f]	5	0.5 (H 0-<30)
					< 0.01	< 0.01	< 0.01				0.02							1.5 (H >30-<90)
			0.02	< 0.01				< 0.01										2.5 (H >90-<150)
		0.04								0.02		< 0.01	0.04					3.5 (H >150-<210)
									0.03									4 (H >=210)
Chromium	µg/L	6.7	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	0.5	1.6	< 0.5	0.9	< 0.5	< 0.5	50	8.9	8.9	50[d]	10[d]
Cobalt	µg/L	5.62	0.72	0.57	0.25	0.06	0.05	0.89	2.34	0.57	0.29	1.50	1.08	n/a	n/a	n/a	20[e]	40
Copper	µg/L													1,000	2 - 4[f]	2 - 4[f]	1,500	20 (H <50)
					0.4	0.8	1.7				*4.2*							30 (H >50-<75)
				0.3				0.4										40 (H >75-<100)
			< 0.2															50 (H >100-<125)
																		60 (H >125-<150)
		17.3								2.0								70 (H >150-<175)
												0.4						80 (H >175-<200)
									3.3				1.0					90 (H >=200)
Lead	µg/L													5	1 - 7[f]	1 - 7[f]	10	40 (H<50)
				< 0.05	< 0.05	< 0.05	< 0.05	< 0.05			0.08							50 (H 50-<100)
		1.00	0.05							< 0.05		< 0.05						60 (H 100-<200)
									0.26				0.11					110 (H 200-<300)
																		160 (H>=300)
Lithium	µg/L	3.3	1.2	< 0.5	0.8	< 0.5	< 0.5	1.7	3.7	0.5	8.5	5.4	4.4	n/a	n/a	n/a	8	n/a
Mercury	µg/L	< 0.01	< 0.01	-	< 0.01	< 0.01	-	< 0.01	< 0.01	-	< 0.01	< 0.01	-	1	0.026	0.026	1	0.25
Molybdenum	µg/L	8.29	2.36	0.76	0.62	0.31	1.40	6.53	9.36	1.76	61.4	42.7	33.6	n/a	73	73	250	10,000
Nickel	µg/L				0.5									n/a	25 - 150[f]	25 - 150[f]	80	250 (H 0-<60)
				1.0		0.4	0.4	1.9			3.2							650 (H 60-<120)
		5.3	1.4							2.9								1,100 (H 120-<180)
									5.6			9.1	4.9					1,500 (H >=180)
Selenium	µg/L	0.6	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	7.2	0.8	3.5	50	1	1	10	20
Silver	µg/L			< 0.02	< 0.02	< 0.02	< 0.02	< 0.02			< 0.02			n/a	0.25	0.25	20	0.5 (H <=100)
		< 0.02	< 0.02						< 0.02	< 0.02		< 0.02	< 0.02					15 (H >100)
Strontium	µg/L	146	-	83.6	80.2	-	63.1	119	-	196	133	-	320	n/a	n/a	n/a	2,500	n/a
Thallium	µg/L	< 0.01	0.01	0.01	< 0.01	< 0.01	0.01	< 0.01	0.03	0.01	< 0.01	< 0.01	0.05	n/a	0.8	0.8	n/a	3
Tin	µg/L	0.29	-	< 0.05	< 0.05	-	< 0.05	0.11	-	0.07	10.7	-	3.99	n/a	n/a	n/a	2,500	n/a
Titanium	µg/L	64.4	1.8	1.3	< 0.5	1.4	0.7	< 0.5	16.7	0.7	0.6	1.2	4.1	n/a	100	100	n/a	1,000
Uranium	µg/L	0.38	0.04	0.02	0.04	0.02	0.03	0.58	2.76	0.80	3.43	7.43	6.38	20	15	15	20	85
Vanadium	µg/L	9.6	< 0.5	< 0.5	0.7	< 0.5	< 0.5	< 0.5	3.3	< 0.5	1.8	3.4	1.5	n/a	n/a	n/a	20	n/a
Zinc	µg/L				< 2	< 1	< 2				< 2			5,000	30	30	3,000	75 (H 0-<90)
				< 2				7										150 (H 90-<100)
		11	< 1							3		2						900 (H 100-<200)
									7				< 2					1,650 (H 200-<300)
																		2,400 (H 300-<400)

Associated AGAT file(s): 15V953496, 20V574597, 20V581132, 20V655154, 20V679305, 20V694422.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[b] Standard to protect freshwater aquatic life.
[c] Field pH not measured but assumed to be ≥ 6.5 based on other pH values.
[d] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[e] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[f] Guideline is hardness dependent.
[g] Guideline is pH dependent.

TABLE 10: Summary of Analytical Results for Groundwater - Dissolved Metals

Sample Location		MW20-11			MW20-12			MW20-13			MW20-17	MW20-18S	FIELD BLANK	Federal Guideline			BC Standard	
Sample ID		MW20-11-200303	MW20-11-20200923	MW20-11-	MW20-12-200302	MW20-12-20200923	MW20-12-201117	MW20-13-201221	MW20-A-201221	QA/QC	MW20-17-201221	MW20-18S-201221	FIELD-201221	Canadian Drinking Water Quality Guidelines (CDWQG)	FIGWQG Tier 2 Residential Land Use (RL)[a]	FIGWQG Tier 2 Industrial Land Use (IL)[a]	CSR Drinking Water (DW)	CSR Aquatic Life (AW)[b]
Sample Date (yyyy mm dd)		2020 03 03	2020 09 23	2020 11 17	2020 03 02	2020 09 23	2020 11 17	2020 12 21	Duplicate	RPD %	2020 12 21	2020 12 21	2020 12 21					
Parameter	Units	Analytical Results																
Physical Parameters																		
pH (field)	pH	8.47	8.3	7.47	8.56	7.4	***6.31***	***6.39***	***6.39***	0	***6.48***	7.69	-	7.0 - 10.5	6.5 - 9	6.5 - 9	n/a	n/a
Hardness	mg/L	68.1	121	178	144	105	110	106	106	0	152	79.8	< 0.1	n/a	n/a	n/a	n/a	n/a
Geochemical Indicators																		
Dissolved Aluminum	µg/L	20	16	< 2	5	6	2	*30*	*32*	6	*7*	10	< 2	100	5 - 100[g]	5 - 100[g]	9,500	n/a
Dissolved Calcium	mg/L	22.8	39.2	56.2	45.1	31.8	34.3	29.5	29.5	0	47.1	26.3	< 0.05	n/a	n/a	n/a	n/a	n/a
Dissolved Iron	µg/L	12	17	< 10	< 10	< 10	12	39	35	*	60	< 10	< 10	300	300	300	n/a	n/a
Dissolved Magnesium	mg/L	2.7	5.64	9.13	7.51	6.17	6	7.77	7.85	1	8.39	3.43	< 0.05	n/a	n/a	n/a	n/a	n/a
Dissolved Manganese	µg/L	15	**388**	**777**	**111**	**65**	**53**	**104**	**104**	0	**289**	**38**	< 1	20	n/a	n/a	n/a	n/a
Dissolved Potassium	mg/L	2.31	1.96	1.84	1.18	0.676	0.488	0.404	0.427	6	1.09	1.27	< 0.05	n/a	n/a	n/a	n/a	n/a
Dissolved Sodium	mg/L	101	54.6	105	13.4	7.81	11.7	16.6	16.6	0	7.9	12.7	< 0.05	200	n/a	n/a	200	n/a
Dissolved Metals																		
Antimony	µg/L	0.5	1.4	0.4	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	*	< 0.2	0.2	< 0.2	6	2,000	2,000	6	90
Arsenic	µg/L	2.3	*6.0*	1.1	1.0	*6.9*	1.5	0.2	0.2	*	0.3	0.9	< 0.1	10	5	5	10	50
Barium	µg/L	19.6	61.5	76.0	29.1	15.7	18.2	8.8	8.7	1	15.7	12.0	< 0.2	2,000	2,900	2,900	1,000	10,000
Beryllium	µg/L	0.04	< 0.01	0.05	< 0.01	< 0.01	0.02	< 0.01	0.02	*	0.03	0.06	< 0.01	n/a	5.3	5.3	8	1.5
Boron	µg/L	127	209	185	18	25	18	13	15	14	14	17	< 2	5,000	1,500	1,500	5,000	12,000
Cadmium	µg/L												< 0.01	7	0.04 - 0.37[f]	0.04 - 0.37[f]	5	0.5 (H 0-<30)
		< 0.01										< 0.01						1.5 (H >30-<90)
			< 0.01		< 0.01	0.01	0.03	0.03	< 0.01	*								2.5 (H >90-<150)
				< 0.01							0.05							3.5 (H >150-<210)
																		4 (H >=210)
Chromium	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	50	8.9	8.9	50[d]	10[d]
Cobalt	µg/L	0.20	1.27	1.27	0.25	0.30	0.43	0.56	0.62	10	1.19	0.08	< 0.05	n/a	n/a	n/a	20[e]	40
Copper	µg/L												< 0.2	1,000	2 - 4[f]	2 - 4[f]	1,500	20 (H <50)
		2.1																30 (H >50-<75)
												1.7						40 (H >75-<100)
			< 0.2			< 0.2	1.5	0.4	0.4	*								50 (H >100-<125)
					< 0.2													60 (H >125-<150)
											0.5							70 (H >150-<175)
				1.5														80 (H >175-<200)
																		90 (H >=200)
Lead	µg/L												< 0.05	5	1 - 7[f]	1 - 7[f]	10	40 (H<50)
		< 0.05										0.25						50 (H 50-<100)
			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	*	< 0.05							60 (H 100-<200)
																		110 (H 200-<300)
																		160 (H>=300)
Lithium	µg/L	6.4	4.2	3.3	1.9	0.6	< 0.5	1.2	2.0	*	< 0.5	0.7	< 0.5	n/a	n/a	n/a	8	n/a
Mercury	µg/L	< 0.01	< 0.01	-	< 0.01	< 0.01	-	-	-	-	-	-	-	1	0.026	0.026	1	0.25
Molybdenum	µg/L	45.0	*98.5*	38.2	6.16	7.79	0.95	1.00	0.56	56	2.78	5.00	< 0.05	n/a	73	73	250	10,000
Nickel	µg/L												< 0.2	n/a	25 - 150[f]	25 - 150[f]	80	250 (H 0-<60)
		1.4				0.9	0.9	0.9	0.9	*		0.4						650 (H 60-<120)
			10.8	2.9	1.3						2.0							1,100 (H 120-<180)
																		1,500 (H >=180)
Selenium	µg/L	*7.1*	0.8	*2.0*	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	0.9	< 0.5	50	1	1	10	20
Silver	µg/L	< 0.02										< 0.02	< 0.02	n/a	0.25	0.25	20	0.5 (H <=100)
			< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	*	< 0.02							15 (H >100)
Strontium	µg/L	117	-	236	161	-	104	73.6	83.0	12	134	114	< 0.1	n/a	n/a	n/a	2,500	n/a
Thallium	µg/L	< 0.01	< 0.01	0.03	< 0.01	< 0.01	< 0.01	0.01	0.02	*	< 0.01	< 0.01	< 0.01	n/a	0.8	0.8	n/a	3
Tin	µg/L	5.58	-	0.84	0.25	-	< 0.05	0.08	0.10	*	0.06	< 0.05	< 0.05	n/a	n/a	n/a	2,500	n/a
Titanium	µg/L	< 0.5	1.4	0.6	< 0.5	1.3	1.1	2.2	1.7	*	< 0.5	< 0.5	< 0.5	n/a	100	100	n/a	1,000
Uranium	µg/L	3.25	9.93	4.37	0.45	0.83	0.08	0.04	0.05	*	0.09	0.63	< 0.01	20	15	15	20	85
Vanadium	µg/L	1.7	2.8	0.9	< 0.5	0.9	0.6	0.9	1.2	*	< 0.5	2.2	< 0.5	n/a	n/a	n/a	20	n/a
Zinc	µg/L	2										< 2	< 2	5,000	30	30	3,000	75 (H 0-<90)
																		150 (H 90-<100)
			< 1	< 2	< 2	< 1	< 2	< 2	< 2	*	< 2							900 (H 100-<200)
																		1,650 (H 200-<300)
																		2,400 (H 300-<400)

Associated AGAT file(s): 15V953496, 20V574597, 20V581132, 20V655154, 20V679305, 20V694422.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[b] Standard to protect freshwater aquatic life.
[c] Field pH not measured but assumed to be ≥ 6.5 based on other pH values.
[d] Individual standards exist for Cr +3 and Cr +6. Reported value represents more stringent standard.
[e] Interim BC MoE Regional Background Estimate (Protocol 9 Determining Background Groundwater Quality).
[f] Guideline is hardness dependent.
[g] Guideline is pH dependent.

TABLE 11: Summary of Analytical Results for Groundwater - Volatile Organic Compounds

Sample Location		MW15-01			MW15-02				MW20-02(D)					Federal Guideline			BC Standard	
Sample ID		MW15-01-150311	MW15-01-200212	MW15-01-20200923	MW15-02-150311	MW15-02-200212	MW15-02-20200923	MW15-02-201116	MW20-02(D)-200302	MW20-A-200302	QA/QC	MW20-02(D)-20200923	MW20-02(D)-20201116	Canadian Drinking Water Quality Guidelines (CDWQG)	FIGWQG Tier 2 Residential Land Use (RL)[b]	FIGWQG Tier 2 Industrial Land Use (IL)[b]	CSR Drinking Water (DW)	CSR Aquatic Life (AW)[c]
Sample Date (yyyy mm dd)		2015 03 11	2020 02 12	2020 09 23	2015 03 11	2020 02 12	2020 09 23	2020 11 16	2020 03 02	Duplicate	RPD %	2020 09 23	2020 11 16					
Parameter	**Units**	**Analytical Results**																
Volatile Organic Compounds																		
Acetone	µg/L	< 10	< 10	< 10	< 10	24	11	58	29	37	*	27	13	n/a	13,000	13,000	3,500	n/a
Bromodichloromethane [BDCM]	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	8,500	8,500	100	n/a
Bromoform	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	380	3,700	100	n/a
Bromomethane	µg/L	< 1	< 1	< 2	< 1	< 1	< 2	< 2	< 1	< 1	*	< 2	< 2	n/a	5.6	33	5.5	n/a
Carbon Tetrachloride	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	2	0.56	6.8	2	130
Chlorobenzene	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	30	1.3	1.3	80	13
Chloroethane	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	n/a	n/a	n/a	n/a
Chloroform	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	1.8	1.8	100	20
Chloromethane	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	n/a	n/a	n/a	n/a
Dibromochloromethane [DBCM]	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	1,100	10,000	100	n/a
Dibromoethane, 1,2-	µg/L	< 0.3[a]	< 0.3[a]	< 0.3[a]	< 0.3[a]	< 0.3[a]	< 0.3[a]	< 0.3[a]	< 0.3[a]	< 0.3[a]	*	< 0.3[a]	< 0.3[a]	n/a	0.25	5.1	0.5	n/a
Dichlorobenzene, 1,2-	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	3	0.7	0.7	200	7
Dichlorobenzene, 1,3-	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	n/a	150	150	n/a	1,500
Dichlorobenzene, 1,4-	µg/L	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	1	26	26	5	260
Dichloroethane, 1,1-	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	320	6,600	30	n/a
Dichloroethane, 1,2-	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	5	10	100	5	1,000
Dichloroethylene, 1,1-	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	14	39	490	14	n/a
Dichloroethylene, 1,2-cis-	µg/L	< 1	< 1	< 1	*83*	*46*	*78*	*33*	19	21	10	5	5	n/a	1.6	30	8	n/a
Dichloroethylene, 1,2-trans-	µg/L	< 1	< 1	< 1	11	5	6	3	7	7	0	2	1	n/a	1.6	30	80	n/a
Dichloromethane	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	50	98	98	50	980
Dichloropropane, 1,2-	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	16	330	4.5	n/a
Dichloropropane, 1,3-	µg/L	-	< 1	< 1.4	-	< 1	< 1.4	< 1.4	< 1	< 1	*	< 1.4	< 1.4	n/a	n/a	n/a	80	n/a
Dichloropropene, 1,3-cis-	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	5.2	100	1.5	n/a
Dichloropropene, 1,3-trans-	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	5.2	100	1.5	n/a
Methyl Ethyl Ketone [MEK]	µg/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	*	19	< 10	n/a	150,000	150,000	2,500	n/a
Methyl Isobutyl Ketone [MIBK]	µg/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	*	< 10	< 10	n/a	58,000	58,000	n/a	n/a
Tetrachloroethane, 1,1,1,2-	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	3.4	66	6	n/a
Tetrachloroethane, 1,1,2,2-	µg/L	< 1[a]	< 0.8	< 0.8	< 1[a]	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	*	< 0.8	< 0.8	n/a	3.2	63	0.8	n/a
Tetrachloroethylene	µg/L	< 1	< 1	< 1	1	2	1	1	< 1	< 1	*	< 1	< 1	10	110	110	30	1,100
Total Trihalomethanes	µg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	*	< 2	< 2	100	n/a	n/a	100	n/a
Trichlorobenzene, 1,2,4-	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	24	24	5.5	240
Trichloroethane, 1,1,1-	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	640	1,100	8,000	n/a
Trichloroethane, 1,1,2-	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	4.7	91	3	n/a
Trichloroethylene	µg/L	< 1	< 1	< 1	**8**	**8**	**6**	4	**6**	**6**	0	2	1	5	20	29	5	200
Trichlorofluoromethane	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	n/a	n/a	n/a	1,000	n/a
Vinyl Chloride	µg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	*	< 1	< 1	2	1.1	13	2	n/a

Associated AGAT file(s): 15V953496, 20V574597, 20V581132, 20V655154, 20V679305, 21V699437.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Laboratory detection limit exceeds regulatory standard/guideline.
[b] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[c] Standard to protect freshwater aquatic life.

TABLE 11: Summary of Analytical Results for Groundwater - Volatile Organic Compounds

Sample Location		MW20-02(2D)							MW15-03		MW20-07	Federal Guideline			BC Standard	
Sample ID		MW20-02(2D)-2020 03 02	MW20-02(2D)-2020 09 23	MW20-A-20200923 Duplicate	QA/QC RPD %	MW20-02(2D)-2020 11 16	MW20-A-201116 Duplicate	QA/QC RPD %	MW15-03-150311 2015 03 11	MW15-03-20200922 2020 09 22	MW20-07-200302 2020 03 02	Canadian Drinking Water Quality Guidelines (CDWQG)	FIGWQG Tier 2 Residential Land Use (RL)[b]	FIGWQG Tier 2 Industrial Land Use (IL)[b]	CSR Drinking Water (DW)	CSR Aquatic Life (AW)[c]
Sample Date (yyyy mm dd)																
Parameter	Units	Analytical Results														
Volatile Organic Compounds																
Acetone	µg/L	< 10	< 10	< 10	*	< 10	< 10	*	< 10	< 10	< 10	n/a	13,000	13,000	3,500	n/a
Bromodichloromethane [BDCM]	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	8,500	8,500	100	n/a
Bromoform	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	380	3,700	100	n/a
Bromomethane	µg/L	< 1	< 2	< 2	*	< 2	< 2	*	< 1	< 2	< 1	n/a	5.6	33	5.5	n/a
Carbon Tetrachloride	µg/L	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	2	0.56	6.8	2	130
Chlorobenzene	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	30	1.3	1.3	80	13
Chloroethane	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	n/a	n/a	n/a	n/a
Chloroform	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	1.8	1.8	100	20
Chloromethane	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	n/a	n/a	n/a	n/a
Dibromochloromethane [DBCM]	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	1,100	10,000	100	n/a
Dibromoethane, 1,2-	µg/L	< 0.3[a]	< 0.3[a]	< 0.3[a]	*	< 0.3[a]	< 0.3[a]	*	< 0.3[a]	< 0.3[a]	< 0.3[a]	n/a	0.25	5.1	0.5	n/a
Dichlorobenzene, 1,2-	µg/L	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	3	0.7	0.7	200	7
Dichlorobenzene, 1,3-	µg/L	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	n/a	150	150	n/a	1,500
Dichlorobenzene, 1,4-	µg/L	< 0.5	< 0.5	< 0.5	*	< 0.5	< 0.5	*	< 0.5	< 0.5	< 0.5	1	26	26	5	260
Dichloroethane, 1,1-	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	320	6,600	30	n/a
Dichloroethane, 1,2-	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	5	10	100	5	1,000
Dichloroethylene, 1,1-	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	14	39	490	14	n/a
Dichloroethylene, 1,2-cis-	µg/L	1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	1.6	30	8	n/a
Dichloroethylene, 1,2-trans-	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	1.6	30	80	n/a
Dichloromethane	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	50	98	98	50	980
Dichloropropane, 1,2-	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	16	330	4.5	n/a
Dichloropropane, 1,3-	µg/L	< 1	< 1.4	< 1.4	*	< 1.4	< 1.4	*	-	< 1.4	< 1	n/a	n/a	n/a	80	n/a
Dichloropropene, 1,3-cis-	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	5.2	100	1.5	n/a
Dichloropropene, 1,3-trans-	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	5.2	100	1.5	n/a
Methyl Ethyl Ketone [MEK]	µg/L	< 10	< 10	< 10	*	< 10	< 10	*	< 10	< 10	< 10	n/a	150,000	150,000	2,500	n/a
Methyl Isobutyl Ketone [MIBK]	µg/L	< 10	< 10	< 10	*	< 10	< 10	*	< 10	< 10	< 10	n/a	58,000	58,000	n/a	n/a
Tetrachloroethane, 1,1,1,2-	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	3.4	66	6	n/a
Tetrachloroethane, 1,1,2,2-	µg/L	< 0.8	< 0.8	< 0.8	*	< 0.8	< 0.8	*	< 1[a]	< 0.8	< 0.8	n/a	3.2	63	0.8	n/a
Tetrachloroethylene	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	10	110	110	30	1,100
Total Trihalomethanes	µg/L	< 2	< 2	< 2	*	< 2	< 2	*	< 2	< 2	< 2	100	n/a	n/a	100	n/a
Trichlorobenzene, 1,2,4-	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	24	24	5.5	240
Trichloroethane, 1,1,1-	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	640	1,100	8,000	n/a
Trichloroethane, 1,1,2-	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	4.7	91	3	n/a
Trichloroethylene	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	5	20	29	5	200
Trichlorofluoromethane	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	n/a	n/a	n/a	1,000	n/a
Vinyl Chloride	µg/L	< 1	< 1	< 1	*	< 1	< 1	*	< 1	< 1	< 1	2	1.1	13	2	n/a

Associated AGAT file(s): 15V953496, 20V574597, 20V581132, 20V655154, 20V679305, 21V699437.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Laboratory detection limit exceeds regulatory standard/guideline.
[b] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[c] Standard to protect freshwater aquatic life.

TABLE 11: Summary of Analytical Results for Groundwater - Volatile Organic Compounds

Sample Location		MW20-08		MW20-17	Federal Guideline			BC Standard	
Sample ID		MW20-08-200302	MW20-08-20200923	MW20-17-210112	Canadian Drinking Water Quality Guidelines (CDWQG)	FIGWQG Tier 2 Residential Land Use (RL)[b]	FIGWQG Tier 2 Industrial Land Use (IL)[b]	CSR Drinking Water (DW)	CSR Aquatic Life (AW)[c]
Sample Date (yyyy mm dd)		2020 03 02	2020 09 23	2021 01 12					
Parameter	Units	Analytical Results							
Volatile Organic Compounds									
Acetone	µg/L	< 10	< 10	< 10	n/a	13,000	13,000	3,500	n/a
Bromodichloromethane [BDCM]	µg/L	< 1	< 1	< 1	n/a	8,500	8,500	100	n/a
Bromoform	µg/L	< 1	< 1	< 1	n/a	380	3,700	100	n/a
Bromomethane	µg/L	< 1	< 2	< 2	n/a	5.6	33	5.5	n/a
Carbon Tetrachloride	µg/L	< 0.5	< 0.5	< 0.5	2	0.56	6.8	2	130
Chlorobenzene	µg/L	< 1	< 1	< 1	30	1.3	1.3	80	13
Chloroethane	µg/L	< 1	< 1	< 1	n/a	n/a	n/a	n/a	n/a
Chloroform	µg/L	< 1	< 1	< 1	n/a	1.8	1.8	100	20
Chloromethane	µg/L	< 1	< 1	< 1	n/a	n/a	n/a	n/a	n/a
Dibromochloromethane [DBCM]	µg/L	< 1	< 1	< 1	n/a	1,100	10,000	100	n/a
Dibromoethane, 1,2-	µg/L	< 0.3[a]	< 0.3[a]	< 0.25	n/a	0.25	5.1	0.5	n/a
Dichlorobenzene, 1,2-	µg/L	< 0.5	< 0.5	< 0.5	3	0.7	0.7	200	7
Dichlorobenzene, 1,3-	µg/L	< 0.5	< 0.5	< 0.5	n/a	150	150	n/a	1,500
Dichlorobenzene, 1,4-	µg/L	< 0.5	< 0.5	< 0.5	1	26	26	5	260
Dichloroethane, 1,1-	µg/L	< 1	< 1	< 1	n/a	320	6,600	30	n/a
Dichloroethane, 1,2-	µg/L	< 1	< 1	< 1	5	10	100	5	1,000
Dichloroethylene, 1,1-	µg/L	< 1	< 1	< 1	14	39	490	14	n/a
Dichloroethylene, 1,2-cis-	µg/L	< 1	< 1	< 1	n/a	1.6	30	8	n/a
Dichloroethylene, 1,2-trans-	µg/L	< 1	< 1	< 1	n/a	1.6	30	80	n/a
Dichloromethane	µg/L	< 1	< 1	< 1	50	98	98	50	980
Dichloropropane, 1,2-	µg/L	< 1	< 1	< 1	n/a	16	330	4.5	n/a
Dichloropropane, 1,3-	µg/L	< 1	< 1.4	< 1.4	n/a	n/a	n/a	80	n/a
Dichloropropene, 1,3-cis-	µg/L	< 1	< 1	< 1	n/a	5.2	100	1.5	n/a
Dichloropropene, 1,3-trans-	µg/L	< 1	< 1	< 1	n/a	5.2	100	1.5	n/a
Methyl Ethyl Ketone [MEK]	µg/L	< 10	< 10	< 10	n/a	150,000	150,000	2,500	n/a
Methyl Isobutyl Ketone [MIBK]	µg/L	< 10	< 10	< 10	n/a	58,000	58,000	n/a	n/a
Tetrachloroethane, 1,1,1,2-	µg/L	< 1	< 1	< 1	n/a	3.4	66	6	n/a
Tetrachloroethane, 1,1,2,2-	µg/L	< 0.8	< 0.8	< 0.8	n/a	3.2	63	0.8	n/a
Tetrachloroethylene	µg/L	< 1	< 1	< 1	10	110	110	30	1,100
Total Trihalomethanes	µg/L	< 2	< 2	< 2	100	n/a	n/a	100	n/a
Trichlorobenzene, 1,2,4-	µg/L	< 1	< 1	< 1	n/a	24	24	5.5	240
Trichloroethane, 1,1,1-	µg/L	< 1	< 1	< 1	n/a	640	1,100	8,000	n/a
Trichloroethane, 1,1,2-	µg/L	< 1	< 1	< 1	n/a	4.7	91	3	n/a
Trichloroethylene	µg/L	< 1	< 1	< 1	5	20	29	5	200
Trichlorofluoromethane	µg/L	< 1	< 1	2	n/a	n/a	n/a	1,000	n/a
Vinyl Chloride	µg/L	< 1	< 1	< 1	2	1.1	13	2	n/a

Associated AGAT file(s): 15V953496, 20V574597, 20V581132, 20V655154, 20V679305, 21V699437.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Laboratory detection limit exceeds regulatory standard/guideline.
[b] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[c] Standard to protect freshwater aquatic life.

TABLE 12: Summary of Analytical Results for Groundwater - PCBs

Sample Location	Sample ID	Sample Date (yyyy mm dd)	PCBs			
			Aroclor 1242 µg/L	Aroclor 1254 µg/L	Aroclor 1260 µg/L	Polychlorinated Biphenyls, Total [PCBs] µg/L
MW15-03	MW15-03-150311	2015 03 11	< 0.009	< 0.009	< 0.009	< 0.009
MW15-04	MW15-04-150311	2015 03 11	< 0.009	< 0.009	< 0.009	< 0.009
Federal Guideline						
Canadian Drinking Water Quality Guidelines (CDWQG) [c]			n/a	n/a	n/a	n/a
FIGWQG Tier 2 Residential Land Use (RL) [a]			n/a	n/a	n/a	n/a
FIGWQG Tier 2 Industrial Land Use (IL) [a]			n/a	n/a	n/a	n/a
BC Standard						
CSR Drinking Water (DW)			n/a	n/a	n/a	n/a
CSR Aquatic Life (AW) [b]			n/a	n/a	n/a	n/a

Associated AGAT file(s): 15V953496.
All terms defined within the body of SNC-Lavalin's report.
< Denotes concentration less than indicated detection limit or RPD less than indicated value.
- Denotes analysis not conducted.
n/a Denotes no applicable standard/guideline.
QA/QC RPD Denotes quality assurance/quality control relative percent difference
* RPDs are not calculated where one or more concentrations are less than five times RDL.
RDL Denotes reported detection limit.

BOLD	Concentration greater than Canadian Drinking Water Quality Guidelines (CDWQG) Guideline
UNDERLINE	Concentration greater than FIGWQG Tier 2 Residential Land Use (RL) Guideline
ITALIC	Concentration greater than FIGWQG Tier 2 Industrial Land Use (IL) Guideline
SHADED	Concentration greater than CSR Drinking Water (DW) standard
OUTLINE	Concentration greater than CSR Aquatic Life (AW) standard

[a] Pathways Included: Freshwater Aquatic Life, Inhalation, Soil Organisms Direct Contact.
[b] Standard to protect freshwater aquatic life.

Annex D. Physical Data

- Borehole and Test Pit Soil Logs
- Groundwater Monitoring Data

SNC·LAVALIN

Client
Public Works and Gov't Services Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH15-01

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2015 03 11	Project Number:	626692
Drilling Method	Solid Stem Auger	Ground Surface Elev. (m)	105.365	Borehole Logged By:	CMT
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	106.002	Date Drilled:	2015 03 02
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444357.854	Easting: 429182.569	Log Typed By:	NDS

Drilling Legend
- Sample Interval
- Auger Flight

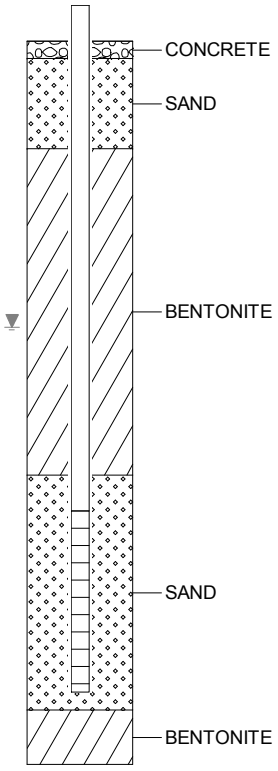
Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Reading within indicated scale
Reading outside indicated scale

Solid PVC
Slotted PVC

Well Name 1: MW15-01

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	SAND (FILL), fine grained, silty, some gravel, fine to coarse, subangular to subrounded, grey/brown, medium dense, damp to moist, rootlets.			1-01		0	
	Below 0.1 m - no rootlets.			**1-02**		10	
1				1-03		0	
	SILT, some sand, fine to coarse grained, trace gravel, subangular, light brown, grey flecking, stiff, damp to moist.			**1-04**		0	
2				1-05		0	
	SAND, fine to coarse grained, some silt, trace gravel, fine, brown.			1-06		5	
3				**1-07**		10	
	Below 4.3 m - moist to wet.			**1-08***			
4	Below 4.6 m - wet.			1-09		0	
				1-10		0	
5	Bottom of hole at 6.1 m.						
6							
7							
8							
9							
10							



NOTES
Bolded sample denotes sample analyzed.
* denotes blind field duplicate.
1-08 is a blind field duplicate of 1-07.

Print Date: 2015.05.15 QA1: CMT Date Approved: 2015.03.11

SNC·LAVALIN

Client
Public Works and Gov't Services Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH15-02

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2015 03 11	Project Number:	626692
Drilling Method	Solid Stem Auger	Ground Surface Elev. (m)	107.760	Borehole Logged By:	CMT
Borehole Dia. (m)	0.20	Top of Casing Elev. (m)	108.396	Date Drilled:	2015 03 02
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444396.141	Easting: 429178.226	Log Typed By:	NDS

Drilling Legend: Sample Interval; Auger Flight

Water/NAPL Levels: Water Level 1; Water Level 2; NAPL; NAPL

Reading within indicated scale; Reading outside indicated scale

Soil Vapour (ppm)

Solid PVC; Slotted PVC

Well Name 1: MW15-02

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	SAND (FILL), fine grained, silty, some gravel, fine to coarse, subangular to subrounded, grey/brown, medium dense, damp to moist.			2-01		5	
1				**2-02**		0	
	SAND, fine to coarse grained, some silt, some gravel, fine to coarse, subangular, grey/brown, medium dense, damp to moist.			2-03		10	
2				2-04		5	
3	Below 2.9 m - moist.			2-05		5	
	SAND, fine grained, some silt, brown, mottled grey, crumbly, damp.			2-06		5	
4				**2-07** **2-08***		10	
5	Below 5.0 m - grey.			**2-09**		0	
	Below 5.6 m - wet.						
	SILT, SAND and GRAVEL, fine to coarse grained, black/dark grey, wet, metal debris, wood debris, hydrocarbon-like odour, septic-like odour.			**2-10**		65	
6	SAND, fine to coarse grained, some silt, trace gravel, fine, grey, moist to wet.			2-11		0	
	At 6.7 m - suspect bedrock.			**2-12**		10	
7	Bottom of hole at 6.7 m.						
8							
9							
10							

CONCRETE
SAND
BENTONITE
SAND
SLOUGH

NOTES
Bolded sample denotes sample analyzed.
* denotes blind field duplicate.
2-08 is a blind field duplicate of 2-07.
Well installed with hollow stem auger.

Print Date: 2015.05.15 QA1: CMT Date Approved: 2015.03.11

SNC·LAVALIN

Client
Public Works and Gov't Services Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH15-03

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2015 03 11	Project Number:	626692
Drilling Method	Solid Stem Auger	Ground Surface Elev. (m)	107.863	Borehole Logged By:	CMT
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	108.635	Date Drilled:	2015 03 02
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444430.573	Easting: 429180.026	Log Typed By:	NDS

Drilling Legend
- Sample Interval
- Auger Flight

Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Reading within indicated scale
Reading outside indicated scale

Solid PVC
Slotted PVC

Well Name 1: MW15-03

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	SAND (FILL), silty, some gravel, fine to coarse, subangular to subrounded, dark brown, very loose, moist, rootlets. Below 0.1 m - no rootlets.			3-01			5
1				**3-02**			5
				3-03			15
2	Below 1.5 m - wet.			3-04			0
3	SILT (FILL), some sand, fine grained, trace gravel, fine to coarse, subangular, dark brown/black/light brown, woody debris.			**3-05**			15
	Below 3.4 m - wet.						
4	SAND, fine to medium grained, grey/red (layers), oxidized red, dense, wet.			**3-06** **3-07***			0
				3-08			0
5				**3-09**			5
6	SILT, trace sand, fine grained, dark brown, hard, moist.			3-10			0
	Bottom of hole at 6.1 m.						
7							
8							
9							
10							

CONCRETE
SAND
BENTONITE
SAND
SLOUGH

NOTES
Bolded sample denotes sample analyzed.
* denotes blind field duplicate.
3-07 is a blind field duplicate of 3-06.

Print Date: 2015.05.15 QA1: CMT Date Approved: 2015.03.11

SNC·LAVALIN

Client
Public Works and Gov't Services Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH15-04

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2015 03 11	Project Number:	626692
Drilling Method	Solid Stem Auger	Ground Surface Elev. (m)	107.694	Borehole Logged By:	CMT
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	108.569	Date Drilled:	2015 03 02
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444464.788	Easting: 429174.625	Log Typed By:	NDS

Drilling Legend
- Sample Interval
- Auger Flight

Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Soil Description

Depth in Metres | Stratigraphy Plot | Sample Interval Core Run | Sample Number | Blow Count | % Recovery

Soil Vapour (ppm)
- Reading within indicated scale
- Reading outside indicated scale

Well Name 1: MW15-04
- Solid PVC
- Slotted PVC

0 SILT, trace sand, fine grained, trace gravel, fine to coarse, subangular.
GRAVEL, fine grained, red/brown, wet. — 4-01 — 0

1 SAND, fine grained, brown, oxidized red, moist to wet. — 4-02 — 10

2 SILT, some sand, fine grained, trace gravel, fine to coarse, subangular to subrounded, grey, hard, moist. — 4-03 — 20

3 — 4-04 — 10

4 — 4-05 — 20

— 4-06 — 15

5 — 4-07 — 0

6 — 4-08 — 0

Bottom of hole at 6.1 m.

7 8 9 10

CONCRETE
BENTONITE
SAND
BENTONITE
SLOUGH

NOTES
Bolded sample denotes sample analyzed.

Print Date: 2015.05.15 QA1: CMT Date Approved: 2015.03.11

SNC·LAVALIN

Client
Public Works and Gov't Services Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH15-05

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2015 03 11	Project Number:	626692
Drilling Method	Solid Stem Auger	Ground Surface Elev. (m)	108.381	Borehole Logged By:	CMT
Borehole Dia. (m)	0.20	Top of Casing Elev. (m)	108.997	Date Drilled:	2015 03 03
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444453.768	Easting: 429159.336	Log Typed By:	NDS

Drilling Legend: Sample Interval; Auger Flight

Water/NAPL Levels: Water Level 1; Water Level 2; NAPL; NAPL

Reading within indicated scale; Reading outside indicated scale

Solid PVC; Slotted PVC

Well Name 1: MW15-05

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	SILT and SAND (FILL), trace gravel, fine, subrounded, occasional coarse gravel, grey/brown, damp to moist, rootlets. Below 0.1 m - no rootlets.			5-01			5
1	SAND, coarse grained, trace fine grained sand, red/brown, moist to wet.			**5-02**			20
	Below 1.5 m - increased fine to medium grained sand.			5-03			10
2	SAND, fine grained, grey/orange, oxidized red, very loose, wet.			**5-04** **5-05***			25
3				5-06			15
	CLAY and SILT, trace sand, fine grained, grey, very soft.			5-07			0
	SAND, fine grained, grey/brown, very loose, wet.			5-08			0
4				**5-09**			5
5	SILT, some gravel, fine to coarse, subangular, trace sand, fine to coarse grained, grey, hard, damp.			5-10			0
6	Bottom of hole at 6.1 m.			5-11			0
7							
8							
9							
10							

Soil Vapour (ppm): 10^1 10^2 10^3 10^4

CONCRETE
BENTONITE
SAND
BENTONITE
SLOUGH

NOTES
Bolded sample denotes sample analyzed.
* denotes blind field duplicate.
5-05 is a blind field duplicate of 5-04.
Well installed with hollow stem auger.

Print Date: 2015.05.15 QA1: CMT Date Approved: 2015.03.11

SNC·LAVALIN

Client
Public Works and Gov't Services Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH15-06

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2015 03 11	Project Number:	626692
Drilling Method	Solid Stem Auger	Ground Surface Elev. (m)	109.019	Borehole Logged By:	CMT
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	109.696	Date Drilled:	2015 03 03
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444482.585	Easting: 429175.991	Log Typed By:	NDS

Drilling Legend
- Sample Interval
- Auger Flight

Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Reading within indicated scale
Reading outside indicated scale

Solid PVC
Slotted PVC

Well Name 1: MW15-06

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	SILT (FILL), trace sand, fine to coarse grained, trace gravel, fine to coarse, subrounded, brown, damp.			6-01			0
1	Below 0.9 m - dark brown, black seams, hydrocarbon-like odour.			**6-02**			45
	SAND, some silt, trace gravel, fine to coarse, subangular to subrounded, grey/green, very loose, moist, hydrocarbon-like odour.			**6-03** **6-04***			140
2	SILT, some gravel, fine to coarse, subangular to subrounded, trace sand, fine to coarse grained, grey, hard, damp.			**6-05**			25
3				6-06			15
4				**6-07**			0
				6-08			0
5				6-09			0
6				6-10			5
	Bottom of hole at 6.1 m.						
7							
8							
9							
10							

10^1 10^2 10^3 10^4

CONCRETE
BENTONITE
SAND
BENTONITE

NOTES
Bolded sample denotes sample analyzed.
* denotes blind field duplicate.
6-04 is a blind field duplicate of 6-03.

Print Date: 2015.05.15 QA1: CMT Date Approved: 2015.03.11

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-02D

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2020 03 02	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	106.576	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	107.354 107.382	Date Drilled:	2020 02 27
Pipe/Slotted Pipe Dia. (m)	0.03/0.03	Northing: 5444395.730	Easting: 429182.203	Log Typed By:	SW

Drilling Legend: Sample Interval; Vibrasonic

Water/NAPL Levels: Water Level 1; Water Level 2; NAPL; NAPL

Reading within indicated scale; Reading outside indicated scale

Soil Vapour (ppm)

Solid PVC; Slotted PVC

Well Name 1: MW20-02(D)
Well Name 2: MW20-02(2D)

Depth in Metres	Soil Description	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	SILT, some sand, fine to medium grained, some gravel, fine to coarse, subrounded to subangular, brown, soft to firm, moist.		02D-01	57		5
			02D-02			5
1			02D-03	80		5
	At 1.5 m - brick chunks.					
2			02D-04 02D-05*			20
3			**02D-06**	90		140
	SAND and GRAVEL, fine to coarse grained sand, fine to coarse gravel, subrounded to subangular, some silt, grey-brown, loose to dense, moist.					
4	Between 4.0 m and 4.6 m - some dark brown wood debris, metal debris, unknown odour.		**02D-07**			15
			02D-08	133		210
5						
			02D-09			160
6			**02D-10**	117		30
	SAND, fine to medium grained, brown, soft, moist.					
7			02D-11			15
				127		
8	SILT, some sand, fine grained, grey, dense, moist. Between 7.9 m and 8.5 m - grey-brown.		**02D-12**			630
9	Below 8.8 m - some gravel, fine to coarse, subangular.		02D-13			35
	Bottom of hole at 9.1 m.					
10						

CONCRETE
BENTONITE
MW20-02(D)
SAND
BENTONITE
MW20-02(2D)
SAND

NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 03 06 Print Date:2020-04-30

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-04R

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	n/a	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	107.481	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	n/a	Date Drilled:	2020 02 27
Pipe/Slotted Pipe Dia. (m)	none/none	Northing: 5444463.805	Easting: 429176.326	Log Typed By:	SW

Drilling Legend
- Sample Interval
- Vibrasonic

Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Soil Description

Stratigraphy Plot | Sample Interval Core Run | Sample Number | Blow Count | % Recovery

Soil Vapour (ppm)
- ○ Reading within indicated scale
- ● Reading outside indicated scale

10^1 10^2 10^3 10^4

Depth in Metres	Soil Description	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	SILT, trace sand, fine grained, trace gravel, fine to coarse, subangular.	04R-01		60	130
	GRAVEL, fine, red-brown, wet.	**04R-02**			75
1		04R-03			60
	SAND, fine grained, brown, oxidized red, moist to wet.			47	
	SILT, some sand, fine grained, trace gravel, fine to coarse, subangular to subrounded, grey, hard, moist.				
2		**04R-04** **04R-05***			100
3				70	
		04R-06			30
4		04R-07			25
	Bottom of hole at 4.6 m.				
5					
6					
7					
8					
9					
10					

SAND

BENTONITE

NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 03 06 Print Date:2020-04-30

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-06R

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2020 03 02	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	109.073	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	109.834	Date Drilled:	2020 02 27
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444483.515	Easting: 429177.431	Log Typed By:	SW

Drilling Legend
- Sample Interval
- Vibrasonic

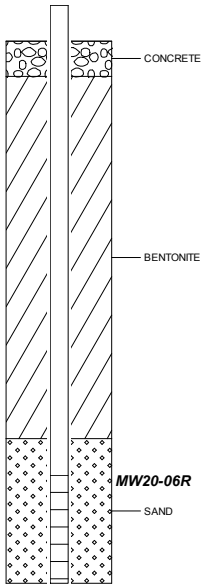
Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Reading within indicated scale
Reading outside indicated scale

Solid PVC
Slotted PVC

Well Name 1: MW20-06R

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	SILT (FILL), trace sand, fine to coarse grained, trace gravel, fine to coarse, subrounded, brown, damp.			**06R-01**		63	60
				06R-02			40
1	Below 0.9 m - dark brown, black seams.						
	SAND, some silt, trace gravel, fine to coarse, subangular to subrounded, grey-green, very loose, moist.			06R-03			25
	SILT, some gravel, fine to coarse, subangular to subrounded, trace sand, fine to coarse grained, grey, hard, damp.					100	
2				**06R-04** **06R-05***			340
3				06R-06		107	15
4				06R-07			15
	Bottom of hole at 4.6 m.						
5							
6							
7							
8							
9							
10							



NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 03 06 Print Date:2020-04-30

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-07

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2020 03 02	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	103.097	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	103.972	Date Drilled:	2020 02 26
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444346.272	Easting: 429209.301	Log Typed By:	SW

Drilling Legend
- Sample Interval
- Vibrasonic

Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Reading within indicated scale
Reading outside indicated scale

Solid PVC
Slotted PVC

Well Name 1: MW20-07

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	SILT, some sand, fine to medium grained, brown, wet, some rootlets.			07-01		57	5
1	SAND and GRAVEL, fine to coarse grained sand, fine gravel, subangular, grey-brown, damp.			07-02			15
				07-03		92	15
2	SAND and GRAVEL, fine to coarse grained sand, fine to coarse gravel, subrounded to subangular, grey-brown, damp.			**07-04**			80
3	ROCK and GRAVEL, fine to coarse, grey.						
	SAND, fine to coarse grained, some silt, brown, dense, moist.					103	30
4	Between 3.7 m and 4.0 m - some gravel, fine, subrounded, grey.			07-05 07-06*			
				07-07		114	65
5	SAND and GRAVEL, fine to coarse grained sand, fine to coarse gravel, subrounded to subangular, grey-brown.						220
	SILT and SAND, fine grained, trace gravel, fine, subrounded to subangular, brown, damp.			**07-08**		200	
6	GRAVEL, fine to coarse, subrounded, some sand, fine to coarse grained, some cobbles, brown, dense.					117	
7				07-09			40
	Bottom of hole at 7.6 m.						
8							
9							
10							

Soil Vapour (ppm): 10^1 10^2 10^3 10^4

CONCRETE
BENTONITE
MW20-07
SAND
BENTONITE

NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 03 06 Print Date:2020-04-30

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-08

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2020 03 02	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	103.377	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	104.175	Date Drilled:	2020 02 26
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444369.720	Easting: 429208.941	Log Typed By:	SW

Drilling Legend: Sample Interval; Vibrasonic

Water/NAPL Levels: Water Level 1; Water Level 2; NAPL; NAPL

Reading within indicated scale; Reading outside indicated scale

Solid PVC; Slotted PVC

Well Name 1: MW20-08

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	SAND and GRAVEL, fine to coarse grained sand, fine to coarse gravel, subrounded to subangular, some silt, brown, loose, moist.			08-01	53		25
1				**08-02**			25
				08-03			25
2	Between 1.5 m and 3.1 m - chunk of concrete.				37		
				08-04			35
3	Between 3.1 m and 4.0 m - no silt, wet.				80		
				08-05			40
4	Between 4.0 m - 4.6 m - fine grained sand, grey, dense.			08-06*			
	SAND and GRAVEL, fine to coarse grained sand, fine gravel, subrounded, brown, dense, damp.			**08-07**	93		610
5							
				08-08			100
6	Bottom of hole at 6.1 m.						
7							
8							
9							
10							

Soil Vapour (ppm) scale: 10^1 10^2 10^3 10^4

CONCRETE; BENTONITE; *MW20-08*; SAND; BENTONITE

NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 03 06 Print Date:2020-04-30

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-09

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2020 03 02	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	105.982	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	106.618	Date Drilled:	2020 02 26
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444453.061	Easting: 429206.906	Log Typed By:	SW

Drilling Legend
- Sample Interval
- Vibrasonic

Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Soil Description

Stratigraphy Plot | Sample Interval Core Run | Sample Number | Blow Count | % Recovery | Soil Vapour (ppm)

Soil Vapour (ppm): ○ Reading within indicated scale; ● Reading outside indicated scale; 10^1 10^2 10^3 10^4

Well Name 1: MW20-09
- Solid PVC
- Slotted PVC

Depth (m)	Soil Description	Sample Number	% Recovery	Soil Vapour (ppm)
0	SILT and SAND, fine grained, some gravel, fine, subrounded, brown, loose, moist, organics	09-01	57	15
	Below 0.2 m - no organics.			15
1		**09-02**		
		09-03	100	20
2	SAND and GRAVEL, fine to medium grained sand, fine to coarse gravel, subrounded to subangular, grey-brown, dense, damp.	**09-04**		80
3	SILT, some sand, fine grained, some gravel, fine, subrounded, to subangular, grey, very dense, moist.	**09-05**	97	55
		09-06*		
4		09-07		20
	Bottom of hole at 4.6 m.			
5				
6				
7				
8				
9				
10				

CONCRETE
BENTONITE
MW20-09
SAND
BENTONITE

NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 03 06 Print Date:2020-04-30

SNC·LAVALIN

	Client **Public Services & Procurement Canada**	**Borehole No. : BH20-10**
	Location **DND Bunker Site, Nanaimo, BC**	PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2020 03 02	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	106.389	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	107.230	Date Drilled:	2020 02 26
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444489.354	Easting: 429207.092	Log Typed By:	SW

Drilling Legend: Sample Interval; Vibrasonic

Water/NAPL Levels: Water Level 1; Water Level 2; NAPL; NAPL

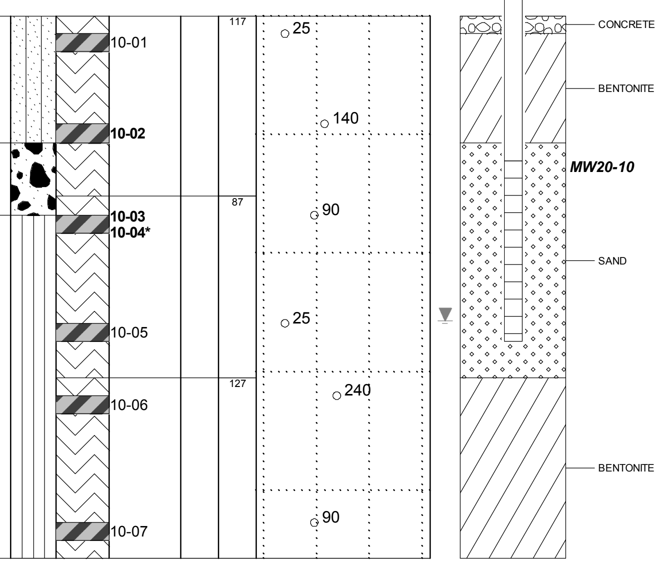
Soil Vapour (ppm): ○ Reading within indicated scale; ● Reading outside indicated scale

Solid PVC; Slotted PVC

Well Name 1: MW20-10

Columns: Depth in Metres | Soil Description | Stratigraphy Plot | Sample Interval Core Run | Sample Number | Blow Count | % Recovery | Soil Vapour (ppm) 10^1 10^2 10^3 10^4

Depth (m)	Soil Description
0	SILT and SAND, fine to medium grained, some gravel, fine to coarse, subangular, brown, loose, damp.
	At 0.5 m - cobble or boulder.
1.1	GRAVEL, fine to coarse, subangular to subrounded, some sand, fine to medium grained, grey, very hard.
1.7	SILT, some sand, fine grained, some gravel, fine to coarse, subrounded to subangular, grey, very dense, moist.
	Between 3.1 m and 4.6 m - cobbles.
4.6	Bottom of hole at 4.6 m.



NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 03 06 Print Date:2020-04-30

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-11

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2020 03 02	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	109.754	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	110.477	Date Drilled:	2020 02 27
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444499.919	Easting: 429177.841	Log Typed By:	SW

Drilling Legend: Sample Interval; Vibrasonic

Water/NAPL Levels: Water Level 1; Water Level 2; NAPL; NAPL

Reading within indicated scale; Reading outside indicated scale

Solid PVC; Slotted PVC

Well Name 1: MW20-11

Depth in Metres	Soil Description	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	SILT and SAND, fine to medium grained, some gravel, fine to coarse, subrounded to subangular, brown, hard to dense, damp.	11-01		107	370
1		**11-02**			190
		11-03			90
		11-04*			
	At 1.5 m - large cobbles, moist.			97	
2		**11-05**			600
	SAND and GRAVEL, fine to medium grained sand, fine to coarse gravel, subrounded to subangular, grey, hard.				
3	SILT, some sand, fine to medium grained, grey, hard.	11-06		127	75
4	Between 4.0 m and 4.6 m - fine to coarse grained sand.	11-07			25
	Bottom of hole at 4.6 m.				
5					
6					
7					
8					
9					
10					

Soil Vapour (ppm) scale: 10^1 10^2 10^3 10^4

CONCRETE; BENTONITE; *MW20-11*; SAND; BENTONITE

NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 03 06 Print Date:2020-04-30

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-12

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2020 03 02	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	109.324	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	110.150	Date Drilled:	2020 02 27
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444484.125	Easting: 429155.408	Log Typed By:	SW

Drilling Legend: Sample Interval; Vibrasonic

Water/NAPL Levels: Water Level 1; Water Level 2; NAPL; NAPL

Reading within indicated scale; Reading outside indicated scale

Solid PVC; Slotted PVC

Well Name 1: MW20-12

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	SILT, some sand, fine to medium grained, some gravel, fine to coarse, subrounded, dark brown, soft, moist. Between 0 m and 0.6 m - dark brown, soft.			12-01		50	10
	Below 0.6 m - brown, stiff.			12-02			25
1				**12-03** **12-04***			15
	GRAVEL, fine, subrounded to subangular, some sand, fine to coarse grained, grey, loose, wet.					77	
2	SILT, some sand, fine to medium grained, some gravel, fine to coarse, subrounded to subangular, grey, very dense, moist.			12-05			30
3				12-06		117	170
	Below 3.7 m - increased gravel, damp.						
4				12-07			35
	Bottom of hole at 4.6 m.						
5							
6							
7							
8							
9							
10							

Soil Vapour (ppm) scale: 10^1 10^2 10^3 10^4

Well construction: CONCRETE; BENTONITE; *MW20-12*; SAND; BENTONITE

NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 03 06 Print Date:2020-04-30

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-02R

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	n/a	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	106.576	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	n/a	Date Drilled:	2020 12 07
Pipe/Slotted Pipe Dia. (m)	0.03/0.03	Northing: 5444404.661	Easting: 429176.676	Log Typed By:	NDS

Drilling Legend
- Sample Interval
- Vibrasonic

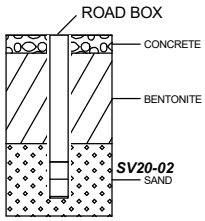
Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Reading within indicated scale
Reading outside indicated scale

Solid PVC
Slotted PVC

Well Name 1: SV20-02

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm) 10^1 10^2 10^3 10^4
0	SILT, some sand, fine to medium grained, some gravel, fine to coarse, subangular to subrounded, grey-brown, soft to firm, moist.					83	
1							
1.5	Bottom of hole at 1.5 m.						
2							
3							
4							
5							
6							
7							
8							
9							
10							



NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 12 16 Print Date:2021-03-31

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-06R

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	n/a	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	109.073	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	109.834	Date Drilled:	2020 02 27
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444483.515	Easting: 429177.431	Log Typed By:	SW

Drilling Legend: Sample Interval; Vibrasonic

Water/NAPL Levels: Water Level 1; Water Level 2; NAPL; NAPL

Reading within indicated scale; Reading outside indicated scale

Solid PVC; Slotted PVC

Well Name 1: MW20-06R

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	SILT (FILL), trace sand, fine to coarse grained, trace gravel, fine to coarse, subrounded, brown, damp.			**06R-01**		63	60
				06R-02			40
1	Below 0.9 m - dark brown, black seams. SAND, some silt, trace gravel, fine to coarse, subangular to subrounded, grey-green, very loose, moist.			06R-03			25
	SILT, some gravel, fine to coarse, subangular to subrounded, trace sand, fine to coarse grained, grey, hard, damp.					100	
2				**06R-04** **06R-05***			340
3				06R-06		107	15
4	Bottom of hole at 4.6 m.			06R-07			15
5							
6							
7							
8							
9							
10							

CONCRETE

BENTONITE

MW20-06R

SAND

NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 03 06 Print Date:2021-03-31

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-08R

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	n/a	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	103.377	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	n/a	Date Drilled:	2020 12 07
Pipe/Slotted Pipe Dia. (m)	none/none	Northing: 5444370.830	Easting: 429208.839	Log Typed By:	NDS

Drilling Legend
- Sample Interval
- Vibrasonic

Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Reading within indicated scale
Reading outside indicated scale

Solid PVC
Slotted PVC

Well Name 1: SV20-08R

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm) 10^1 10^2 10^3 10^4
0	SAND and GRAVEL, fine to coarse grained sand, fine to coarse gravel, subangular to subrounded, some silt, brown, loose, moist.					53	
1							
2	Bottom of hole at 1.5 m.						
3							
4							
5							
6							
7							
8							
9							
10							

BENTONITE
SAND
SV20-08R

NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.
SV probe shown above installed 2020 12 17 to replace original installation.

QA CWM 2020 12 16 Print Date:2021-03-31

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-13

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2020 12 21	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	103.695	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	103.628	Date Drilled:	2020 12 07
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444328.476	Easting: 429199.269	Log Typed By:	NDS

Drilling Legend
- Sample Interval
- Vibrasonic

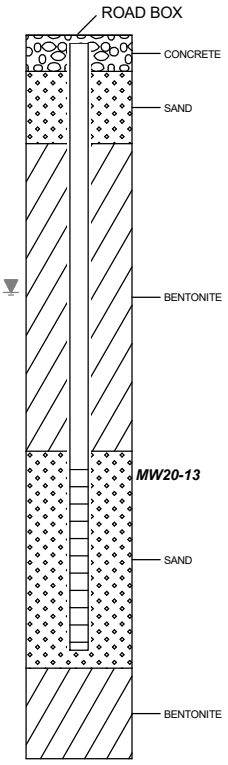
Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Reading within indicated scale
Reading outside indicated scale

Solid PVC
Slotted PVC

Well Name 1: MW20-13

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	ASPHALT.					80	0
	SAND and GRAVEL, fine to coarse grained sand, fine to coarse gravel, subangular to subrounded, some silt, trace cobbles, brown, loose, damp.			**13-01**			20
1				13-02			
	SILT and SAND, fine to medium grained, trace gravel, fine, subangular to subrounded, dark brown, soft, damp.			13-03			80
	Between 1.5 m and 1.7 m - SAND and GRAVEL seam, fine to coarse grained sand, fine to coarse gravel, wet.					139	55
2	SILT and SAND, fine grained, trace gravel, coarse, subrounded, grey-brown, firm, damp.			13-04			
				13-05			30
						167	
3				13-06			40
						97	
				13-07			250
4	GRAVEL, fine to coarse, subangular to subrounded, some sand, fine to coarse grained, some cobbles, grey, very dense, damp.						
				13-08		161	110
5	SAND, fine to coarse grained, some gravel, fine to coarse, subrounded, trace silt, brown, loose, wet.			13-09*			
	SAND and GRAVEL, fine to coarse grained sand, fine to coarse gravel, subangular to subrounded, some silt, grey-brown, dense, damp.						
						150	60
6				13-10			
	Bottom of hole at 6.1 m.						
7							
8							
9							
10							



NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 12 16 Print Date:2021-03-31

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-14

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	n/a	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	102.251	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	n/a	Date Drilled:	2020 12 07
Pipe/Slotted Pipe Dia. (m)	none/none	Northing: 5444346.464	Easting: 429218.494	Log Typed By:	NDS

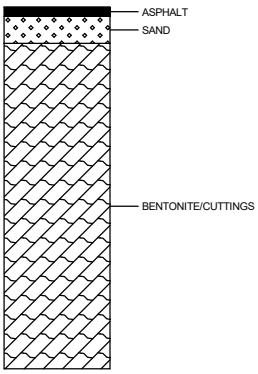
Drilling Legend
- Sample Interval
- Vibrasonic

Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	ASPHALT.						
	SAND, fine to coarse grained, some silt, trace gravel, fine, subangular to subrounded, grey-brown, dense, damp. At 0.2 m - some cobbles.			**14-01**		73	25
1				14-02			35
	SILT and SAND, fine grained, grey, damp, hard.			14-03			35
	SAND and GRAVEL, fine to coarse grained sand, fine to coarse gravel, subangular to subrounded, grey-brown, loose, moist. At 1.5 m - large cobble.			**14-04** **14-05***		133	40
2	SILT and SAND, fine to medium grained, some gravel, fine to coarse, subangular to subrounded, brown, some orange, dense, damp. Below 2.4 m - grey.			14-06			25
				14-07		117	10
3	Bottom of hole at 3.1 m.						
4							
5							
6							
7							
8							
9							
10							

Reading within indicated scale
Reading outside indicated scale

Soil Vapour (ppm): 10^1 10^2 10^3 10^4



NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 12 16 Print Date:2021-03-31

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-15

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	n/a	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	102.242	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	n/a	Date Drilled:	2020 12 07
Pipe/Slotted Pipe Dia. (m)	none/none	Northing: 5444370.797	Easting: 429218.361	Log Typed By:	NDS

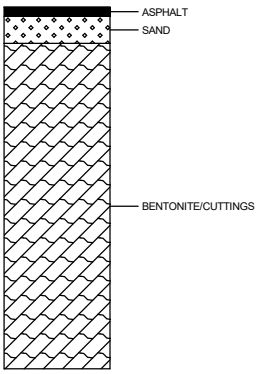
Drilling Legend
- Sample Interval
- Vibrasonic

Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	ASPHALT.					70	0
	SAND and GRAVEL, medium to coarse grained sand, fine to coarse gravel, subrounded, grey, loose, moist.			**15-01**			0
	SILT and SAND, fine to coarse grained, some gravel, fine to coarse, subangular to subrounded, brown, dense, damp.			15-02			20
1	Between 1.2 m and 1.5 m - dark brown.			15-03			
	Below 1.4 m - trace gravel.			15-04*		107	280
2				**15-05**			
	SILT and SAND, fine to medium grained, trace gravel, fine to coarse, subangular to subrounded, grey, some brown, firm to stiff, damp.			15-06		167	15
				15-07		189	0
3	Bottom of hole at 3.1 m.						

Reading within indicated scale
Reading outside indicated scale

Soil Vapour (ppm): 10^1 10^2 10^3 10^4



NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 12 16 Print Date:2021-03-31

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-16

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	n/a	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	102.016	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	n/a	Date Drilled:	2020 12 08
Pipe/Slotted Pipe Dia. (m)	none/none	Northing: 5444370.370	Easting: 429227.682	Log Typed By:	NDS

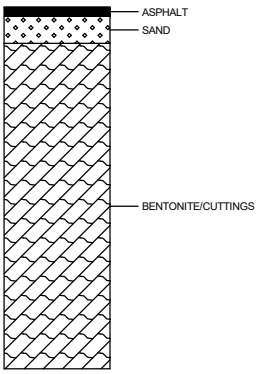
Drilling Legend
- Sample Interval
- Vibrasonic

Water/NAPL Levels
- Water Level 1
- Water Level 2
- NAPL
- NAPL

Reading within indicated scale
Reading outside indicated scale

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	ASPHALT.					77	15
	SAND and GRAVEL, fine to coarse grained sand, fine to coarse gravel, subangular to subrounded, grey-brown, loose, moist.			**16-01**			30
1	SILT and SAND, fine to medium grained, trace gravel, coarse, subangular to subrounded, grey-brown, stiff, damp.			16-02			35
				16-03			
2	GRAVEL, fine to coarse, subangular to subrounded, some silt, some sand, fine to coarse grained, red-brown, loose to dense, moist, trace dark staining.			16-04 16-05*		100	15
	SAND, fine to coarse grained, some gravel, fine, subangular to subrounded, brown, loose, damp.			**16-06**			30
3	Below 2.6 m - some silt, descreased sand, fine to medium grained, medium dense.			16-07			25
	Bottom of hole at 3.1 m.						

10^1 10^2 10^3 10^4



NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 12 16 Print Date:2021-03-31

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-17

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2020 12 21	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	102.983	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	102.840	Date Drilled:	2020 12 08
Pipe/Slotted Pipe Dia. (m)	0.05/0.05	Northing: 5444393.974	Easting: 429217.741	Log Typed By:	NDS

Drilling Legend: Sample Interval; Vibrasonic

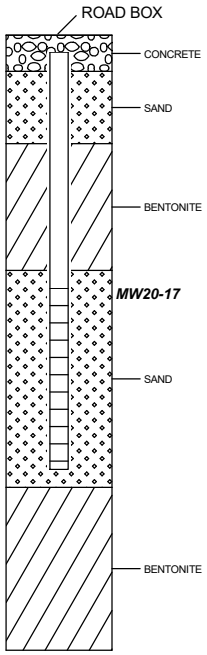
Water/NAPL Levels: Water Level 1; Water Level 2; NAPL; NAPL

Reading within indicated scale; Reading outside indicated scale

Solid PVC; Slotted PVC

Well Name 1: MW20-17

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	ASPHALT.			**17-01**		94	45
	SAND, fine to coarse grained, some gravel, fine to coarse, subangular to subrounded, trace silt, brown, loose, moist.						55
	SILT and SAND, fine grained, some gravel, coarse, subrounded, grey-brown, dense, damp.			17-02			
1				17-03		108	45
				17-04		93	110
2	SAND and GRAVEL, fine to coarse grained sand, fine to coarse gravel, subangular to subrounded, trace silt, red-brown, loose to dense, moist.						
	SAND, fine to coarse grained, trace silt, trace gravel, fine to coarse, subangular to subrounded, brown, loose, wet.			**17-05** **17-06***			55
3						106	110
	SILT and SAND, fine to medium grained, trace gravel, fine to coarse, subangular to subrounded, grey, very stiff, damp. At 3.7 m - trace dark staining			17-07			
4	Between 4.0 m and 4.3 m - no gravel, some brown, wet.			**17-08**		150	510
	Below 4.6 m - trace cobbles.			17-09		83	130
5	At 5.2 m - refusal.						
	Bottom of hole at 5.2 m.						
6							
7							
8							
9							
10							



NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 12 16 Print Date:2021-03-31

SNC·LAVALIN

Client
Public Services & Procurement Canada

Location
DND Bunker Site, Nanaimo, BC

Borehole No. : BH20-18

PAGE 1 OF 1

Drilling Contractor	Drillwell Enterprises Ltd.	Date Monitored	2020 12 21	Project Number:	626692
Drilling Method	Vibratory Sonic	Ground Surface Elev. (m)	104.616	Borehole Logged By:	CWM
Borehole Dia. (m)	0.15	Top of Casing Elev. (m)	104.507 104.514	Date Drilled:	2020 12 08
Pipe/Slotted Pipe Dia. (m)	0.03/0.03	Northing: 5444442.660	Easting: 429216.624	Log Typed By:	NDS

Drilling Legend: Sample Interval; Vibrasonic

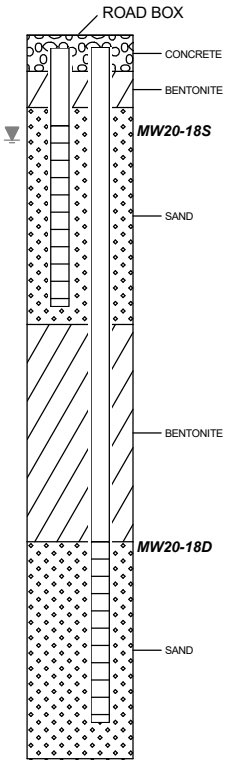
Water/NAPL Levels: Water Level 1; Water Level 2; NAPL; NAPL

Reading within indicated scale; Reading outside indicated scale

Solid PVC; Slotted PVC

Well Name 1: MW20-18S
Well Name 2: MW20-18D

Depth in Metres	Soil Description	Stratigraphy Plot	Sample Interval Core Run	Sample Number	Blow Count	% Recovery	Soil Vapour (ppm)
0	ASPHALT.					60	0
	SAND and GRAVEL, fine to coarse grained sand, fine to coarse gravel, subangular to subrounded, brown, loose, moist. Below 0.3 m - some silt.			18-01			
1	SILT and SAND, fine to medium grained, trace gravel, fine to coarse, subangular to subrounded, grey, some brown, stiff, damp.			18-02			15
						78	
2				18-03		125	75
						178	15
	Below 2.7 m - some gravel, grey.			18-04			
3	Below 3.0 m - trace cobbles.					60	
							40
4				18-05			
	Below 4.6 m - saturated.					103	0
5				18-06			
							0
6	Bottom of hole at 6.1 m.			18-07			
7							
8							
9							
10							



NOTES
Bolded sample denotes sample analyzed. *denotes blind field duplicate.

QA CWM 2020 12 16 Print Date:2021-03-31

TABLE 1: Groundwater Monitoring Results

Monitoring Well No.	Top of Pipe Elevation[1] (masl)	Ground Surface Elevation (masl)	Screen Interval (mbgs)	Depth to Bottom (masl)	Date (yyyy/mm/dd)	Well Riser Headspace Vapour Reading [2] (ppmv)	Apparent Free Product Thickness [3] (mm)	Groundwater Depth (mtop)	Groundwater Depth (mbgs)	Potentiometric Elevation (masl)
MW15-01	106.00	105.37	4.0 - 5.5	6.18	2015-03-11	10	ND	3.05	2.41	102.95
	106.00				2020-02-12	15	ND	2.58	1.94	103.42
	106.00				2020-09-22	160	ND	3.37	2.73	102.64
	106.00				2020-11-16	NM	ND	2.32	1.69	103.68
MW15-02	108.40	107.76	4.9 - 6.4	7.07	2015-03-11	60	ND	6.01	5.37	102.39
	108.40				2020-02-12	25	ND	5.80	5.17	102.59
	108.40				2020-09-22	2950	ND	6.68	6.04	101.72
	108.40				2020-11-16	930	ND	6.66	6.02	101.74
MW15-03	108.64	107.86	3.0 - 4.6	5.42	2015-03-11	0	ND	4.27	3.50	104.36
	108.64				2020-02-12	0	ND	4.10	3.33	104.54
	108.64				2020-09-22	85	ND	4.66	3.89	103.97
	108.64				2020-11-16	NM	ND	3.97	3.20	104.66
MW15-04	108.57	107.69	0.6 - 2.1	3.13	2015-03-11	80	ND	1.75	0.88	106.82
	108.57				2020-02-12	25	ND	1.60	0.73	106.97
	108.57				2020-09-22	100	ND	2.01	1.14	106.56
	108.57				2020-11-16	NM	ND	1.17	0.29	107.40
MW15-05	109.00	108.38	0.6 - 2.1	2.83	2015-03-11	75	ND	2.02	1.40	106.98
	109.00				2020-02-12	50	ND	1.90	1.29	107.09
	109.00				2020-09-22	110	ND	2.07	1.45	106.93
	109.00				2020-11-16	NM	ND	1.65	1.03	107.35
MW15-06	109.70	109.02	1.2 - 2.7	3.45	2015-03-11	75	ND	3.35	2.67	106.35
	109.70				2020-02-12	0	ND	1.88	1.20	107.82
	109.70				2020-09-22	60	ND	1.92	1.24	107.78
	109.70				2020-11-16	NM	ND	1.61	0.93	108.09
MW20-02(2D)	107.38	106.58	8.2 - 9.1	9.93	2020-03-02	630	ND	6.14	5.33	101.25
	107.38				2020-09-22	60	ND	6.59	5.78	100.80
	107.38				2020-11-16	0	ND	5.04	4.24	102.34
MW20-02(D)	107.35	106.58	5.2 - 6.1	6.91	2020-03-02	95	ND	6.00	5.22	101.35
	107.35				2020-09-22	20	ND	6.33	5.55	101.03
	107.35				2020-11-16	120	ND	5.67	4.89	101.68
MW20-06R	109.83	109.07	3.7 - 4.6	5.32	2020-03-02	0	ND	0.03	-0.73	109.80
MW20-07	103.97	103.10	3.1 - 4.6	5.38	2020-03-02	4180	ND	3.91	3.04	100.06
	103.97				2020-09-22	60	ND	4.61	3.73	99.36
	103.97				2020-11-16	NM	ND	3.15	2.28	100.82
MW20-08	104.17	103.38	2.4 - 4.0	4.77	2020-03-02	120	ND	3.25	2.45	100.92
	104.17				2020-09-22	110	ND	3.80	3.00	100.38
	104.17				2020-11-16	NM	ND	0.64	-0.15	103.53
MW20-09	106.62	105.98	1.4 - 2.9	3.54	2020-03-02	190	ND	1.74	1.11	104.88
	106.62				2020-09-22	25	ND	2.62	1.98	104.00
	106.62				2020-11-16	NM	ND	1.35	0.72	105.26
MW20-10	107.23	106.39	1.2 - 2.7	3.59	2020-03-02	2860	ND	3.41	2.57	103.82
	107.23				2020-09-22	65	ND	3.00	2.16	104.23
	107.23				2020-11-16	NM	ND	2.03	1.18	105.20
MW20-11	110.48	109.75	1.2 - 2.7	3.55	2020-03-02	4840	ND	2.83	2.11	107.64
	110.48				2020-09-22	0	ND	1.50	0.78	108.98
	110.48				2020-11-16	NM	ND	0.81	0.09	109.67
MW20-12	110.15	109.32	1.2 - 2.7	3.62	2020-03-02	3630	ND	2.25	1.42	107.90
	110.15				2020-09-22	110	ND	2.42	1.59	107.73
	110.15				2020-11-16	NM	ND	2.06	1.24	108.09
MW20-13	103.63	103.69	3.7 - 5.2	NM	2020-12-21	NM	ND	2.10	2.17	101.53
MW20-17	102.84	102.98	2.1 - 3.7	NM	2020-12-21	860	ND	1.72	1.86	101.12
MW20-18S	104.51	104.62	0.8 - 2.3	NM	2020-12-21	NM	ND	0.77	0.88	103.73

NOTES:

mm - millimetres
masl - metres above sea level
mbgs - metres below ground surface
top - top of pipe
ppmv - parts per million by volume
NS - Not Surveyed
NA - Not Available
NM - Not Measured/Monitored
ND - Not Detectable

[1] Reference Elevation is a mark on the rim of the monitoring well standpipe surveyed with respect to Geodetic datum.
[2] Readings in parts per million by volume (ppmv) relative to hexane, unless otherwise specified.
[3] Free Product specific gravity assumed to be 0.80 g/mL.

Annex E. Environmental Protection Reports

- Annex DE1A
- Summary of Environmental Assessment

PROJECTS AND PHYSICAL ACTIVITIES ON FEDERAL LANDS

ENVIRONMENTAL IMPACT ASSESSMENT EVALUATION FORM

57. This form shall be filled out by the Project / Physical Activity Office of Primary Interest (OPI) during the planning phase of every Project or new Physical Activity undertaken in the MARPAC Area of Responsibility. Upon completion of this form, it is to be sent to MARPAC Environmental Specialist Staff (ESS). MARPAC ESS will review, register on the DND EIA Portal and identify the Environmental Impact Assessment (EIA) requirements. Further information for this form can be found by referencing the MARPAC SEMS Directive E1: Environmental Impact Assessments (MARPAC SEMS DE1). Any queries regarding the requirements for and use of this form can be directed to MARPAC ESS (250-363-7547).

SECTION A: PROJECT / PHYSICAL ACTIVITY IDENTIFICATION

58. To be completed by the Project / Physical Activity OPI.

Date:	July 2, 2021
Project / Physical Activity Title: Ensure title is unique and descriptive. For example "Construction of a New Medical Centre at CFB Esquimalt" versus "Construct a building".	Remedial Excavation - CFB Esquimalt Nanaimo Military Camp (NMC) Bunker, Nanaimo, BC
Project / Physical Activity File Number (if applicable):	R.116936
Projected Start Date of Project / Physical Activity:	Fall 2021
DND OPI Name:	Rachel Speller
DND OPI Contact Information: (E-mail / Telephone)	rachel.speller@forces.gc.ca 250-818-0543
Project / Physical Activity Description: Include a description of all components associated with the proposed work. Provide information in plain language that is concise, but clearly details the intended purpose of the work and describes all activities that will be undertaken. Do not use acronyms. Enclose copies of any supporting documentation that may provide further details on proposed work.	
The project will consist of the remediation of contaminated soil in four areas of the NMC Bunker property shown as Excavation Areas 1A, 1B, 2 and 3 (refer to map below) . Contaminants of Concern (COC) in soil identified in previous investigations include ethylbenzene, naphthalene, phenanthrene, Index of Additive Cancer Risk (IACR), trichloroethylene, lead, hydrocarbon fraction F2, and copper. The goal of remediation is to reduce future liability related to environmental conditions. A remedial excavation of the contaminated soils will be completed with the aim to achieve confirmatory results that satisfy the appropriate federal guidelines for the Site. The contaminated soil is to be excavated for transport and disposal at an approved off-site facility. Following the completion of the excavations, they will be backfilled and restored to current grade.	

Map: Insert a map showing the location of all proposed Project / Physical Activity components. Include laydown/staging areas, excavation zones, soil storage areas, and off-road vehicle/equipment access routes if applicable.

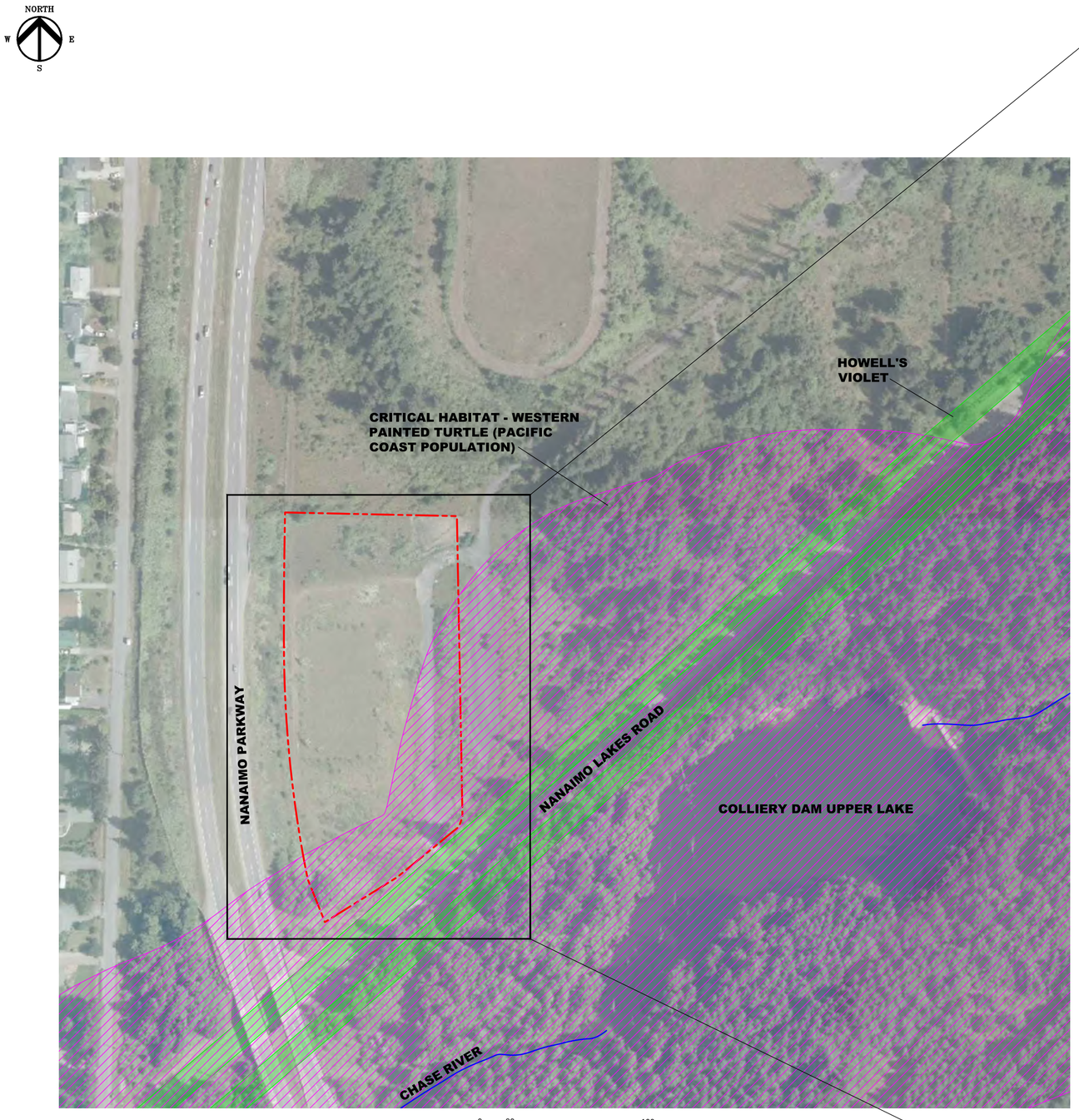
See Drawing 626692-403.

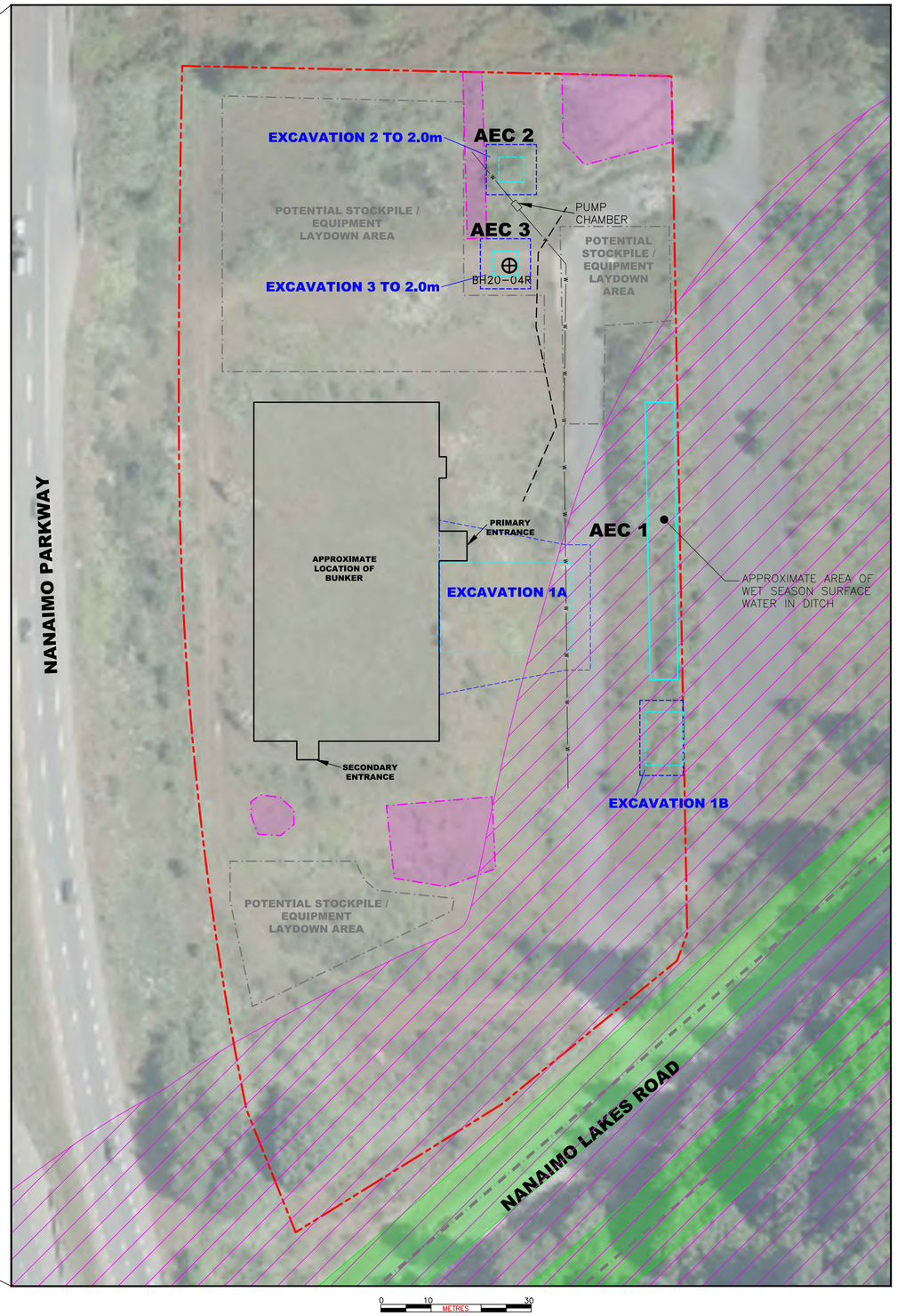
Description of Environment: Describe environmental setting and any features (e.g., waterbodies, vegetation, buildings, parking lots, etc.) that are within and adjacent to the Project / Physical Activity footprint.

The Site is approximately 2 hectares in size and is located on the north side of Nanaimo Lakes Road and east of the Nanaimo Parkway, in the City of Nanaimo. The Site is accessed through the entrance on the south side of the Site along Nanaimo Lakes Road and is enclosed with chain link fencing along the north, east and southern perimeters, and wood panel fencing on the western perimeter. The Site is occupied by a two-storey bunker that was decommissioned and sealed in the late 1990's and is currently vacant. Vegetation on Site is dominated by a mixture of grasses and herbaceous species intermixed with common hawthorn (non-native) and invasive species including Himalayan blackberry and Scotch broom. Some native tree and shrub species (i.e. primarily immature black cottonwood, Coastal Douglas-fir, Saskatoon and red alder) are also present. The Chase River and Colliery Dam's Upper Lake are located across Nanaimo Lakes Road approximately 100 m south/southwest of the Site of the Site. An unnamed watercourse is also located approximately 325 m to the north of the Site. Searches through iMapBC identified some areas of the Site to be located within proposed Critical Habitat for the Western Painted Turtle (Pacific Coast population) (Endangered, Schedule 1 of the SARA). Historical occurrences of Howell's violet (provincially Red-listed, not listed federally) have been reported along Nanaimo Lakes Road to the south of the Site.

MARPAC ESS has reviewed Threshold Conditions and noted the following:

PROCEED TO SECTION B: INITIAL EVALUATION





LEGEND

- SUBJECT PROPERTY LIMITS
- SITE FEATURES
- WATER LINE
- COMMUNICATION LINE
- APPROXIMATE TOP OF LIMITS OF EXCAVATION
- APPROXIMATE BASE OF EXCAVATION
- CRITICAL HABITAT – WESTERN PAINTED TURTLE (PACIFIC COAST POPULATION)
- HOWELL'S VIOLET
- MEDIUM QUALITY NESTING HABITAT AREA

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. LOCATION OF EXISTING UTILITIES SHOWN ARE APPROXIMATE ONLY AND SHOULD BE CONFIRMED ON SITE. NOT ALL UTILITIES MAY BE SHOWN.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	–	–

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
1	2021-11-24	ISSUED TO CLIENT	PRT	IM
0	2021-10-21	ISSUED TO CLIENT	AJK	IM

CLIENT NAME: PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT LOCATION: NANAIMO BUNKER, NANAIMO, B.C.

SNC·LAVALIN

TITLE: **ENVIRONMENTAL OVERVIEW**

DWN BY: PRT	SCALE: AS SHOWN	DATE: 2021-06-17	DWG No: REV.: 1
CHK'D: JJ	PLOT: 20211124,1135	CADFILE: 626692R11	626692-501

PATH: P:\CURRENT PROJECTS\PWGSC\626692 – BUNKER SITE\4.0 EXECUTION\4.5 GIS AND DRAWINGS\CAD\626692R11.DWG

SECTION B: INITIAL EVALUATION

59. To be completed by the Project/Physical Activity OPI. This section will determine the IAA requirements associated with activities.

		YES	NO
B1	**Is the proposed activity planned to occur in an area of Northern Canada (north of 60˚)?** If YES, no further evaluation on this form is required. The IAA does not apply and engagement with the appropriate Northern office will be required. OPI shall contact MARPAC ESS for further guidance.	☐	☑
B2	**Is the proposed activity captured under the Physical Activities Regulations: SOR/2019-285 (DE1A1)?** If YES, an Impact Assessment for a Designated Project may be required. No further evaluation on this form is required. OPI shall contact MARPAC ESS for further guidance. MARPAC ESS will liaise with ADM (IE) DGESM who will provide direction regarding the scope of the activity, its potential for being a Designated Project, and notifications required in accordance with the IAA.	☐	☑
B3	**Is the proposed activity planned to occur on either Federal Lands or outside of Canada?** If NO, the proposed activity does not meet the definition of a Project under the IAA. However, activities (whether related to a physical work or not) that take place in Canada off of federal lands have the potential to trigger provincial and/or municipal environmental requirements and must still be assessed from a due diligence perspective in accordance with Departmental policy. OPI to continue evaluation on this form and submit to MARPAC ESS once complete. NOTE: For activities occurring on non-DND lands, the OPI is also responsible for initiating a request for Land Use Agreement support with the geographically located Real Property Officer.	☑	☐
B4	**Is the proposed activity being carried out in response to (1) in relation to matters of national security; (2) in response to a national emergency for which special temporary measures are being taken under the *Emergencies Act*; OR (3) in response to an emergency, and carrying out the activities without delay is in the interest of preventing damage to property or the environment or is in the interest of public health and safety.** If YES to any of the above, an Environmental Effects Determination is not required. No further evaluation on this form is required. OPI shall contact MARPAC ESS for further guidance.	☐	☑
B5	**Is the proposed activity associated with a Physical Work? Does this activity involve construction, modification, operation, or decommissioning of any type of feature/structure that (1) has been built by humans (2) has a defined area and (3) has a fixed locality. All three elements must be present in order for the answer to be YES.** If YES, the proposed activity meets the definition of a Project under the IAA. Proceed to B6 below. If NO, proceed to SECTION E: EVALUATION OF A PHYSICAL	☐	☑

	ACTIVITY.		
B6	**Does the proposed Project meet the criteria for one of the Designated Classes of Projects, as detailed in Schedule 1 of the Designated Classes of Projects Order: SOR/2019-323 (DE1A3)?** If YES, **i**dentify the applicable Section of the Order (e.g. 4(1)) and proceed to Section D: STANDARD MITIGATION MEASURES. Note that MARPAC ESS will evaluate the Project to determine whether it meets all of the stipulated conditions detailed in the Order. If MARPAC FSE verifies that the project meets all of the conditions, it is excluded from the IAA and there is no requirement for an EED. However, applicable standard mitigation measures, as detailed in Annex DE1B are still required to be implemented. If NO, proceed to SECTION C: APPLICATION OF ABBREVIATED REPORT CRITERIA	☐	☑
		Order Section #	

SECTION C: APPLICATION OF ABBREVIATED REPORT CRITERIA (ARC)

60. To be completed by the Project OPI. This section will assist MARPAC ESS in determining whether the Project qualifies for an Abbreviated EED report.

		YES	NO
C1	**Is there a possibility that the proposed Project could fall under the ARC (DE1A2)?** Note that MARPAC ESS will evaluate the Threshold Conditions for sensitivity to Project activities and proximity to project footprint. If Threshold Conditions have the potential to be impacted by Project activities, the Project will no longer qualify for an abbreviated report. It should be noted that even if your activity appears in the ARC, it can only qualify for an abbreviated report if the mitigation measures required do not go beyond avoiding or reducing environmental effects. If the mitigation measures include repairing the system or compensating for the damages elsewhere, this would no longer fall under the ARC and a full EED would be required. If this is the case, select the NO option for this question.	☐	☑
C2	**If YES, identify the applicable ARC section number (e.g. 1.1).**	**ARC Section #**	
PROCEED TO SECTION D: STANDARD MITIGATION MEASURES			

SECTION D: STANDARD MITIGATION MEASURES

61. To be completed by the Project OPI. This section will identify standard mitigation measures for routine activities/effects.

		YES	NO
D1	**Does the Project involve land alteration activities (e.g. excavation, digging, drilling)?** If YES: Prior to intrusive activities, contact BC One Call and obtain an authorized Excavation Clearance Form from RP Ops Unit (Pacific) and follow all digging instructions; Review Directive E2 Environmental and Archaeological Management of Land Alteration Activities; and Incorporate mitigation measures identified in Annex DE1B Table 1 into the EED report.	☑	☐
D2	**Does the Project involve the proposed modification, repair, removal or decommissioning of equipment/appliances/devices that may contain PCBs (e.g. transformers, capacitors, electrical equipment, fluorescent light ballasts, cable insulation, etc)?** If YES: Notify the RP Ops Det Electrical Business Manager and RP Ops Det PCB Unit Authority; Review Directive E9 Polychlorinated Biphenyls (PCBs); and Incorporate mitigation measures detailed in Annex DE1B Table 2 into the EED report.	☐	☑
D3	**Does the Project involve the proposed installation, modification, repair, removal or decommissioning of a petroleum products tank system?** If YES: Notify the RP Ops Det WFE Supervisor, RP Ops Det Storage Tank Unit Authority and MARPAC FSE Storage Tank Program Manager; Review Directive E8 Storage Tank Management; Review the RP Ops Unit (P) Petroleum Storage Tank Management Program Regional Directive; and Incorporate mitigation measures detailed in Annex DE1B Table 3 into the EED report.	☐	☑
D4	**Does the Project involve the use of a generator and associated fuel tank (e.g. belly tank) to provide temporary power during project implementation?** If YES: Incorporate mitigation measures detailed in Annex DE1B Table 4 into the EED report.	☐	☑
D5	**Does the Project involve the proposed installation, modification, repair, removal or decommissioning of a Heating Ventilation and Air Conditioning (HVAC) system or Halocarbon containing equipment (e.g.**	☐	☑

	refrigerators, chillers, etc). If YES: Notify the RP Ops Det Halocarbon Unit Authority; Review Directive E3 Halocarbon Management; Review the RP Ops Unit (P) Halocarbon Management Program Regional Directive; and Incorporate mitigation measures detailed in Annex DE1B Table 5 into the EED report.		
D6	**Does the Project involve the use of hazardous materials and/or the generation of hazardous wastes?** If YES: Review Directive SE2 Hazardous Materials Management; and Incorporate mitigation measures detailed in Annex DE1B Table 6 into the EED report.	☐	☑
D7	**Does the Project involve the generation of non-hazardous waste materials?** If YES: Review Directive E4 Solid Waste Management; and Incorporate mitigation measures detailed in Annex DE1B Table 7 into the EED report.	☑	☐
D8	**Does the Project have the potential to generate increased levels of noise in the environment external to a building or enclosure?** If YES: Incorporate mitigation measures detailed in Annex DE1B Table 8 into the EED report.	☑	☐
D9	**Does the Project have the potential to impact vegetation?** If YES: Incorporate mitigation measures detailed in Annex DE1B Table 9 into the EED report.	☑	☐
D10	**Does the Project involve concrete and/or asphalt works?** If YES: Incorporate mitigation measures detailed in Annex DE1B Table 10 into the EED report.	☐	☑
D11	**Does the Project involve materials, equipment, infrastructure that could potentially release a deleterious substance (e.g. oil, fuel, chemicals, halocarbons, PCBs) into the environment?** If YES: Review Directive SE1 Emergency Reporting, and Directive SE5 Spill Response; and Incorporate mitigation measures detailed in Annex DE1B Table 11 into the EED report.	☑	☐

D12	**Will the Project be occurring in or near a surface water feature?** If YES: Incorporate mitigation measures detailed in Annex DE1B Table 12 into the EED report.	☐	☑
D13	**Does the Project involve building construction, maintenance, repair, renovation or demolition activities?** If YES: Consult the RP Ops U (P) Designated Substances Database; Review Directive S13 Asbestos; and Incorporate mitigation measures detailed in Annex DE1B Table 13 into the EED report.	☐	☑
D14	**All Projects have health and safety requirements.** Review Safety Directives, DND General Safety Program, Canada Labour Code, Canada and Provincial Occupational Health and Safety Regulations; and Incorporate mitigation measures detailed in Annex DE1B Table 14 into the EED report.		
D15	**Does the project involve the proposed construction, installation, expansion or modification of equipment/infrastructure?** If YES: Notify RP Ops Sect ESQ Geomatics and obtain a Job Number that will be referenced on all sketches, site records and standard drawings. Submit all project deliverables to RP Ops Sect ESQ Geomatics upon project completion, IAW DND CAD/BIM Standard CETO (Construction Engineering Technical Order) C-98-002-CAD/FP-003; and Consult with all internal MARPAC stakeholders during project planning phase to ensure awareness, address scheduling and siting conflicts, and document long term roles and responsibilities associated with operations and maintenance of new equipment/infrastructure.	☐	☑
SUBMIT FORM TO MARPAC ESS			

SECTION E: EVALUATION OF PHYSICAL ACTIVITY

62. To be completed by the Physical Activity OPI. This section will assist the MARPAC ESS in determining whether a Due Diligence Environmental Effects Determination is required for your Physical Activity.

		YES	NO
E1	Have documented procedures already been developed and implemented for the proposed Physical Activity and its potential environmental impacts (e.g. Ship Class SEMS Manual SOPs, Formation SEMS Manual Directives, Unit Specific SOPs and/or Work Orders, etc). If you are uncertain, contact your UEnvO. If YES: Submit copies of all documented procedures to MARPAC ESS for review.	☑	☐
SUBMIT FORM TO MARPAC ESS			

SECTION F: EIA EVALUATION RESULTS

63. To be completed by MARPAC ESS once form has been reviewed.

MARPAC ESS has evaluated the Project / Physical Activity and determined:	
☐	Activities meet the definition of a Project under Section 81 of the IAA as it is to be carried out on federal lands or outside Canada and is in relation to a physical work. However, the proposed Project is included as one of the classes of projects set out in the Designated Classes of Projects Order and all stipulated conditions can be met. Therefore, the proposed Project does not trigger the IAA and no Environmental Effects Determination is required under section 82/83 before Project can proceed. DND OPI shall ensure that standard mitigation measures (Annex DE1B) applicable to the proposed project are implemented.
☐	Activities meet the definition of a Project under Section 81 of the IAA as it is to be carried out on federal lands or outside Canada and is in relation to a physical work. The Project is not included as one of the classes of projects set out in the Designated Classes of Projects Order or is excluded from the Order as stipulated conditions cannot be met. This Project is not found in the DND Abbreviated Report Criteria and/or Threshold Conditions are likely to be impacted by Project Activities. Therefore, an Environmental Effects Determination is required under section 82/83 before Project can proceed.
☐	Activities meet the definition of a Project under Section 81 of the IAA as it is to be carried out on federal lands or outside Canada and is in relation to a physical work. The Project is not included as one of the classes of projects set out in the Designated Classes of Projects Order or is excluded from the Order as stipulated conditions cannot be met. Therefore, an Environmental Effects Determination is required under section 82/83 before Project can proceed. This Project is found in the DND Abbreviated Report Criteria and MARPAC FSE has confirmed that Threshold Conditions are not likely to be impacted by Project Activities provided mitigation measures are implemented; therefore an Abbreviated Environmental Effects Determination (AEED) may be completed to meet the section 82/83 requirements.
☐	Activities do not meet the definition of a Project under Section 81 of the IAA. MARPAC ESS has confirmed that Threshold Conditions may be impacted by proposed Physical Activity and/or documented procedures have not been developed to adequately evaluate and mitigate the effects of the proposed Physical Activity. A Due Diligence Environmental Effects Determination is required before Physical Activity can proceed.
☑	Activities do not meet the definition of a Project under Section 81 of the IAA. MARPAC ESS has confirmed that Threshold Conditions are not likely to be impacted by proposed Physical Activity and documented procedures have been developed which adequately evaluate and mitigate the effects of the proposed Physical Activity. Provided documented procedures are implemented, no Environmental Effects Determination is required and proposed Physical Activity can proceed. Documented procedures must be reviewed on an annual basis.
Additional Information:	
Activities do not meet the definition of a Project under Section 81 of the IAA. MARPAC ESS has confirmed that Threshold Conditions are not likely to be impacted by the proposed Physical Activity provided documented procedures are implemented. Therefore, the proposed Project does not trigger the IAA and no Environmental Effects Determination is required under section 82/83 before Project can proceed. DND OPI shall ensure that the following mitigation measures are implemented: TABLE 1: LAND ALTERATION ACTIVITIES. The DND OPI will engage an	

PHYSICAL ACTIVITIES REGULATIONS: SOR/2019-285

64. The following Defence specific activities are listed in the Physical Activities Regulations:

a. The low-level flying of military fixed-wing jet aircraft, for more than 150 days in a calendar year, as part of a training program, at an altitude below 330 m above ground level on a route or in an area that was not established before October 7, 1994 by or under the authority of the Minister of National Defence or the Chief of the Defence Staff as a route or area set aside for low-level flying training;

b. The construction and operation of a new military base or military station that is established for more than 12 consecutive months;

c. The expansion of an existing military base or military station, if the expansion would result in an increase in the area of the military base or military station of 50% or more;

d. The decommissioning and abandonment of an existing military base or military station.

e. The construction, operation, decommissioning and abandonment, outside an existing military base, of a new military training area, range or test establishment for training or weapons testing that is established for more than 12 consecutive months.

f. The testing of military weapons for more than five days in a calendar year in an area other than a training area, range or test establishment established before October 7, 1994 by or under the authority of the Minister of National Defence for the testing of weapons.

DND ABBREVIATED REPORT CRITERIA

RDIMS #532901

DESIGNATED CLASSES OF PROJECTS ORDER SOR/2019-323

STANDARD MITIGATION MEASURES FOR ROUTINE ACTIVITIES/EFFECTS

TABLE 1: LAND ALTERATION ACTIVITIES

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Atmosphere, Health and Safety	Land alteration activities, such as clearing vegetation, moving soil, excavating, or placing fill, have the potential to generate dust and temporarily degrade local atmospheric conditions. Dust generated may present a risk to workers or other people in the area if contaminated soil is encountered. Inhaled dust particles could cause irritation of respiratory tracts or create an exposure pathway for potentially adsorbed contaminants.	Employ good housekeeping and dust suppression techniques to reduce airborne dust and prevent off-site migration: - Monitor and manage track out of vehicles and equipment from the Site in order to reduce the potential for the dispersion of material and debris as fugitive dust - Remove excess soil from equipment, machinery and vehicles - Sweep haul roads and construction site daily - Cover stockpiled materials - Enforce speed control on Site - Employ proper truck loading - Cover all materials transported to and from the Site as appropriate. Cover dust-producing materials with 6 mil polyethylene sheeting (at a minimum) - Application of water spray as a dust suppressant is acceptable provided run-off is appropriately managed - Application of oil as a dust suppressant is prohibited - Application of other dust suppressants is not permitted without prior authorization from DND OPI Develop and implement a plan which details dust emission and control measures to be employed. Ensure plan assigns implementation and monitoring roles. Ensure on-Site personnel have reviewed the plan, understand their roles and responsibilities, and are properly trained and equipped to implement the plan. Schedule work to avoid periods of extremely dry or windy conditions. Monitor airborne dust conditions daily and employ additional housekeeping and dust suppression techniques as required. DND OPI is responsible for coordinating notification of the affected community of the nature and likely duration of forthcoming project activities that may temporarily degrade local atmospheric conditions. Coordinate notification to individuals and/or organizations/municipalities outside the Department through Base Public Affairs.
Atmosphere	Emissions from construction equipment, machinery and vehicles used during land alteration activities will generate Green House Gases (GHG) and temporarily reduce local air quality.	Ensure equipment, machinery and vehicles used on Site are in good working order and comply with applicable air quality standards. Operate equipment and machinery at optimum rated loads. Turn off equipment and machinery when not in use to minimize exhaust. Repair or replace equipment and machinery producing excessive exhaust. Minimize vehicle idling time. Use stationary emission sources (e.g. portable diesel generators, compressors, etc.) only as necessary and turn off when not in use.
Surface Water, Aquatic Animals and Habitat	Land alteration and equipment traffic on roadways will increase the potential for transport of silt-laden water to the aquatic environment (directly or via storm water drainage system). This could result in runoff with high levels of suspended solids entering surface water features. Increases in suspended solids will degrade surface water quality. An elevated load of suspended solids in surface water can coat fish gills and reduce oxygen concentrations in the water causing asphyxiation. There is potential for storm water from the site to	Isolate the work area and prevent the release of any potential sediment laden or polluted runoff from entering a surface water feature or encroaching onto adjacent properties or roadways. Develop and implement a plan which details erosion and sediment control measures and storm water pollution prevention measures to be employed. Ensure plan assigns implementation and monitoring roles. Ensure on-Site personnel have reviewed the plan, understand their roles and responsibilities, and are properly trained and equipped to implement the plan. Ensure plan addresses unforeseen storm events with associated potential overland erosion from rainfall impact and storm water run-off. Consult, at a minimum, the following documents to ensure the plan avoids causing Serious Harm to Fish (Section 35) under the Fisheries Act and fulfill the BC Water Act Regulations' Protection of Habitat Section 42(1) and Protection of Water Quality (Section 41) Standards: - DFO's Land Development Guidelines for the Protection of Aquatic Habitat (1993) - DFO's Measures to Protect Fish and Fish Habitat - BC Ministry of Environment Develop with Care Environmental Guidelines for Urban and Rural Land Development in British Columbia (2014) - BC Ministry of Environment General Best Management Practices and Standard Project Considerations

	contain contaminants in concentrations exceeding applicable discharge guidelines, due to historical soil or groundwater contamination. Elevated levels of contaminants in surface water can potentially cause a variety of adverse effects on aquatic wildlife including tumours, organ damage, physical deformities, reproductive disorders and population decline.	Implement, at a minimum, the following erosion and sediment control measures: - Install effective erosion and sediment control measures prior to land disturbance in areas where there is potential surface run-off to sensitive receptors, such as drainage ditches, catch basins or water features - Inspect and maintain erosion and sediment and control measures on a regular basis while in use - Repair erosion and sediment control measures if damage occurs - Ensure on-site personnel are prepared to quickly erect additional erosion and sediment control measures to minimize sediment entering receiving waters if necessary - Minimize the area of soil exposed at any one time by: phasing construction activities; retaining vegetation as much as possible; and, once construction works are completed, stabilizing any exposed soils as soon as possible using temporary measures such as mulch, erosion sediment control blankets, hydro-seeding, and/or plastic sheeting or replanting exposed soils with an approved seed mix or long-term vegetation - Remove non-biodegradable erosion and sediment control measures once the area is stabilized (not before) - Implement measures to manage water flowing into the Site as well as water being pumped/diverted from the Site such that sediment is filtered out prior to the water entering a waterbody - Schedule work to avoid periods of heavy precipitation and extreme dry conditions - Discontinue work during periods of heavy rain that may lead to excessive erosion of soils and cause increased sedimentation - Limit the movement of vehicles/machinery to defined work areas - Avoid off-road access of vehicles/machinery. If off-road access is unavoidable, minimize disturbance to soils/vegetation by using the same access route and avoiding wet areas. Restore areas impacted by off-road access to original condition. Implement mitigation measures identified in Annex DE1B Table 9 Vegetation, as applicable - Limit laydown and material storage areas to previously paved/developed areas (impermeable surfaces) - Replant exposed soils with an approved seed mix during site restoration activities Implement, at a minimum, the following storm water pollution prevention measures: - Do not permit water containing deleterious substances to be pumped into surface water features, sewer or drainage systems - Implement site isolation measures to minimize water flowing onto the Site and into excavation areas - Characterize all water, through sampling and analysis, prior to pumping/discharging off Site. This includes water that is captured within an excavation zone (from precipitation and groundwater/marine infiltration) - Do not pump/discharge water off Site until sampling and analysis have confirmed that water meets the discharge criteria applicable to the point of discharge. Water discharged to the sanitary sewer must meet the applicable municipal sewer use bylaw requirements. Water discharged to the aquatic environment must meet the CCME Water Quality Guidelines for the Protection of Aquatic Life, the BC Approved Water Quality Guidelines (Aquatic Life) and BC Working Water Quality Guidelines (Aquatic Life) – the most stringent standard from these guidelines is to be applied - Engage a Qualified Environmental Professional (QEP) to complete the required sampling - Ensure samples are tested for all known or potential contaminants of concern - Ensure analysis is completed by an independent testing agency accredited according to the Standards Council of Canada, the Canadian Association of Laboratory Accreditation Inc. (ISO/IEC 17025) and British Columbia Ministry of Environment - Use flocculation tanks, settling basins or other treatment facilities to ensure water meets discharge criteria applicable to the point of discharge - No vehicle washing is permitted on site. If a wheel wash is installed, all wash water must be contained and disposed of at an appropriately licensed facility - No construction wastes, including hazardous products or wastes, will be discharged to surface water features, drainage features, or sanitary sewer
Surface Water, Ground Water, Soils, Aquatic Animals and Habitat	Accidental fuel spills from equipment, machinery and vehicles used during land alteration activities have the potential to pollute soils, nearby surface water features and enter the underlying aquifer. Releases of petroleum based products can induce toxic effects in aquatic organisms including mortality and sub-lethal effects such as impaired growth or reproductive capacity.	Implement mitigation measures identified in Annex DE1B, Table 11: Spills, Leaks, Releases, as applicable.
Soils	Land alteration activities have the potential to uncover metals, hydrocarbons, PAHs, and other	**GENERAL** On-site personnel will stop work if suspected contamination (e.g. hydrocarbon staining or odour, wood waste, metal debris) is encountered during project

	Contaminants of Concern associated with historical activities. Relocation and export of these soils from the Site has the potential to contaminate adjacent soils in the export area. Residual soil on equipment and vehicles has the potential to migrate to and contaminate off-site soils and surface waters during track out of equipment and vehicles from the Site. The import of fill material from off-site sources that do not meet Site soil criteria has the potential to be a continued source of contamination if imported to the site.	implementation. On-site personnel will immediately notify the DND OPI. The DND OPI is responsible for informing MARPAC FSE. Do not disturb contaminated soils until a Qualified Environmental Professional (QEP) has assessed the situation and developed a management plan that has been approved by DND OPI and MARPAC FSE. Develop and implement a Soil Management Plan to address how soils will be handled, stockpiled and disposed of. Ensure this plan assigns implementation and monitoring roles. Ensure on-Site personnel have reviewed the plan, understand their roles and responsibilities, and are properly trained and equipped to carry out the plan. Ensure the plan includes the following information: - work title - work number - Contract Authority contact information (if applicable) - On-site Supervisor contact information - location of the excavation and soil storage area - list of known or potential contaminants of concern - approximate volume of soil - plan for soil storage, reuse, relocation or disposal - management plan for stockpiled soils - signature of individual responsible for plan Stockpile and cover all excavated materials in an appropriate temporary soil storage area, with continuous impermeable surface and appropriate grading and berming. Temporary soil storage area must be approved by the DND OPI prior to its use. DND OPI is responsible for engaging and gaining approval from all appropriate stakeholders (including MARPAC FSE) prior to approving a temporary soil storage area. Ensure the temporary soil storage area is in a protected location, at least 30m away from any sensitive receptors. Place all stockpiled materials on a minimum 6 mm PVC or plastic liner to prevent contamination of underlying surface materials. Cover all stockpiled materials with a minimum 6mm PVC or plastic liner to minimize interaction with wind and precipitation. Monitor and manage track out of vehicles and equipment from the Site in order to reduce the potential for the dispersion of material and debris as fugitive dust. Remove excess soil from equipment, machinery, vehicles and roadways. No vehicle washing is permitted on site. If a wheel wash is installed, contain all wash water and dispose of at a facility in accordance with Federal, Provincial and Municipal criteria applicable to the method of disposal. **RELOCATION OF SOIL/FILL** Include the following in the Soil Management Plan if excess soil/fill will be relocated to another area within the DND, to another DND property, or relocated off of federal land: - Sampling plan - results - Plan for the reuse of excess materials on DND property - If relocated to provincial land, name and address of authorized facility and copy of BC MOE permits - Manifests/weight tickets/disposal certificates Do not relocate soils/fill to another area within the DND property or to another DND property without prior authorization from DND OPI. DND OPI is responsible for engaging and gaining approval from all appropriate stakeholders (including RP Ops Sect ESQ Planning Officer and MARPAC FSE) prior to relocating soils on DND properties. Prior to relocating any excess soil/fill, conduct environmental characterization of stockpiled materials in accordance with the British Columbia Ministry of Environment Technical Guidance on Contaminated Sites – Site Characterization and Confirmation Testing (2009). Conduct sampling using Qualified Environmental Professional (QEP). Complete sample analysis using a laboratory that has been accredited by an internationally recognized body (e.g. Standards

Council of Canada (SCC) or Canadian Association for Laboratory Accreditation (CALA)) and in accordance with the International Standard ISO/IEC 17025.

Manage soils in accordance with the BC Hazardous Waste Regulations or complete a Contaminated Soils Relocation Agreement (CSRA) as required under the BC Contaminated Sites Regulations (CSR) if excess soil/fill be relocated from federal to provincial land.

Soils/fill are only approved for relocation to another area on CFB Esquimalt property if analytical shows that they meet the Canadian Council of Ministers of the Environment (CCME) Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health criteria for the land use at the receiving site. Soils that do not meet this criteria are not approved for relocation to another area on CFB Esquimalt property. Manage these soils in accordance with the BC Hazardous Waste Regulations or through a Contaminated Soils Relocation Agreement (CSRA) as required under the BC Contaminated Sites Regulations (CSR) if excess soil/fill be relocated from federal to provincial land. Dispose of soil/fill at a facility authorized to accept contaminated soil or hazardous waste under the BC Environmental Management Act when not relocating soil/fill through a CSRA. Ensure all applicable documentation (sampling plan / results / manifests / CSRA / disposal certificates) for the relocation of soil to provincial land are included with the Soil Management Plan. If the soil will be relocated from federal to provincial land, the Project OPI shall consult Base Safety and Environment (BSE) and DCC or PSPC to determine if a CSRA is required under the BC CSR or whether the soil should be managed according to the BC Hazardous Waste Regulations. Contaminated soil that is not relocated through a CSRA must be disposed of at a facility authorized under the BC EMA to accept contaminated soil or hazardous waste.

Expedite characterization and relocation of soil to minimize risk of contaminant migration from stockpiles.

IMPORT OF FILL

DND OPI shall ensure adherence with the Directorate of Contaminated Sites (DCS) Contaminated Sites Instruction (CSI.004.001): Imported Fill (15 June 2020). Specifically:
- Imported fill shall be virgin material and shall not contain any recycled material. If this is not possible, Base Safety and Environment (BSE) and DCS shall be engaged during the selection process for imported fill;
- At a minimum, prior to importing materials to DND property, imported fill shall be tested for: metals, VOCs, PAHs, hydrocarbons and PFAS.
- Sampling for PFAS shall include the following compounds:

PFAS Name	PFAS Acronym	Criteria (mg/kg)
Perfluorooctane sulfonate	PFOS	0.01
Perfluorooctanoic acid	PFOA	0.01
Perfluorobutanoate	PFBA	0.01
Perfluorobutane sulfonate	PFBS	0.01
Perfluoropentanoate	PFPeA	0.01
Perfluorohexane sulfonate	PFHxS	0.01
Perfluorohexanoate	PFHxA	0.01
Perfluoroheptanoate	PFHpA	0.01
Perfluorononanoate	PFNA	0.01

- Complete sample analysis using a laboratory that has been accredited by an internationally recognized body (e.g. Standards Council of Canada (SCC) or Canadian Association for Laboratory Accreditation (CALA)) and in accordance with the International Standard ISO/IEC 17025;
- Conduct environmental characterization of imported fill in accordance with the British Columbia Ministry of Environment Technical Guidance on Contaminated Sites – Site Characterization and Confirmation Testing (2009);
- All tested samples of imported fill shall meet the CCME criteria for an Agricultural Land Use (or ambient background concentrations). If this is not possible, BSE and/or DCS shall be engaged during the selection process for imported fill;
- A record of all sampling shall be kept for verification, along with details of the source site (the location where the imported fill is coming from) and the receiving site (the location of where the imported soil is being reused);
- Pits and quarries cannot be pre-qualified. Sampling results shall be no more than three months old;

		- Stockpiling of material on DND property prior to sampling is not recommended. A risk-based approach may be permitted, if necessary. However, sampling shall be completed prior to the use of the material. If the material is found to exceed CCME Agricultural criteria, material shall be removed from DND property; - Due to the low risk of some activities and material, sampling is not required for the following: a. topsoil; b. imported fill less than 10 m3; c. gravel/aggregates larger than 2 mm (i.e. do not pass a US #10 sieve); d. fines generated by the mechanical activity of crushing virgin rock (i.e. crusher dust); or e. gravel/aggregate material with less than 20% fines (US #10/2 mm sieve) by volume. These materials shall be from a virgin source and shall not be recycled material. These materials shall be inspected to ensure that they contain no visual or olfactory indications of contamination; Prior to the import of crushed rock, recent analytical results of the proposed imported crushed rock must be provided to MARPAC FSE. If no current data is available, leachate testing must be completed. Any project requiring the import of crushed rock shall consult with MARPAC FSE for approval prior to import. - Contact BSE to determine specific requirements for any imported fill to be placed below HWM.
Cultural	Land alteration activities have the potential to uncover and disturb previously unidentified cultural features. Archaeological sites are protected by The Heritage Conservation Act (HCA). They are non-renewable, very susceptible to disturbance and are finite in number. Archaeological sites are an important resource that is protected for their historical, cultural, scientific and educational value to the general public, local communities and First Nations. Impacts to archaeological sites must be avoided or managed.	DND OPI will consult with MARPAC FSE during project design phase to determine whether project activities are occurring within known cultural sites and/or within areas of high archeological potential (within 50m of known cultural sites). If project activities are occurring within known cultural sites and/or within areas of high archaeological potential, prior to onsite work commencing, a professional archaeologist shall assess the potential for project activities to impact cultural sites and shall identify the appropriate measures required to avoid impacts based on specific project components and cultural sites in the area. Project implementation will not commence until these measures have been approved by DND OPI and MARPAC FSE. DND OPI is responsible for developing contingency plans to modify project activities in accordance with the recommended measures. Prior to excavation activities, site supervisors and excavation operators will attend an on-site archaeological briefing. Develop and implement a chance finds procedure that will address the possibility of encountering archaeological materials during land alteration activities and to provide protocols to follow in the event of a chance archaeological find to ensure that archaeological sites are documented and protected, and that appropriate reporting and notification requirements are being followed, as required. Chance finds procedure to include the following: - Stop work immediately if potential archaeological materials are discovered during project activities and immediately notify the DND OPI. The DND OPI is responsible for immediately reporting archaeological chance finds to MARPAC FSE. MARPAC FSE will advise if any internal and/or external notifications are required and if there are any specific restrictions/considerations required prior to moving forward with further archaeological assessment/investigation. - Do not disturb potential archaeological materials until a professional archaeological has been to the site, assessed/investigated the materials and developed a management plan that has been approved by DND OPI and MARPAC FSE. DND OPI is responsible for providing MARPAC FSE with a final copy of any archaeological reports and all associated GIS datasets. GIS datasets to be provided as ArcGIS file geodatabases and/or shapefiles.
Soils, Surface Water, Health and Safety	Land alteration activities have the potential to impact underground utilities which could result in worker injury, release of deleterious substances, and disruptions to operations.	Initiate a BC One Call and obtain an approved RP Ops U (P) Excavation Clearance Form prior to project commencement. Implement mitigation measures identified in Annex DE1B, Table 11 Spills, Leaks, Releases, as applicable.

	Land alteration activities have the potential to uncover metals, hydrocarbons, PAHs, and other Contaminants of Concern. Exposure to these contaminants during sub-surface work may impact worker health. Use of heavy machinery and equipment and increased vehicle traffic associated with land alteration activities carries the potential for accident and injury to workers, visitors and local residents.	Implement mitigation measures identified in Annex DE1B, Table 14 Health and Safety, as applicable.
Terrestrial Species and Habitat, SAR, Migratory Birds	Machinery and equipment used in land alteration activities have the potential to harm terrestrial wildlife, including SAR and migratory birds that enter the project site and damage previously unknown wildlife habitat features that are encountered during project implementation. Wildlife may become trapped in open excavation areas, areas of standing water (e.g. stormwater ponds, sumps), and open pipes on the Site.	Develop and implement a plan which details wildlife protection measures to be employed. Ensure plan assigns implementation and monitoring roles. Ensure on-Site personnel have reviewed the plan, understand their roles and responsibilities, and are properly trained and equipped to implement the plan. Implement, at a minimum, the following wildlife protection measures: - Employ temporary fencing and barricades when possible to prohibit wildlife from entering the Site - Ensure all food wastes are secured in wildlife-proof containers and are removed promptly from the Site (particularly in warm weather) - Ensure all potential sources of water are minimized by limiting standing pools of water on the Site - Fence off or barricade temporary storm water ponds and other waterbodies and/or sumps on the Site - Limit potential sources of shelter by covering or containing piles of soil, fill, brush, rocks and other loose materials, capping ends of pipes; and ensuring that trailers, bins, boxes, and vacant buildings are secured at the end of each work day - Check the Site for wildlife, prior to beginning work each day - Regularly inspect protective fencing, barricades or other installed measures to ensure their integrity and continued function On-site personnel will stop work if wildlife enter the Site. Work will not commence until wildlife have vacated the vicinity of the Site. Wildlife will be allowed to exit the site on their own, via safe routes. On-site personnel are prohibited from capturing, handling or harassing wildlife. In the event that wildlife on Site appear to be injured, abandoned, or in distress, on-site personnel will immediately notify the DND OPI. The DND OPI is responsible for engaging MARPAC FSE who will advise on the appropriate management strategy. On-site personnel will stop work if wildlife habitat features (nest, den, burrow, hibernaculum, etc) are discovered during project implementation. On-site personnel will immediately notify the DND OPI. The DND OPI is responsible for informing MARPAC FSE. Do not disturb wildlife habitat features within the Site until a Qualified Environmental Professional (QEP) has assessed the situation and developed a management plan that has been approved by DND OPI and MARPAC FSE.

Health and Safety	Land alteration activities occurring in former or active military bases or training areas have the potential to uncover Unexploded Explosive Ordnance (UXO). Disturbance to UXO may result in the item exploding and causing damage, injury and / or fatalities.	DND OPI is responsible for engaging the appropriate Departmental authority for determining the level of UXO risk associated with the proposed project activities. DND OPI is responsible for communicating and providing documentation of UXO activities conducted as part of their project to the appropriate Departmental authority. Develop and implement a chance finds procedure that will address the possibility of encountering UXO and provide protocols to follow in the event of a chance UXO find. On-site personnel will stop work immediately if potential UXO are encountered. Potential UXO will not be touched or disturbed. On-site personnel will note the location of the potential UXO and will immediately leave the area, call 911 and notify the DND OPI. Depending on the level of risk identified, the following additional mitigation measures may be required: - Engage a Qualified UXO Expert as defined within the Directorate of Ammunition and Explosive Regulation (DAER) - Conduct UXO surveys using visual and/or detector aided scans prior to commencing on-site work - Develop and Implement UXO avoidance procedures - Develop and Implement UXO clearance procedures - Establish and implement UXO safety procedures - Establish and implement a UXO hazard-reporting procedure that all on-site personnel must follow - Ensure all on-site personnel are aware of the UXO hazards and have received a UXO safety briefing

TABLE 2: PCBS

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Surface Water, Ground Water, Soil, Aquatic Species and Habitat, Terrestrial Species and Habitat	Accidental releases of PCBs into the environment can impact soil, surface water, aquatic and terrestrial species and human health. Once released, PCBs persist in the environment due to their chemical stability and accumulate in the fatty tissue of living creatures, moving up the food chain. Long-term exposure to PCBs can impact these animals' reproduction, cause cancer and have immunotoxic effects. PCB Regulations issued under CEPA took effect 05 September 2008 and cover four basic areas: - General requirements; - Ban on the release, manufacture, export, import, offer for sale, sale, processing and use of PCBs and products containing PCBs and exceptions to that ban; - Storage requirements for PCBs and products containing PCBs and deadlines for the end of PCB storage; and - Labelling, recordkeeping and reporting requirements for PCBs and products containing PCBs.	During project design, ensure all potential PCBs and PCB containing equipment are identified. Consult the RP Ops U (P) Designated Substances Database. Develop and implement a work plan to appropriately manage, store and dispose of PCBs and PCB containing equipment. Ensure this plan assigns implementation and monitoring roles. Ensure on-Site personnel have reviewed the plan, understand their roles and responsibilities, and are properly trained and equipped to carry out the plan. Consult, at a minimum, the following documents to ensure this plan complies with applicable legal requirements: - PCB Regulations (SOR/2008-273) - Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149) - PCB Waste Export Regulations, 1996 (SOR/97-109) - Hazardous Waste Regulation, B.C. Reg. 63/88 Ensure this plan details project specific practices associated with the following aspects: - Handling of PCBs and PCB containing equipment - Packaging of PCBs and PCB containing equipment - Storage pf PCBs and PCB containing equipment - Labeling of PCBs and PCB containing equipment - Transport of PCBs and PCB containing equipment - Disposal of PCBs and PCB containing equipment DND OPI is responsible for ensuring that all Departmental requirements associated with PCB reporting IAW MARPAC SEMS DE9: PCBs are met. Implement mitigation measures identified in Annex DE1B Table 11: Spills, Leaks, Releases, as applicable.
Health and Safety	Short- and long-term exposure to PCBs may impact human health.	Implement mitigation measures identified in Annex DE1B, Table 14: Health and Safety, as applicable.

TABLE 3: PETROLEUM PRODUCT STORAGE TANKS

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Soils, Surface Water, Aquatic Animals and Habitat	Removal, installation and ongoing use of petroleum product storage tank systems has the potential to contaminate soil, surface water and ground water from accidental fuel spills or leaks.	**GENERAL** Design, install, operate, maintain, relocate, withdrawal and remove storage tank systems in accordance with the following, as applicable: - Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (SOR/2008-197) - CAN/CSA B-139: Installation Code for Oil Burning Equipment - CAN/CSA C-282: Emergency Electrical Power Supply for Buildings Installation Code - Canadian Council of Ministers of Environment (CCME) PN1326 Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products - National Fire Code of Canada DND OPI is responsible for ensuring that all Departmental specific requirements associated with storage tank system management are implemented during all project components IAW Directive E8 and RP Ops Unit (P) Petroleum Storage Tank Management Program Directive. This includes: - Liaising with Storage Tank Unit Authority and MARPAC FSE during storage tank system design phase - Submitting all checklists, reports, forms, drawings and notifications to the Storage Tank Unit Authority and MARPAC FSE for review and approval - Ensuring Operation and Maintenance manual and supporting tank system documentation is provided to the Storage Tank Unit Authority Storage Tank Unit Authority is responsible for: - Updating the Environmental Emergency Response Plan (EERP) IAW SOR/2008-197 prior to the first transfer of any petroleum products or allied petroleum products into the storage tank system - Providing EERP personnel awareness training - Labeling the storage tank system with an Environment Canada storage tank identification number in a readily visible location on or near the storage tank system (preferably in a visible location near the fill port for fuel delivery personnel) prior to the first transfer of any petroleum products or allied petroleum products into the storage tank system - Maintaining all tank system records IAW SOR/2008-197 and Directive E8 **PERMANENT WITHDRAWAL AND REMOVAL OF STORAGE TANKS** Ensure removal of all storage tank systems is conducted by a Certified Petroleum Equipment Installer, as established by the BC Industry Training Authority (ITA). Submit a report identifying all storage tank removal procedures. This report will verify the removal was done in compliance with applicable codes, standards and regulations and will be retained as a record IAW SOR/2008-197. **DESIGN OF NEW STORAGE TANKS** Submit design drawings bearing the stamp and signature of a professional engineer. Design a Product Transfer Area (PTA) for the new location of all ECCC tanks. Submit a PTA Letter to DND OPI that documents how the PTA has been designed to contain spills IAW SOR/2008-197. Ensure PTA Letter identifies and evaluates risks, estimates potential product releases and proposes a design to mitigate risks. DND OPI responsible for providing PTA Letter to MARPAC FSE and Storage Tank Unit Authority for review and approval prior to the relocation. Submit a fueling Standard Operating Procedure (SOP) based on the storage tank and product transfer area design. Submit operation and maintenance manuals for use in demonstration and instructions. **INSTALLATION OF NEW STORAGE TANKS** Ensure installation of all storage tank systems is conducted by a Certified Petroleum Equipment Installer, as established by the BC Industry Training Authority (ITA). Submit as-built drawings bearing the stamp and signature of a professional engineer prior to the first transfer of any petroleum products or allied petroleum products into the storage tank system. Submit a Spill Response Plan specific to the storage tank system prior to the first transfer of any petroleum products or allied petroleum products into the storage tank system.

		Submit the DND Storage Tank Registration Form (Annex DE8E of Directive E8). Allow three weeks for processing and generation of the ECCC storage tank identification number. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment of storage tank system at agreed upon times, at the designated location. Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction. Review contents of manual in detail to explain aspects of operation and maintenance. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions. **RELOCATION OF STORAGE TANKS** DND OPI is responsible for ensuring that all Departmental specific requirements associated with storage tank relocations are implemented IAW Directive E8. This includes engaging Storage Tank Unit Authority, MARPAC FSE and other responsible authorities to approve a proposed relocation site. Submit a Spill Response Plan specific to the tank system to be relocated. Ensure plan details spill prevention and response measures to be employed. Ensure plan notes the temporary withdrawal, relocation, installation and commissioning of storage tanks and describe the tanks, the site characteristics, response measures, spill kit equipment and emergency contact numbers. Spill Response Plan to be approved by DND OPI. DND OPI is responsible for providing this plan to the Unit Authority. Unit Authority is responsible for updating the Environmental Emergency Response Plan (EERP) prior to the system being returned to service and following the commissioning. Ensure relocation of all storage tank systems is conducted by a Certified Petroleum Equipment Installer, as established by the BC Industry Training Authority (ITA). Design a Product Transfer Area (PTA) for the new location of all ECCC tanks. Submit a PTA Letter to DND OPI that documents how the PTA has been designed to contain spills IAW SOR/2008-197. Ensure PTA Letter identifies and evaluates risks, estimates potential product releases and proposes a design to mitigate risks. DND OPI responsible for providing PTA Letter to MARPAC FSE and Storage Tank Unit Authority for approval prior to the relocation. Submit a Relocation Letter to DND OPI that documents the storage tank relocation and verifies procedures were followed in accordance with SOR/2008-197 and Directive E8, Annex DE8C. DND OPI responsible for providing Relocation letter to MARPAC FSE and Storage Tank Unit Authority within 45 days of the date of withdrawal. Submit a Commissioning Report to DND OPI that includes a record of all tests performed (alarms, interstitial space, vents, piping, leak testing) and verification that the tank and associate components passed and the system can be returned to service. DND OPI is responsible for providing Commissioning Report to MARPAC FSE and Unit Authority. Ensure Commissioning Report is signed by all stakeholders, including Consultant, Contractor, Contract Authority, and DND OPI. Revise design drawings and ensure they bear the stamp and signature of a professional engineer. Submit to DND OPI. DND OPI responsible for providing revised drawings to MARPAC FSE and Storage Tank Unit Authority. **SPILL RESPONSE** Spill response will be conducted IAW the specific tank system EERP once fuel tank system is operational. **PRODUCT DELIVERY** DND OPI to ensure Base personnel responsible for implementing fuel delivery contracts are aware of the fuel delivery requirements as detailed in Directive E8. **EMERGENCY GENERATORS WITH STORAGE TANK SYSTEMS <2,500L** **I**nstall tank in compliance with: - CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products - National Fire Code of Canada - CSA Standard B139, Installation Code for Oil-Burning Equipment - CAN/CSA C282 Emergency Electrical Power Supply for Buildings Installation Code Tank is to be designed to a ULC standard appropriate/applicable to its use/application (e.g. CAN/ULC-S601-07).

		Inspect the generator and tank for potential damage accrued during transit prior to the first transfer of any petroleum products or allied petroleum products into the storage tank system. Install the generator and tank in a location that is protected from potential vehicle/machinery impacts, is on an impermeable surface and is at least 30m away from sensitive receptors such as surface water or drainage features. Use secondary spill containment if generator and tank cannot be located at least 30m away from sensitive receptors. If the tank and generator are not a single unit, a BC ITA Certified Tank Installer is strongly recommended. Storage Tank Unit Authority is responsible for ensuring that tank system is operated IAW: - Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products - National Fire Code of Canada - CSA Standard B139, Installation Code for Oil-Burning Equipment - CAN/CSA C282 Emergency Electrical Power Supply for Buildings Installation Code Storage Tank Unit Authority is responsible for developing and implementing a plan, prior to commissioning or turning the system on, which details spill prevention and response measures to be employed in the event of a leak or spill from the tank. Ensure plan includes safe fueling procedures that will be employed. Ensure plan includes a list of spill response equipment that will be present on Site. Ensure on-Site personnel have reviewed the plan, understand their roles and responsibilities, and are properly trained and equipped to conduct spill response activities. Spill response will be conducted IAW this plan once fuel tank system is operational. Storage Tank Unit Authority is responsible to install spill response equipment at the tank location. Include an inventory of required contents at the top of the kit. Locate PPE at the top of the spill kit to ensure easy access for the spill responder. Keep spill kits closed with a safety seal affixed to indicate if the kit has been used or tampered with.

TABLE 4: GENERATORS, TEMPORARY POWER DURING PROJECT IMPLEMENTATION

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Soils, Surface Water, Aquatic Animals and Habitat	Accidental fuel spills or leaks from fuel storage tanks associated with temporary power generators have the potential to contaminate soil, surface water and ground water.	Install, operate, maintain and test temporary power generator and associated fuel tank IAW the following, as applicable: - CCME Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products - National Fire Code of Canada - CSA Standard B139, Installation Code for Oil-Burning Equipment Implement mitigation measures identified in Annex DE1B Table 11: Spills, Leaks, Releases, as applicable. Consider the generator to be a high-risk location where spills are probable and maintain spill kits at the generator location. Ensure the generator fuel tank is completely empty of product when transiting to/from the Site. Inspect the generator and fuel tank for potential damage accrued during transit prior to the first transfer of any petroleum products or allied petroleum products into the storage tank system. Ensure safe fueling procedures are developed and adhered to. Install the generator and fuel tank in a location that is protected from potential vehicle/machinery impacts, is on an impermeable surface and is at least 30m away from sensitive receptors such as surface water or drainage features. Use secondary spill containment if generator and fuel tank cannot be located at least 30m away from sensitive receptors. Block off or plug storm drains in the vicinity of the generator and fuel tank to prevent migration of product in the event of a spill from the belly tank. Use sand bags, portable berms or specially designed mats.
Atmosphere, Ambient Noise	Emissions from generator will generate Green House Gases (GHG) and temporarily reduce local air quality. Generator use will temporarily increase local ambient	Install the generator in a location that will minimize disturbance, from emissions and noise, to adjacent community. DND OPI is responsible for coordinating notification of the affected community prior to generator use.

	noise levels.	

TABLE 5: HVAC AND HALOCARBON CONTAINING EQUIPMENT

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Atmosphere	Project activities involve the installation, maintenance or decommissioning of Heating Ventilation and Air Conditioning (HVAC) system of a building. Halocarbon containing equipment is normally associated with these systems. Releases from halocarbon containing equipment systems and equipment lead to ozone depletion and contribute to climate change. Halocarbon containing systems and equipment owned by DND are regulated by the Federal Halocarbon Regulations, 2003.	**GENERAL** Design, install, operate, maintain, withdrawal and dispose of systems and equipment containing halocarbons in accordance with the following, as applicable: - Federal Halocarbon Regulations, 2003 (FHR, 2003) - Ozone Depleting Substance Regulations, 1998 (ODSR, 1998) - Environment Canada's Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems - CSA-B52-13 Mechanical Refrigeration Code - CAN/CSA B339-02 Cylinders, Spheres, and Tubes for the Transportation of Dangerous Goods All logs, notices, records and reports will be completed in accordance with FHR, 2003, as applicable, and submitted to the DND OPI. DND OPI is responsible for ensuring that all Departmental specific requirements associated with halocarbon management are implemented during all project components IAW MARPAC SEMS Directive E3 and the RP Ops Unit (P) Halocarbon Management Program Directive. This includes: - liaising with Halocarbon Unit Authority prior to project implementation; - submitting all logs, notices, records and reports to the Halocarbon Unit Authority; and - ensuring Operation and Maintenance manual and supporting halocarbon system documentation is provided to the Halocarbon Unit Authority. Work on systems and equipment containing halocarbons, including any work that might result in the release of a halocarbon, will be conducted by appropriately qualified personnel. All personnel will hold a valid certificate indicating they have successfully completed an environmental awareness course in recycling, recovery, and handling procedures of halocarbon refrigerants as outlined in Environment Canada's Code of Practice for Elimination of Fluorocarbon Emissions from Refrigeration and Air Conditioning Systems, such as the course recognized by The Heating, Refrigeration and Air Conditioning Institute (HRAI) of Canada. All personnel will hold valid industry training credentials, or industry training recognition credentials as a Refrigeration Mechanic issued under the Industry Training Authority Act of BC and a refrigeration contractor's license (class 'REF') as issued by Technical Safety BC in accordance with the Safety Standards Act of the Province of BC, Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulations (BC Reg. 104/2004). **DISMANTLING/DECOMMISSIONING** The dismantling or decommissioning of halocarbon systems will be done in accordance with the FHR, 2003. Before dismantling, decommissioning or destroying any system, the following will occur: - recover all halocarbons contained in the system into a container designed and manufactured to be refilled and to contain that specific type of halocarbon; - affix a notice to the system before dismantling, decommissioning, or destruction; and - keep a record of the information on the notice. Provide DND OPI with record. Appropriately dispose of halocarbons as HazWaste at a facility licensed to accept such wastes. **LEAKS/RELEASES** If work on systems and equipment containing halocarbons results in a leak, the following will occur as soon as possible and no later than seven days after the day on which the leak is detected: - repair the leak; - isolate the leaking portion of the system and recover the halocarbon from that portion; or - recover the halocarbon from the system. Implement mitigation measures identified in Annex DE1B Table 11: Spills, Leaks, Releases, as applicable.

		INSTALLATION Ensure FHR 2003 required information is properly affixed to installed systems.

TABLE 6: HAZARDOUS MATERIALS

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Surface Water, Ground Water, Soil	Accidental spills of hazardous materials or hazardous wastes may pollute adjacent soils and enter nearby surface waters and the underlying aquifer. Releases of hazardous materials or hazardous wastes can induce toxic effects in aquatic organisms including mortality and sublethal effects such as impaired growth or reproductive capacity.	Develop and implement a work plan to appropriately manage and dispose of hazardous materials that will be used or hazardous wastes that will be generated during project implementation. Ensure this plan assigns implementation and monitoring roles. Ensure on-Site personnel have reviewed the plan, understand their roles and responsibilities, and are properly trained and equipped to carry out the plan. Consult, at a minimum, the following documents to ensure this plan complies with applicable legal requirements: - Transportation of Dangerous Goods Regulations (SOR/2016-95) - National Fire Code of Canada, 2015 - Hazardous Products Regulations (SOR/2015-17) - Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2005-149) - Canada Occupational Health and Safety Regulations SOR 86/304, Canada Labour Code (DND/CAF personnel) - Occupational Health and Safety Regulation, B.C. Reg. 195/2015, Workers Compensation Act (Contractor personnel) - Hazardous Waste Regulation, B.C. Reg. 63/88, Environmental Management Act - Transport of Dangerous Goods Regulations, B.C. Reg. 231/2002, Transport of Dangerous Goods Act Ensure this plan details site and project specific practices associated with the following aspects: - Selection of hazardous materials - Labeling of hazardous materials and wastes - Packaging of hazardous materials and wastes - Handling of hazardous materials and wastes - Storage of hazardous materials and wastes - Transport of hazardous materials and wastes - Disposal of hazardous wastes Ensure hazardous materials and hazardous waste storage areas adhere to the following general safe storage requirements: - Place storage areas at least 30m away from sensitive receptors, such as surface water or drainage features - Locate storage areas on level, impermeable surfaces - Keep storage areas well ventilated and away from sources of heat and direct sunlight - Use approved containers. Be aware of any special venting requirements (e.g. for flammables, corrosives) - Do not store incompatible materials together - Keep an inventory of materials in storage and their amounts and locations - Keep storage area separate from work areas and emergency exits - Ensure all stored materials are properly labeled - Ensure appropriate spill control and fire protection equipment is readily available in or near the storage area - Use secondary containment trays to contain potential spills - Keep empty containers closed. Empty containers may contain hazardous residue - Restrict access to storage areas to authorized personnel only. Keep highly hazardous materials under lock and key - Maintain good housekeeping and minimize clutter

		- Inspect storage area and containers regularly for signs of leaks, corrosion or other damage Vehicles used for the removal of hazardous materials and hazardous wastes must be empty prior to entering the Site to eliminate incidents on MARPAC property involving off-Base hazardous materials or wastes. Implement mitigation measures identified in Annex DE1B Table 11: Spills, Leaks, Releases, as applicable.
Human Health	Hazardous products and hazardous wastes have the potential to impact the health and safety of workers, visitors and residents/personnel adjacent to the Site.	Implement mitigation measures identified in Annex DE1B Table 14: Health and Safety.

TABLE 7: SOLID WASTE

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Terrestrial Animals and Habitat, Surface Waters, Soils,	Food wastes and other garbage may attract wildlife to the Site. Off-site disposal of waste materials in landfills results in displacement of terrestrial animals and destruction of habitat. Inappropriate storage of waste materials could result in soil and/or surface water pollution.	Develop and implement a work plan to appropriately manage and dispose of project waste materials. Ensure this plan assigns implementation and monitoring roles. Ensure all waste materials are segregated, salvaged and recycled where practical. Store waste materials in a protected, secure location at least 30m from sensitive receptors, such as surface water or drainage features. Visually inspect waste material storage area regularly to identify potential problems or leaks. Provide on-site containers for collection, handling, and storage of anticipated quantities of waste materials. Do not use the CFB Esquimalt waste collection system. Ensure on-site containers are enclosed to limit contact with rain and runoff and prevent light materials from blowing out. Ensure on-site containers are not easily accessible by wildlife (e.g. gulls, bears, racoons) Do not allow on-site containers to overflow. Do not allow waste materials to accumulate on the ground. Do not bury waste materials on Site. Do not dispose of waste materials in surface water or drainage features. Segregate potentially hazardous waste from nonhazardous site debris. Remove waste material and debris from site and deposit in waste containers at end of each working day.

TABLE 8: NOISE

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Ambient Noise, Terrestrial Animals and Habitat, SAR and Migratory Birds, Land Use, Health and Safety	Ambient noise levels will increase during project implementation. Increased levels of noise may be disruptive to residents/personnel adjacent to the Site. High levels of noise from equipment and activities at the project site have the potential to harm hearing of	Comply with Canada Occupational Health and Safety Regulations (DND/CAF personnel) and the BC Occupational Health and Safety Regulations (Contractor personnel) regarding noise regulations and PPE requirements. Properly maintain equipment and machinery to minimize unnecessary noise pollution. Fit all machinery and equipment with functioning exhaust and muffler systems. Ensure machinery covers and equipment panels are well fitted and remain in place to muffle noise. Ensure bolts and fasteners are tight to avoid rattling. Place power-generating equipment to reduce exposure and minimize disruption to adjacent occupants.

	on-site workers. Increased levels of noise in the natural environment may be disruptive to terrestrial animals, including raptors and migratory/SAR birds, in the immediate area, potentially resulting in their relocation from the area.	Shield loud power equipment and turn off equipment when not in use. Prevent occurrence of multiple noise activities during a single event (cumulative effects) or for prolonged periods. DND OPI is responsible for completing a noise generation evaluation if noise complaints are reported. Project activities that have the potential to increase ambient noise levels will comply with time periods identified in applicable municipal noise bylaws. If work is required outside these hours, the DND OPI is responsible for gaining approval as required. DND OPI is responsible for coordinating notification of the affected community of the nature and likely duration of any particularly noisy operations that may be forthcoming as a part of project activities. Coordinate notification to individuals and/or organizations/municipalities outside the Department through Base Public Affairs. Schedule noise generating activities to avoid sensitive bird periods such as breeding, nesting, roosting, rearing young and staging (migration). The general nesting period for southern BC is February – September. A QEP will conduct a bird nest survey within 7 days prior to commencement of noise generating activities if activities will be conducted during the nesting period and/or if there is the potential that nests of species at risk, migratory birds, eagles, peregrine falcons, gyrfalcons, ospreys, herons and/or burrowing owls may be present. If nests are present, a QEP will develop a management plan identifying protective measures specific to the species present. Management plan should be developed in accordance with the most recent version of the following documents, as applicable: - Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia, BC Ministry of Environment - Guide for developing Beneficial Management Practices for Migratory Bird Conservation, Environment and Climate Change Canada Project implementation will not commence until the management plan is approved by DND OPI and MARPAC FSE. DND OPI is responsible for developing contingency plans to modify project activities in accordance with the management plan. A QEP, who is provided with authority to modify or halt project activities if it is deemed necessary to do so for the protection of bird species or habitat, will monitor the plan through implementation.

TABLE 9: VEGETATION

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Terrestrial Animals and Habitat, SAR and Migratory Birds, Vegetation, Soils	Project activities will involve the removal/disturbance of vegetation within the project footprint. This includes the disturbance of cultivated grasslands associated with land alteration activities occurring outside of pre-developed areas (e.g., gravel, asphalt, concrete). Removal/disturbance of vegetation may result in direct loss of Species At Risk (SAR), harm or harassment of SAR, and destruction of SAR critical habitat. The federal Species at Risk Act (SARA) contains general prohibitions that make it an offence to: - kill, harm or harass a listed species - destroy or damage the residence of a listed species - destroy any part of critical habitat of a listed species Removal/disturbance of native plants and/or trees may result in a loss of regional biodiversity. The potential for soil erosion increases if the soil has	**SAR** DND OPI will consult with MARPAC FSE during project design phase to determine whether project activities have the potential to impact SAR and/or critical habitat. If potential exists, MARPAC FSE will advise on the following: - targeted field surveys required to confirm presence or absence of SAR on the Site - specific mitigation measures required to protect SAR and/or critical habitat during project implementation - applicability of invoking a SARA S.83 Exception Implement mitigation measures identified in Annex DE1B Table 15: Works near Sensitive Features, if project activities are occurring near SAR and/or critical habitat. Stop work if SAR and/or SAR habitat features are encountered at any time and inform the DND OPI. DND OPI is responsible for contacting MARPAC FSE for advice. **NATIVE PLANTS/TREES** If project activities have the potential to impact native plants and/or trees, DND OPI will consult with MARPAC FSE during project design phase to determine salvage/replacement/restoration requirements. DND OPI is responsible for implementing salvage/replacement/restoration requirements, including aftercare to ensure survival. Schedule site restoration activities to occur as soon as work is complete to prevent erosion. If there is insufficient time remaining in the growing season for the seeds to germinate, stabilize the site (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and implement site restoration activities as soon as the growing season permits.

	no or very little vegetative cover of plants. Plant cover protects the soil from raindrop impact and splash, tends to slow down the movement of runoff water and allows excess surface water to infiltrate.	Avoid impacting the following trees on CFB Esquimalt properties: - Arbutus (*Arbutus menziesii*) - Garry oak, (*Quercus garryana*) - Pacific Dogwood (*Cornus nuttalli*) - Pacific Yew (*Taxus brevifolia*), - Big Leaf Maple (*Acer marophyllum*) - Conifers greater than 80 cm diameter Remove vegetation using mechanical or hand clearing methods. Do not use biocides. Do not tear moss from rocks when moving materials/supplies in rocky areas. If vegetation/tree removal is necessary, avoid grubbing and use vegetative maintenance and removal techniques such as pruning, mowing, girdling, topping and select tree removals that allow the root system to remain intact, to help bind the soil and encourage rapid colonization of low-growing plant species.
Vegetation, Terrestrial Animals and Habitat, SAR	Removal/disturbance of vegetation may result in the loss of nesting habitat, loss of nests (direct mortality) and the disruption to bird breeding and nesting activities. Section 34 (a) of the provincial Wildlife Act protects all birds and their eggs. Section 34 (c) protects their nests while they are occupied by a bird or egg. Section 34(b) of the provincial Wildlife Act protects the nests of eagles, peregrine falcons, gyrfalcons, ospreys, herons and burrowing owls year-round. Most native bird species in Canada are protected under the Migratory Birds Convention Act, 1994 (MBCA), and are collectively referred to as *migratory birds*. General prohibitions under the Act and its regulations protect migratory birds, their nests and eggs anywhere they are found in Canada. Section 33 of the Species at Risk Act (SARA) prohibits damaging or destroying the residence of a listed threatened, endangered, or extirpated species. SARA defines residence as: "a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating" [s.2(1)].	Schedule vegetation disturbance/clearing activities to avoid sensitive bird periods such as breeding, nesting roosting, rearing young and staging (migration). The general nesting period for southern BC is February – September. Trees or other structures containing the nests of eagles, peregrine falcons, gyrfalcons, ospreys, herons and burrowing owls will not be felled or disturbed, even outside of the breeding season. Nests of migratory birds are protected all year, whether occupied or not. It is prohibited to damage, destroy or remove a non-active nest without a permit or an authorization. Barn swallows (*Hirundo rustica)* are present on numerous CFB Esquimalt properties and are protected under the Species at Risk Act (Threatened). Under the Act, the nest, occupied or not, is considered a residence and is protected from any activity that damages or destroys the function of the nest from 1 May or the date when adults are first seen building or occupying the nest (whichever is earlier) to 31 August or when the bird is last seen at the nest (whichever is later). Activities include, but are not limited to, moving, damaging or destroying the nest; blocking access to the nest; and/or disturbing the nest (including auditory disturbance), or any other activity that would damage or destroy the functions of the nest. A QEP will conduct a bird nest survey within 7 days prior to commencement of vegetation removal activities, if activities will be conducted during the nesting period and/or if there is the potential that nests of species at risk, migratory birds, eagles, peregrine falcons, gyrfalcons, ospreys, herons and burrowing owls may be present. If nests are present, a QEP will develop a management plan identifying protective measures specific to the species present. Management plan should be developed in accordance with the most recent version of the following documents, as applicable: - Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia, BC Ministry of Environment - Guide for Developing Beneficial Management Practices for Migratory Bird Conservation, Environment and Climate Change Canada Project implementation will not commence until the management plan is approved by DND OPI and MARPAC FSE. DND OPI is responsible for developing contingency plans to modify project activities in accordance with the management plan. A QEP, who is provided with authority to modify or halt project activities if it is deemed necessary to do so for the protection of bird species or habitat, will monitor the plan through implementation. Stop work if nests are encountered at any time during project implementation and inform the DND OPI. Note that nests of migratory birds are protected all year, whether occupied or not. It is prohibited to damage, destroy or remove a non-active migratory bird nest without a permit or an authorization. Do not commence work in the vicinity of the nest until a QEP has been to the Site, assessed the feature and developed a management plan which has been approved by MARPAC FSE.
Vegetation, SAR	Heavy machinery and equipment used during project implementation may increase the risk of transporting noxious weeds and invasive species to the site. Noxious weeds and invasive species may negatively impact biodiversity by out-competing and replacing native plants and plant SAR in the area, potentially	Ensure machinery and materials arrive on site in a clean condition and are maintained free of invasive species and noxious weeds. Restore disturbed areas to function as they did in their pre-disturbance condition. Replant exposed soils with an approved seed mix during site restoration activities to prevent the establishment of invasive species.

	causing species extirpation and even extinction.	
Surface Water, Ground Water, Soils, Aquatic Animals and Habitat	Accidental fuel spills from equipment, machinery and vehicles used during vegetation removal activities have the potential to pollute soils, nearby surface water features and enter the underlying aquifer. Releases of petroleum based products can induce toxic effects in aquatic organisms including mortality and sub-lethal effects such as impaired growth or reproductive capacity.	Implement mitigation measures identified in Annex DE1B Table 11: Spills, Leaks, Releases, as applicable.
Vegetation, Soils, SAR	Off-road operation or storage of equipment, machinery and vehicles may crush vegetation and damage tree root systems. Heavy construction equipment can compact soil and dramatically reduce pore space. Compaction inhibits root growth, limits water penetration, and decreases oxygen needed for root survival.	DND OPI will consult with MARPAC FSE during project design phase to determine whether off-road activities have the potential to impact SAR and/or critical habitat. Off-road activities will be limited to routes authorized by MARPAC FSE that avoid impacts to SAR and minimize impacts to vegetation. Restrict the storage of machinery and equipment to pre-disturbed areas (e.g. parking lots, roads) whenever possible. Conduct off-road operation of equipment, machinery and vehicles when ground is dry. Erect visible temporary fencing to protect existing vegetation and trees from accidental damage by heavy machinery. Ensure protection includes tree roots within the dripline. Do not permit equipment, machinery and vehicles in these areas. Ensure on-site personnel are aware of these areas and associated restrictions.
Vegetation, Aquatic Species and Habitat, SAR	Riparian areas are located adjacent to streams, lakes, wetlands, and waterbodies and provide vegetation that is important for fish and wildlife habitat, and the proper functioning of streams, lakes and wetlands. Removal or disturbance of riparian vegetation, including trees, can impact aquatic species and habitat and SAR present in the waterbody by causing a: - Change in water temperature - Change in habitat structure and cover - Change in sediment concentrations - Change in nutrient concentrations - Change in food supply	DND OPI will consult with MARPAC FSE during project design phase to determine whether the riparian area is identified as part of critical habitat of an aquatic listed species at risk. Implement BC Ministry of Environment Best Management Practices for Tree Topping, Limbing and Removal in Riparian Areas, as applicable. Use of herbicides prohibited in riparian areas. Clearing of riparian vegetation should be kept to a minimum: use existing trails, roads or cut lines wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction. If riparian vegetation removal is unavoidable, avoid grubbing and use vegetative maintenance and removal techniques such as pruning, mowing, girdling, topping and select tree removals that allow the root system to remain intact, to help bind the soil and encourage rapid colonization of low-growing plant species. Limit machinery and equipment access and direct disturbance to riparian areas. When falling or topping trees prevent branches from entering the water feature. If any branches do inadvertently end up in the water feature, remove them from the site to where they will not enter the water feature during high flows. Remove limbs from the water feature in a manner that will not disturb aquatic organisms. Retain large woody debris (LWD) and the stubs of large diameter trees where it is safe to do so. Fall the tree away from the water feature unless there is an immediate threat to the public, and remove the material within the instream work window. Vegetate all disturbed soils, banks and riparian areas by seeding and/or planting trees and shrubs in accordance with the DFO guidance on Riparian Re-vegetation and in consultation with MARPAC FSE. Cover seeded and vegetated areas with appropriate measures to prevent soil erosion and to help seeds germinate. If there is insufficient time remaining in the growing season for the seeds to germinate, stabilize the site (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.
Vegetation, Surface Waters, Aquatic Animals and Habitat, Health and Safety, Soil, Groundwater	Use of pesticides for vegetation control (herbicides) can result in a number of potential effects: - Use of some pesticides can pollute the soil or groundwater and can persist for long periods of time. If pesticides are unintentionally washed into	Pesticide use will comply with the following: - DND Environmental Directive ED 4003–4/02 Directive to Eliminate the use of Pesticides for Cosmetic Lawn Care Purposed on DND Properties; - CFAO 34-46, Pest Control; - Pest Control Product Act and Regulations; - BC Integrated Pest Management Regulations; and

	stormwater collection systems, creeks, streams or other water bodies may become polluted. - Some pesticides can cause accidental injury or death to aquatic organisms, birds, mammals and beneficial insects such as bees and butterflies. Microorganisms in the soil can also be harmed, reducing their ability to enrich the soil and provide nutrients for plants. - Human health risks associated with some pesticides, ranging from minor skin or eye irritation, to poisoning and death, depending on the product and type of exposure. Some pesticides can produce noxious and/or explosive gases if combined with other materials or mixed or applied using the wrong type of container.	- Applicable municipal pesticide bylaws. Choose the least toxic formulation. Read and follow all label directions and never use more than is recommended. Spot treat the problem rather than dispersing over wide areas. Cover yourself with protective clothing and PPE as prescribed on the label when mixing and applying. Stay clear of the treated area for the time period prescribed on the label. DND OPI is responsible for coordinating notification of the affected community of pesticide applications. Coordinate notification to individuals and/or organizations/municipalities outside the Department through Base Public Affairs.

TABLE 10: CONCRETE AND ASPHALT WORKS

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Soils, Surface Water, Aquatic Animals and Habitat	The first precipitation event following asphalt paving could result in runoff containing hydrocarbons, and subsequent transport to nearby drainages or surface water could affect surface water quality.	Install hydrocarbon absorbent padding in any drains around newly asphalted areas during the first few precipitation events.
Surface Water, Aquatic Animals and Habitat	Concrete will be used during construction in or adjacent to surface water or drainage features. Concrete and concrete wash water is particularly harmful to aquatic organisms due to its alkaline properties and elevated heavy metal concentrations. High levels of turbidity may also be created where uncured concrete contacts surface waters that can impair predator/prey detection and oxygen transfer across gills in fish and can cause smothering of benthic communities. Concrete wash water from delivery trucks, pumps, equipment and tools also has the potential to enter surface waters. Discharge of high pH water associated with concrete work would be considered a *deleterious substance* under the Fisheries Act.	Ensure all works involving the use of concrete, cement, mortars, and/or other Portland cement or lime-containing construction materials do not deposit (directly or indirectly) sediments, debris, concrete, leachate concrete fines, wash or contact water into or about any surface water feature or storm sewer system. Ensure cast in place concrete remains isolated from water inside sealed formed structures until cured (approximately 48-72 hours). Do not wash concrete trucks, pumping equipment and/or tools on DND property. Prevent any water that contacts uncured or partly cured concrete (during activities like exposed aggregate wash-off or wet curing) from directly or indirectly entering any surface water feature or storm sewer system. Isolate and hold any water that contacts uncured or partly cured concrete until the pH is between 6.5 and 8.0 pH units and the turbidity is less than 25 nephelometric turbidity units (NTU), measured to an accuracy of +/- 2 NTU. Construct all concrete forms so that they are properly sealed. Deliver concrete without spillage. Isolate concrete from the aquatic environment during curing. Ensure concrete works that have the potential to impact surface waters are monitored by a qualified environmental professional. Maintain surrounding surface water pH within 7 to 9 pH units. Emergency measures should be implemented if downstream pH has changed more than 1.0 pH unit, measured to an accuracy of +/- 0.2 pH units from the background level, or is below 6.0 or above 9.0 pH units Do not perform concrete work if precipitation events are anticipated within 72 hours and the work cannot be contained. Implement mitigation measures identified in Annex DE1B Table 11: Spills, Leaks, Releases.

TABLE 11: SPILLS, LEAKS, RELEASES

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Surface Water, Aquatic Species and Habitat	Accidental fuel spills from machinery, equipment and vehicles have the potential to pollute the nearby aquatic environment.	Develop and implement a plan which details spill prevention and response measures to be employed. Ensure plan includes a list of spill response equipment that will be present on Site. Ensure plan assigns implementation and monitoring roles. Ensure on-Site personnel have reviewed the plan, understand their roles and responsibilities, and are properly trained and equipped to conduct spill response activities. Identify high-risk locations where spills are probable and maintain spill kits, capable of handling the largest potential spill through the duration of the project, at these locations. Locate PPE at the top of the spill kit to ensure easy access for the spill responder. Keep spill kits closed with a safety seal affixed to indicate if the kit has been used or tampered with. Respond immediately to all spills in accordance with plan. Contact the following if a spill cannot be contained and cleaned up and second level response is required: - Port Operations and Emergency Services Queen's Harbour Master/Environmental Protection Office (250-363-2160 (24/7) / VHF Ch 10 (Esquimalt Harbour) / VHF Ch 19 (Nanoose Harbour) / Duty Q 250-889-0044 (silent hours)) for marine spills in Esquimalt and Nanoose Harbours and their approaches; - 911 for land-borne spills. Inform the 911 operator that the spill has occurred on CFB Esquimalt property. Verbally report all spills to DND OPI immediately. If DND OPI is not available, contact the Joint Operations Centre (JOC) (363-2425, 363-5848). Submit the following information to DND OPI within one day of a spill incident: - Date and time of spill (indicate occurrence, discovery and cleanup commencement and - Type of material spilled and Transport of Dangerous Goods classification - Spill surface (gravel, water, pavement, shop floor) - Quantity of material spilled and quantity recovered (kg/L) - Source/origin of spill - Cause of spill (description of incident) - Corrective action take and action plan to prevent a subsequent spill - Human impacts - Environmental impacts (ground, water, vegetation, wildlife) - Weather conditions at the time of the incident - Agencies or authorities notified or involved - Media interest - Additional comments DND OPI is responsible for ensuring that all spills are reported to MARPAC FSE in accordance with Directive SE1 Safety and Environmental Emergency Incident Reporting. If MARPAC FSE personnel are not immediately available, contact the Joint Operations Centre (JOC) (363-2425, 363-5848). If required, MARPAC FSE or the JOC will contact Emergency Management BC directly to ensure that ECCC's notification requirement is met. Ensure all equipment, machinery and vehicles brought on Site are clean and free of leaks, excess oil, and grease. Check all equipment, machinery and vehicles every morning for leaks and ensure they are maintained in good working order. Ensure hydraulic machinery, if required, uses environmentally-sensitive hydraulic fluids that are non-toxic to aquatic life and are readily or inherently biodegradable. Limit refueling, fuel stockpiling and maintenance of equipment to designated areas on level, impermeable surface areas at least 30m away from any drainage or surface water features. Ensure all refueling occurs with funnels, pads and drip pans in place. Store fuels, lubricants and chemicals appropriately on Site, with proper controls to prevent the release of deleterious substances, in a designated area at least

		30m away from surface water features or surface water drainage. Place properly sized oil drip pans under all equipment and vehicles left on site.

TABLE 12: WORKS IN/NEAR WATER

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Surface Water, Aquatic Species and Habitat	Projects occurring in/near water have the potential to cause serious harm to Species at Risk and aquatic species and their habitat.	DND OPI will consult with MARPAC FSE during project design phase to determine whether works in/near water have the potential to impact SAR, critical habitat, and sensitive habitat. Design and plan activities and works in/near a waterbody such that loss or disturbance to aquatic habitat is minimized and sensitive spawning habitats are avoided, and impacts to SARA-listed aquatic species, their residences or critical habitat are avoided. MARPAC FSE will advise if authorizations, permits, notifications or reviews from other federal or provincial government departments (e.g. Fisheries and Oceans Canada, BC Ministry of Environment) are required and will assist the DND OPI in facilitating if required. Implement DFO Measures to Protect Fish and Fish Habitat, as applicable. Implement BC Ministry of Environment General Best Management Practices and Standard Considerations, as applicable. Implement activity specific Best Management Practices from the BC Ministry of Environment Standards and Best Practices for Instream Works, as applicable. Implement BC Ministry of Environment Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia, as applicable. Implement mitigation measures identified in Annex DE1B Table 9 Vegetation, if activities may cause impacts to riparian vegetation. Implement mitigation measures identified in Annex DE1B Table 15 Works near Sensitive Features.

TABLE 13: BUILDING CONSTRUCTION, MAINTENANCE, REPAIR, RENOVATION AND DEMOLITION

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Heritage	DND, as a custodian department, has heritage obligations under the Treasury Board Policy on Management of Real Property. The Treasury Board policy stipulates that departments must manage the buildings they administer so as to conserve their heritage character throughout their lifecycle. It also contains statements regarding the protection of the heritage character of federal buildings in the context of their acquisition, use and disposal, and actions that could affect their heritage character.	DND OPI to consult the Federal Heritage Buildings Review Office (liaise through RP Ops Real Estate Services) before undertaking any intervention that could alter the heritage character of a classified federal building. Work occurring on recognized Federal Heritage Buildings, listed on the Canadian Register of Historic Places, shall comply with the Standards & Guidelines for the Conservation of Historic Places in Canada.
Health and Safety	Hazardous building materials such as asbestos, lead, mercury, polychlorinated biphenyls (PCB), chlorofluorocarbons, and radioactive sources may be encountered during building maintenance, repair, and renovation or demolition activities. The uncontrolled disturbance of such materials may result in overexposures for contractor employees, contamination of the building, project delays, additional expenses and regulatory violations.	All potential hazardous building materials associated with the Project will be identified prior to on-site work commencing, including Asbestos-Containing Materials (ACMs); Lead-based paint (LBP); Mercury-based paint (MBP); Polychlorinated biphenyls (PCB)-based paint; Urea formaldehyde foam insulation (UFFI); sources of ozone depleting substances (ODSs); and other potentially hazardous building materials (e.g. mould, silica). Consult the RP Ops U (P) Designated Substances Database and/or conduct a hazardous building materials survey prior to commencing on-site work to identify hazardous building materials on-site that will require special handling and disposal procedures. DND OPI to ensure the Departmental requirements identified in Directive S13: Asbestos and the RP Ops U (P) Asbestos Management Program Directive are implemented. Handling, storage, transportation and disposal procedures will be developed in accordance with the following regulations.

		- Transportation of Dangerous Goods Regulations, SOR/2016-95, Transportation of Dangerous Goods Act - National Fire Code of Canada, 2015 - Hazardous Products Regulations, SOR/2015-17, Hazardous Products Act - Canada Occupational Health and Safety Regulations SOR 86/304, Canada Labour Code (DND/CAF personnel) - Occupational Health and Safety Regulation, B.C. Reg. 195/2015, Workers Compensation Act (Contractor personnel) - Hazardous Waste Regulation, B.C. Reg. 63/88, Environmental Management Act - Transport of Dangerous Goods Regulations, B.C. Reg. 231/2002, Transport of Dangerous Goods Act - Lead and Mercury: Surface Coating Materials Regulations, SOR/2016-193, Canada Consumer Product Safety Act - PCBs: PCB Regulations, SOR/2008-273, Canadian Environmental Protection Act - Halocarbons: Federal Halocarbon Regulations, SOR/2003-289, Canadian Environmental Protection Act, Ozone Depleting Substances and Other Halocarbons Regulation, B.C. Reg. 317/2012, Environmental Management Act - Mercury: American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values and Biological Exposure Indices - Silica: American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values and Biological Exposure Indices - Mould: Canadian Construction Industry, Standard Construction Document CCA 82 – 2004, Canadian Construction Association Particular handling, storage, transportation and disposal procedures associated with any identified hazardous building material will be implemented and documented during Project implementation. Abatement, containment, and disposal of hazardous building materials will be conducted prior to building maintenance, repair, renovation or demolition and will be conducted by qualified and trained personnel. Third party monitoring of high risk abatement activities will be conducted to ensure the health of workers and employees in adjacent buildings. Ensure all applicable documentation (manifests / disposal and/or destruction certificates) are submitted to the DND OPI. Implement mitigation measures identified in Annex DE1B Table 14: Health and Safety, as applicable.
Health and Safety	Building repair, maintenance and renovation activities can introduce a number of contaminants into the work environment, which have the potential to impact indoor air quality (IAQ). These contaminants may be released in to the environment through maintenance/repair activities or the installation of new building materials, and include but are not limited to dust, volatile organic compounds (VOCs) and biological contaminants (e.g. mould, fungus).	DND OPI is responsible for coordinating notification of the affected community of the nature and likely duration of forthcoming project activities that may temporarily degrade indoor air quality. Notification will include the location of the repair/maintenance work, start and anticipated completion date, the nature of the work, and areas where work activities may be disrupted. Develop and implement a plan which details indoor air quality control measures to be employed. Ensure plan assigns implementation and monitoring roles. Ensure on-Site personnel have reviewed the plan, understand their roles and responsibilities, and are properly trained and equipped to implement the plan. Employ good housekeeping and dust suppression techniques to reduce airborne contaminants. Implement general cleaning, including wet wiping of surfaces/equipment and vacuuming (preferably with a HEPA filter), throughout the project and upon completion, in the work area and other areas accessed. Vacuum new flooring to remove loose matter and particles generated by the installation and renovation work in the area. Monitor indoor air quality conditions daily and employ additional housekeeping and dust suppression techniques as required. Reduce the emissions and/or the impact of volatile organic contaminants from new carpets and furnishings by: - Unwrapping and storing in well-ventilated areas, so that volatile organic compounds can be off-gassed before installation - Allowing adequate time for off-gassing before employees are relocated to a newly renovated building or area - Scheduling activities that produce dust, odours, emissions or unacceptable levels of noise during off-hours when the building is unoccupied, or will be isolated from occupied areas Take all reasonable measures to isolate the work area by: - Installing temporary barriers such as floor to ceiling plastic sheets to enclose the work area and any contaminants generated - Isolating the ventilation system servicing the work area by closing return registers in occupied spaces or installing adequate filters/barriers. This will prevent air containing dust and contaminants being re-circulated from the renovation site into adjoining areas

		- Ventilating the work area using both mechanical (Heating Ventilation Air Conditioning (HVAC) unit, local exhausts, portable fans) and natural ventilation (open doors, windows). Ventilation rates should be increased to help dissipate off-gassed contaminants, and the ventilation should remain elevated until the off-gassing of new products is complete - Placing the area where renovation work is being done under negative pressure in relation to other work areas Clean and inspect components of the HVAC system servicing the renovation site to ensure it is free from debris/dust, and change the filters once work is complete.
Services	The generation of electricity is a large source of greenhouse gas (GHG) emissions. Ongoing operations of buildings is a significant source of energy consumption. Under the Federal Sustainable Development Strategy target, DND is committed to a 40% reduction below 2005 levels of greenhouse gas emissions from its buildings by 2030.	IAW DAOD 3015-0: Green Procurement, apply the principles of green procurement by integrating environmental performance considerations into the procurement decision-making process. Ensure building renovations and new building installations are designed in collaboration with the Defence Energy and Environment Strategy During design phase, DND OPI to engage the local energy manager to determine opportunities to reduce greenhouse gas emissions, identify efficiencies, prepare and deliver training and awareness for building occupants and operators, and negotiate with utility companies to find grants and resources to further reduce emissions and save taxpayer dollars.
Terrestrial Species and Habitat, Migratory Birds and SAR	Building maintenance, repair, renovation and demolition activities have the potential to disturb bat roosts and bird nests. Bats may form maternity colonies under roofs during summer months. Bats can roost under roof tiles, buckled metal, chimney flashing, wood shakes and shingles, soffits, ridge caps and vents. Bats may be roosting under the roof or accessing another part of the building structure (e.g. attic) through the roof. Between May and August, bat pups are particularly vulnerable to disturbance, as they cannot fly. Disturbance to the roost site during summer months is considered "harassment" and is illegal under the BC Wildlife Act. Removal/disturbance of buildings may result in the loss of nesting habitat, loss of nests (direct mortality) and the disruption to bird breeding and nesting activities. Section 34 (a) of the provincial Wildlife Act protects all birds and their eggs. Section 34 (c) protects their nests while they are occupied by a bird or egg. Section 34(b) of the provincial Wildlife Act protects the nests of eagles, peregrine falcons, gyrfalcons, ospreys, herons and burrowing owls year-round. Most native bird species in Canada are protected under the Migratory Birds Convention Act, 1994 (MBCA), and are collectively referred to as "migratory birds". General prohibitions under the Act and its regulations protect migratory birds, their nests and eggs anywhere they are found in Canada. Section 33 of the Species at Risk Act (SARA) prohibits damaging or destroying the residence of a listed threatened, endangered, or extirpated species. SARA defines residence as: "a dwelling-place, such as a den,	Schedule on-site work to avoid sensitive bird periods such as breeding, nesting, roosting, rearing young and staging (migration) and sensitive bat roosting periods. The general nesting period for southern BC is February – September. The bat maternity season is from May to September. A QEP will conduct a bird nest and bat roost survey within 7 days prior to commencement of on-site work, if activities will be conducted during the nesting period or maternity season. If nests or roosts are present, a QEP will develop a management plan identifying protective measures specific to the species present. Management plan should be developed in accordance with the most recent version of the following documents, as applicable: - Guidelines for Raptor Conservation during Urban and Rural Land Development in British Columbia, BC Ministry of Environment - Guide for developing Beneficial Management Practices for Migratory Bird Conservation, Environment and Climate Change Canada - Got Bats? A BC Guide for Managing Bats in Buildings Management plan may recommend exclusion/deterrence activities to be implemented prior to the nesting/maternity season. On-site work will not commence until the management plan is approved by DND OPI and MARPAC FSE. DND OPI is responsible for developing contingency plans to modify project activities in accordance with the management plan. A QEP, who is provided with authority to modify or halt project activities if it is deemed necessary to do so for the protection of bird and/or bat species or habitat, will monitor the plan through implementation. Stop work if nests and/or bat roosts are encountered at any time during project implementation and inform the DND OPI. Do not commence work in the vicinity of the nest/roost until a QEP has been to the Site, assessed the feature and developed a management plan which has been approved by MARPAC FSE. Note the following: - The nests of migratory birds are protected all year, whether occupied or not. It is prohibited to damage, destroy or remove a non-active migratory bird nest without a permit or an authorization. - Barn swallows (*Hirundo rustica*) are present on numerous CFB Esquimalt properties and are protected under the Species at Risk Act (Threatened). Under the Act, the nest, occupied or not, is considered a residence and is protected from any activity that damages or destroys the function of the nest from 1 May or the date when adults are first seen building or occupying the nest (whichever is earlier) to 31 August or when the bird is last seen at the nest (whichever is later). Activities include, but are not limited to, moving, damaging or destroying the nest; blocking access to the nest; and/or disturbing the nest (including auditory disturbance), or any other activity that would damage or destroy the functions of the nest.

	nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating" [s.2(1)].	
Terrestrial Species, Migratory Birds and SAR	Glacous-winged gulls and Canada geese often nest and rear young on building roofs. Roofing maintenance activities may result in the loss of nesting habitat, loss of nests (direct mortality) and the disruption to bird breeding and nesting activities of this species. Both species are protected under the Migratory Birds Convention Act, 1994 (MBCA).	If on-site work activities will be conducted during the nesting period (March to June), nesting deterrence prior to project commencement is required in accordance with the Migratory Bird Damage or Danger Permit that is issued under Subsection 4.(1) of the Migratory Bird Regulations to MARPAC FSE. DND OPI is responsible for liaising with MARPAC FSE prior to conducting any nesting deterrence activities to determine the permit stipulations, limitations and reporting requirements.
Terrestrial Species and Habitat, SAR, Migratory Birds	Building construction/demolition activities and maintenance/repair/renovation activities occurring outside a building envelope, have the potential to impact wildlife and wildlife habitat. Machinery and equipment have the potential to harm terrestrial wildlife, including SAR and migratory birds that enter the project site and damage previously unknown wildlife habitat features that are encountered during project implementation. Wildlife may become trapped in open excavation areas, areas of standing water (e.g. stormwater ponds, sumps), and open pipes on the Site.	Develop and implement a plan which details wildlife protection measures to be employed. Ensure plan assigns implementation and monitoring roles. Ensure on-Site personnel have reviewed the plan, understand their roles and responsibilities, and are properly trained and equipped to implement the plan. Implement, at a minimum, the following wildlife protection measures: - Employ temporary fencing and barricades when possible to prohibit wildlife from entering the Site - Ensure all food wastes are secured in wildlife-proof containers and are removed promptly from the Site (particularly in warm weather) - Ensure all potential sources of water are minimized by limiting standing pools of water on the Site - Fence off or barricade temporary storm water ponds and other waterbodies and/or sumps on the Site - Limit potential sources of shelter by covering or containing piles of soil, fill, brush, rocks and other loose materials, capping ends of pipes; and ensuring that trailers, bins, boxes, and vacant buildings are secured at the end of each work day - Check the Site for wildlife, prior to beginning work each day - Regularly inspect protective fencing, barricades or other installed measures to ensure their integrity and continued function On-site personnel will stop work if wildlife enter the Site. Work will not commence until wildlife have vacated the vicinity of the Site. Wildlife will be allowed to exit the site on their own, via safe routes. On-site personnel are prohibited from capturing, handling or harassing wildlife. In the event that wildlife on Site appear to be injured, abandoned, or in distress, on-site personnel will immediately notify the DND OPI. The DND OPI is responsible for engaging MARPAC FSE who will advise on the appropriate management strategy. On-site personnel will stop work if wildlife habitat features (nest, den, burrow, hibernaculum, etc) are discovered during project implementation. On-site personnel will immediately notify the DND OPI. The DND OPI is responsible for informing MARPAC FSE. Do not disturb wildlife habitat features within the Site until a Qualified Environmental Professional (QEP) has assessed the situation and developed a management plan that has been approved by DND OPI and MARPAC FSE.
Terrestrial Species and Habitat, Health and Safety	Wildlife can cause significant property damage and even health and safety issues when they seek shelter in, on or under buildings. The most common access points are through vents, chimneys, roofs and eaves; wildlife will also frequently seek shelter underneath porches, stairs and raised decks.	Include wildlife-proofing measures in the design of new buildings and whenever feasible during applicable building repair and renovation activities. Implement the following wildlife-proofing measures as applicable: - upgrade materials to use more wildlife-resistant metal components instead of plastic - install heavy screening or other exclusion measures to keep wildlife out of crawl spaces under porches or exterior stairs, including below grade to deter digging animals - install bird deterrent systems on roofs DND OPI to liaise with MARPAC FSE on proposed wildlife-proofing measures to ensure compliance with applicable wildlife legislation (e.g. BC Wildlife Act, Species at Risk Act, Migratory Birds Convention Act).
Terrestrial Species, Migratory Birds	Buildings which feature large windows or other expanses of glass pose a risk to birds, which may not recognize the glass as a barrier. Many birds are injured and killed in collisions with glass each year, especially during spring and fall migration. Light pollution impedes the navigational system of birds	Incorporate bird-friendly measures in the design of new buildings and whenever feasible during applicable building repair and renovation activities. Implement recommended design guidelines/best practices from the following: - US Fish and Wildlife Service, Reducing Bird Collisions with Buildings and Building Glass Best Practices, March 2016; - City of Vancouver, Bird Friendly Design Guidelines, September 2014.

	as they migrate at night; migrating birds appear reluctant to leave artificially lighted areas once they enter them during nocturnal migration. Habitat loss associated with the construction of new buildings has the potential to reduce bird species diversity and abundance.	

TABLE 14: HEALTH AND SAFETY

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
Human Health	Potential hazards associated with project activities may impact the health and safety of workers, visitors and residents/personnel adjacent to the Site.	Develop and implement a Health and Safety Plan to minimize the potential for accidental injury or property damage during all stages of the project. Ensure the plan outlines measures for protecting site workers, visitors, and DND/CAF personnel working adjacent to the Site. Ensure the plan is monitored through project implementation. Ensure all project activities comply with the direction detailed in the Canada Occupational Health and Safety Regulations (DND/CAF personnel) and the BC Occupational Health and Safety Regulations (Contractor personnel) regarding Occupational Health and Safety (OHS). Immediately take measures to rectify unforeseen or peculiar safety related hazards that become evident during project implementation. Verbally advise the DND OPI immediately and provide a written report of the hazard or condition as soon as practical. Conduct regular safety briefings and meetings with on-site workers to encourage safe working procedures are followed. Investigate and report all incidents and accidents as required by: - DND General Safety Program (DND/CAF personnel) - Occupational Health and Safety Regulation, B.C. Reg. 195/2015, Workers Compensation Act (Contractor personnel) DND OPI is responsible for ensuring compliance with BSO 2-539: Occupational Health and Safety Liaison with Private Contractors. This includes: - ensuring that all hazards associated with the project are identified and assessed and mitigation strategies are developed prior to work commencing - ensuring that a communication plan is developed with the appropriate DND/CAF supervisors for hazards that have the potential to impact adjacent DND/CAF personnel

TABLE 15: WORKS NEAR SENSITIVE FEATURES

VEC(s) AFFECTED	DESCRIPTION OF EFFECTS	MITIGATION MEASURES
SAR, Migratory Birds, Aquatic Animals and Habitat, Terrestrial Animals and Habitat, Vegetation	Sensitive features, including but not limited to SAR occurrences, critical habitat, sensitive aquatic habitat, nesting sites and significant trees, may be damaged or destroyed by machinery, equipment, vehicles and on-site activities when works are occurring in the near vicinity.	DND OPI will consult with MARPAC FSE during project design phase to determine whether works are occurring near sensitive features. QEP to conduct the following when works are occurring near sensitive features: - Flag off/barricade any sensitive areas that are near project footprint - Monitor on-site activities to verify compliance with the EED and to ensure that mitigation measures are sufficient for avoiding adverse environmental effects. - Alter work methodology and/or issue stop work orders, in order to prevent environmental impacts and/or adverse environmental effects, whether probable, imminent, or occurring. Once corrective actions have been implemented and deemed appropriate by the QEP, the suspended project activities will resume under the guidance of the QEP. - Report all environmental non-compliances and incidents to DND OPI immediately. DND OPI to inform MARPAC FSE of all environmental non-compliances and incidents. - Complete and submit an environmental monitoring report that includes the following: - Names of on-site personnel - Dates and brief description of the activities that were monitored - Description of sensitive features and corresponding mitigation measures implemented to protect these features - Description of environmental non-conformances and incidents and actions taken to mitigate impacts

		- Photographs documenting sensitive features, activities, mitigation measures, environmental non-compliances and incidents, and corrective actions Conduct a pre-construction meeting that includes the QEP and on-site personnel to ensure a common understanding of the sensitive features and the required mitigation measures for the Project.

SNC-Lavalin Inc.
#301 - 3795 Carey Road
Victoria, British Columbia, Canada V8Z 6T8
250.385.5028 604.515.5150
www.snclavalin.com

MEMORANDUM

To:	Public Services and Procurement Canada	Date:	November 24, 2021
Attention:	Kristen Ritchot		
cc:	Rachel Speller, Department of National Defence		
From:	Janet Jeffery, P.Ag., RPBio Geoff Sherman MSc, PBio	Ref:	626692
Subject:	Summary of Environment Assessment, Nanaimo Bunker, Nanaimo Lakes Road, Nanaimo BC		

1 Introduction

At the request of Public Services and Procurement Canada (PSPC) on behalf of the Department of National Defence (DND), SNC-Lavalin Inc. (SNC-Lavalin) has prepared this environmental assessment summary memorandum for implementation of the planned remediation at the Canadian Forces Base (CFB) Esquimalt Nanaimo Military Camp (NMC) Bunker (the "Site"), Nanaimo, BC.

This work was completed under PSPC Contaminated Sites Remediation Services Contract No. EZ897-192499/003/VAN (CTA) and Task Authorization No. 700592454. The Site layout and environmental overview is provided on Drawing 626692-501, attached.

2 Project/Physical Activity Description

The project will consist of the remediation of contaminated soil in four areas of the NMC Bunker property shown as Excavation Areas 1A, 1B, 2, and 3 (refer to Drawing 626692-501). Contaminants of concern in soil identified in previous investigations include ethylbenzene, naphthalene, phenanthrene, Index of Additive Cancer Risk (IACR), trichloroethylene, lead, Hydrocarbon fraction F2, and copper. The goal of remediation at the Site is to reduce future liability related to environmental conditions. A remedial excavation of the contaminated soils will be completed with the aim to achieve confirmatory results that satisfy the appropriate federal guidelines for the Site.

Remedial activities will include the following:

- Site preparation activities (i.e., utility locations, preparation of spaces for Site support, such as office trailers, portable washrooms, lay-down areas, preparation of soil staging area, worker parking, equipment refueling, where necessary, and installation of erosion and sediment control measures and traffic control requirements if needed);

- Remedial excavation, temporary stockpiling of contaminated soil on-Site, and backfilling activities; and
- Site restoration activities (i.e., restoration to pre-excavation conditions, including the re-establishment of vegetation on-Site).

The excavation sequence will be designed to allow for multiple tasks to be completed at the same time, where possible, and to limit the exposure of excavation equipment to contaminated media. Sequencing will be at the discretion of the contractor. It is recommended that Excavation 1A be conducted first to ensure the soils in the highest risk areas are removed and allow for characterization of the suspect quality overburden including topsoil. Some vegetation removal, including shrubs and immature trees, will be required for excavation and/or Site preparation activities.

All contaminated soil removed within the specified extents will be either hot-loaded or stockpiled without further characterization for subsequent transport to the off-Site facility. The exception to this is suspect quality material at Excavation 1A which requires characterization prior to off-Site disposal or reuse on-Site.

The project is anticipated to be completed in the fall of 2021.

3 Description of Environment

A Site visit was completed by SNC-Lavalin on June 22, 2021 to complete an assessment of wildlife and plant habitat to determine the potential presence of Species at Risk and/or sensitive habitat at the Site for planning purposes.

The Site is approximately two hectares in size and is located on the north side of Nanaimo Lakes Road and east of the Nanaimo Parkway, in the City of Nanaimo, as shown on Drawing 626692-501. Site access is through the entrance on the south side of the Site along Nanaimo Lakes Road.

An asphalt access road extends from the gate entrance to the northern portion of the Site (Drawing 626692-501). The Site is enclosed with chain-link fencing along the north, east, and southern perimeters, and wood panel fencing on the western perimeter. The Site is occupied by a two-storey bunker that was decommissioned and sealed in the late 1990s. The Site is currently vacant with the exception of the decommissioned and sealed bunker.

Vegetation on-Site is dominated by a mixture of grasses and herbaceous species intermixed with common hawthorn (*Crataegus monogyna*) (a cultivated European species that often naturalizes) and invasive species including Himalayan blackberry (*Rubus armeniacus*) and Scotch broom (*Cytisus scoparius*), and some native tree and shrub species (mostly immature) including black cottonwood (*Populus trichocarpa*), coastal Douglas-fir (*Pseudotsuga menziesii* var. *menziesii*), saskatoon (*Amelanchier alnifolia*), and red alder (*Alnus rubra*).

The Chase River and Colliery Dam's Upper Lake are located across Nanaimo Lakes Road approximately 100 m south/southwest of the Site. An unnamed watercourse is also located approximately 325 m to the north of the Site. Surface water on-Site has been reported to be present during winter months within a drainage ditch reported to be present near the eastern perimeter of the Site. Portions of what appeared to be this ditch were observed at the time of the Site visit; however, the course of the ditch was unclear due to the presence of heavily armed vegetation (i.e., blackberry). What appeared to be the ditch outfall was observed along Nanaimo Lakes Road.

The general soil stratigraphy encountered during recent drilling investigations (SNC-Lavalin, 2021) is consistent with the stratigraphy observed during the previous investigations. A fill layer consisting of varying amounts of sand and gravel was identified generally to a depth between 0.5 m and 2.1 m below ground surface (bgs). The fill layer was underlain by dense silt and/or sand layers with varying amounts of gravels encountered up to a depth of 6.1 m bgs (the maximum depth investigated). Soil stratigraphy was found to be heterogeneous across the Site.

4 Species at Risk

A preliminary search through iMapBC identified some areas of the Site to be located within proposed Critical Habitat (CH) for the Western Painted Turtle (*Chrysemys picta*; Pacific Coast population) (Photograph 1; Drawing 626692-501). The Western Painted Turtle (Pacific Coast population) is listed as Threatened on Schedule 1 of the *Species at Risk Act* (SARA), and was downlisted from Endangered on February 20, 2021 (Government of Canada, 2021). A finalized recovery plan, including final Critical Habitat identification, was posted July 8, 2021 for this species (ECCC, 2021). A digital coverage of the final Critical Habitat polygons is not yet available from the federal mapping service, but the final polygons are expected to be similar to the proposed polygons.

The nearest recorded occurrence of Western Painted Turtles is located at Morrell Lake, approximately 1.1 km northwest of the Site. Additional occurrences have also been recorded at three locations ~2.0 km north of the Site (i.e., Buttertubs Marsh, Cathers Lake, and Diver Lake) (iMapBC, 2021).

The extent of the proposed Critical Habitat in the vicinity of the Site includes terrestrial areas that extend up to 150 m from the Chase River and the Colliery Dam Upper Lake, which are located across Nanaimo Road, approximately 100 m south of the Site. Critical Habitat for this species was identified based on a compilation and review of occurrence records, identification of suitable aquatic habitat features within a radial distance of 3 km of each record, and preliminary delineation of geospatial area containing critical habitat by applying a 150 m terrestrial distance around known nest locations and suitable aquatic habitat (ECCC, 2021).

Painted turtles require both aquatic and terrestrial habitat to support basking, nesting, foraging, and overwintering habitat. In general, biophysical features of Critical Habitat for Western Painted Turtles include slow-moving or stagnant fresh waterbodies and open terrestrial habitat with exposed soil and little to no vegetation and substrate comprised of sand, gravel, and/or silt, with low organic content. Suitable nesting sites are characterized as having exposed soil with little vegetation, on south-facing aspects, with gently sloping or flat ground and in areas of open canopy, and without standing water (ECCC, 2021). The majority of nesting sites are on anthropogenic sites such as gravel road shoulders, gravel pits, boat launches, recreational beaches, lawns and gardens, gravel rails, driveways, dikes, and sandy campsites (WPTRT, 2016).

There are several potential barriers to turtle movement present between the Chase River and Lower Colliery Dam and the Site. These include Nanaimo Lakes Road and adjacent ditches (Photograph 2). On the north side of the road near the vicinity of the Site, the ditches are steeply sloped and range from an estimated 2.0 m to over 3.0 m in height (west to east). An approximately 1.0 m wide area from ditches on the north Site is subject to maintenance and had been recently mowed. Additional barriers to turtle movement into the Site area include dense vegetation and a chain-link fence present along the Site's southern boundary (Photograph 3). While some small gaps do exist under the fence, it is expected that turtle movement through these areas would be impeded by the thick vegetation. Although these barriers may not be

insurmountable, movement of turtles from the Chase River/Colliery Dam areas to the Site is considered unlikely.

The Lower Colliery Dam area is a recreational site and includes a busy off-leash dog park. Those features may result in disturbance and possible mortality for turtles leaving the water or hatchlings leaving the nest.

Vegetation is prevalent over the majority of the Site (with the exception of the paved access road, and some less thickly-vegetated areas in the north end of the Site, beyond the extent of the proposed turtle Critical Habitat), resulting in very little exposed friable soil to provide suitable nesting sites (Photograph 4). The introduction of non-native plant species to the Site has likely resulted in degraded nesting habitat in this area due to encroachment. Soils in the area have been described as dense and have likely been compacted historically during development of the Site. Exposed soil noted along a cutbank at the north end of the Site was less compact; however, this area is located over 230 m from nearest portion of the Colliery Dam Upper Lake and not located within the CH polygon. The Site has been reported as having standing water in the winter, further decreasing its suitability as nesting habitat for turtles.

A search of the BC Conservation Data Centre's (CDC) Internet Mapping Service through iMapBC also identified the potential occurrence of one sensitive species in the Site area. A request for additional information relating to the species occurrence was forwarded to the CDC on June 22, 2021. The CDC response was received on June 23, 2021 and indicated the masked species occurrence is not anticipated to be impacted by proposed activities at the Site due to its distance from the Site (CDC, 2021).

4.1 Western Painted Turtle Survey

SNC-Lavalin retained Biolinx Environmental Research Ltd (Biolinx) to conduct a site-specific study of mapped CH on and adjacent to the Site, as well as to determine the likelihood that the mapped CH has reasonable potential to support painted turtles. A Site visit was conducted on August 9, 2021 by two QEPs and an assessment report was provided (Biolinx, 2021), included in Attachment 1.

Two types of surveys were conducted during the Site visit:

- A survey of nesting habitat within the NMC property boundary; and
- A turtle survey of wetland habitats within a range of up to 1.5 km of the NMC property boundary.

The assessment of nesting habitat within the NMC boundary focused on identifying features consistent with preferred nesting habitat (described in Section 4). During the survey, the majority of the NMC property surface was observed to be covered in dense shrubs and grass and considered unsuitable for turtle nesting. A total of eight locations potentially suitable for turtle nesting were identified. Based on their suitability for turtle nesting, four locations were rated as medium-quality nesting habitat and four were rated as low-quality nesting habitat. No evidence of hatchling emergence holes was observed at any location within the NMC property, suggesting that turtle nesting had not occurred within the 2020 nesting season.

The Turtle Survey of nearby wetland habitats was conducted up to within 1.5 km of the NMC boundary and included the boundaries of Upper and Middle Colliery Dam Lakes (approximately 300 m east of the Site) and Upper Chase River wetlands (approximately 600 m south of the Site), neither of which had recorded observations of painted turtle. A survey was also conducted at Morell Lake (approximately 1.1 km north of the Site), at which a 2014 record of painted turtle occurrence exists.

The habitat at the Colliery Dam Lakes was observed to be of low suitability and poor quality due to treed and modified shorelines, lack of vegetated shallows, as well as being located in an area heavily used for recreation and off-leash dog walking. At Upper Chase River wetlands, located across Nanaimo Parkway (Hwy 19) from the Site, small wetland areas appeared to be more suitable for painted turtle habitat, but no turtles were observed during the survey. At Morell Lake, high quality turtle habitat was found at the northernmost reaches (approximately 1.5 km north of the Site); however, no painted turtles were observed during the Morell Lake survey.

Accessibility between the aquatic habitats beyond NMC property boundaries and the Site was also assessed. The perimeter chain-link fence around NMC was observed to reach the ground surface but contained some gaps that could potentially allow turtle passage, although turtles would need to find the gaps in order to successfully enter the Site. The aquatic habitat at the Colliery Dam Lakes is separated from the Site by Nanaimo Lakes Road. Crossing of Nanaimo Lakes Road is considered possible, but subject to a high rate of mortality due to high vehicle traffic. The aquatic habitat at the Upper Chase River wetlands is separated from the Site by Hwy 19, a four-lane highway. Similarly, crossing by turtles is considered possible, but with very high levels of mortality and much difficulty. The high-quality turtle habitat at the north end of Morell Lake is separated from the Site by over 1 km of densely wooded forest, as well as Hwy 19. Turtles from Morell Lake traveling to the Site is considered highly unlikely.

In relation to the planned remediation program, Biolinx recommended that soil disturbance in areas of medium suitability be avoided.

5 Summary

Based on the generally low suitability of the habitat of the Site, the lack of records for Western Painted Turtles, the barriers between the Site and suitable aquatic habitat for turtles, and the extent of proposed project activities, it is unlikely that the project will have impacts on Western Painted Turtle. Nevertheless, the Critical Habitat definition for this species provided in the federal recovery strategy is broad and includes "*Additional types of natural terrestrial habitat features, e.g.: forest, shrublands, grasslands, fields*" (ECCC, 2021). The final digital coverage of the Critical Habitat mapping for painted turtle should be checked, once available, to confirm that the final polygons overlap the Site.

The recovery strategy for Western Painted Turtle Pacific Coast population states:

> *"In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area be described in the Canada Gazette within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the Canada Gazette. For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies*."

Given that the Site is not a federally protected area (e.g., a national park), the prohibition of destruction of Critical Habitat within the Site would not apply until or unless the competent minister has made a statement or order as described above. Residences of all Species at Risk are protected on federal lands. A formal residence description is not yet available for Western Painted Turtle, but nest sites are likely to be included

in that designation. Although the Site appears to be medium to low-suitability for nesting habitat, obtaining a SARA permit to authorize destruction of potential residences of a Species at Risk is recommended as a best management strategy.

We do not anticipate difficulty in obtaining such a permit. Remediation of contaminated soils would ultimately improve nesting habitat quality for turtles and the chances of residence destruction or mortality of individuals are low. Construction mitigation pertaining to turtles will include instruction to construction crews to watch for wildlife (including turtles), to cover all open excavations before leaving for the day, and to check all excavations for trapped wildlife before filling.

6 References

Biolinx Environmental Research Ltd. (2021). Surveys and Mitigation Recommendations for Western Painted Turtle on DND Lands Subject to Soil Remediation at the Nanaimo Bunker Property, Vancouver Island.

Conservation Data Centre (2021). CDC request for masked species information – DND Bunker/Military Camp Property, Nanaimo, BC. Email response dated June 22, 2021.

Environment and Climate Change Canada. 2021. Recovery Strategy for the Western Painted Turtle (*Chrysemys picta bellii*) Pacific Coast population in Canada. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. 2 parts, 31 pp. + 59 pp.

Government of Canada. 2021. Canada Gazette, Part I, Volume 155, Number 8: Order Amending Schedule 1 to the Species at Risk Act. Available: https://canadagazette.gc.ca/rp-pr/p1/2021/2021-02-20/html/reg1-eng.html.

SNC-Lavalin Inc. 2021. Federal Contaminated Sites Action Plan (FCSAP) Site Closure Report: Nanaimo Military Camp Bunker, CFB Esquimalt. Report to Department of National Defence.

Western Painted Turtle Recovery Team (WPTRT). 2016. Recovery Plan for the Painted Turtle – Pacific Coast Population (*Chrysemys picta* pop. 1), in British Columbia. BC Ministry of Environment, Victoria, BC. 89 pp. Repr. of 1st ed., The Western Painted Turtle Recovery Team, Victoria, BC. 89 p.

Janet Jeffery, P.Ag., RPBio
Project Scientist
Environment
Engineering, Design & Project Management

Geoff Sherman MSc, PBio
Wildlife Biologist, Biology West
Environment Permitting & Management
Engineering, Design & Project Management

JJ/GS/nmf

P:\CURRENT PROJECTS\PWGSC\626692 - BUNKER SITE\5.0 DELIVERABLES\5.5 OTHER\20211124_626692_MEM_EA_FINAL.DOCX

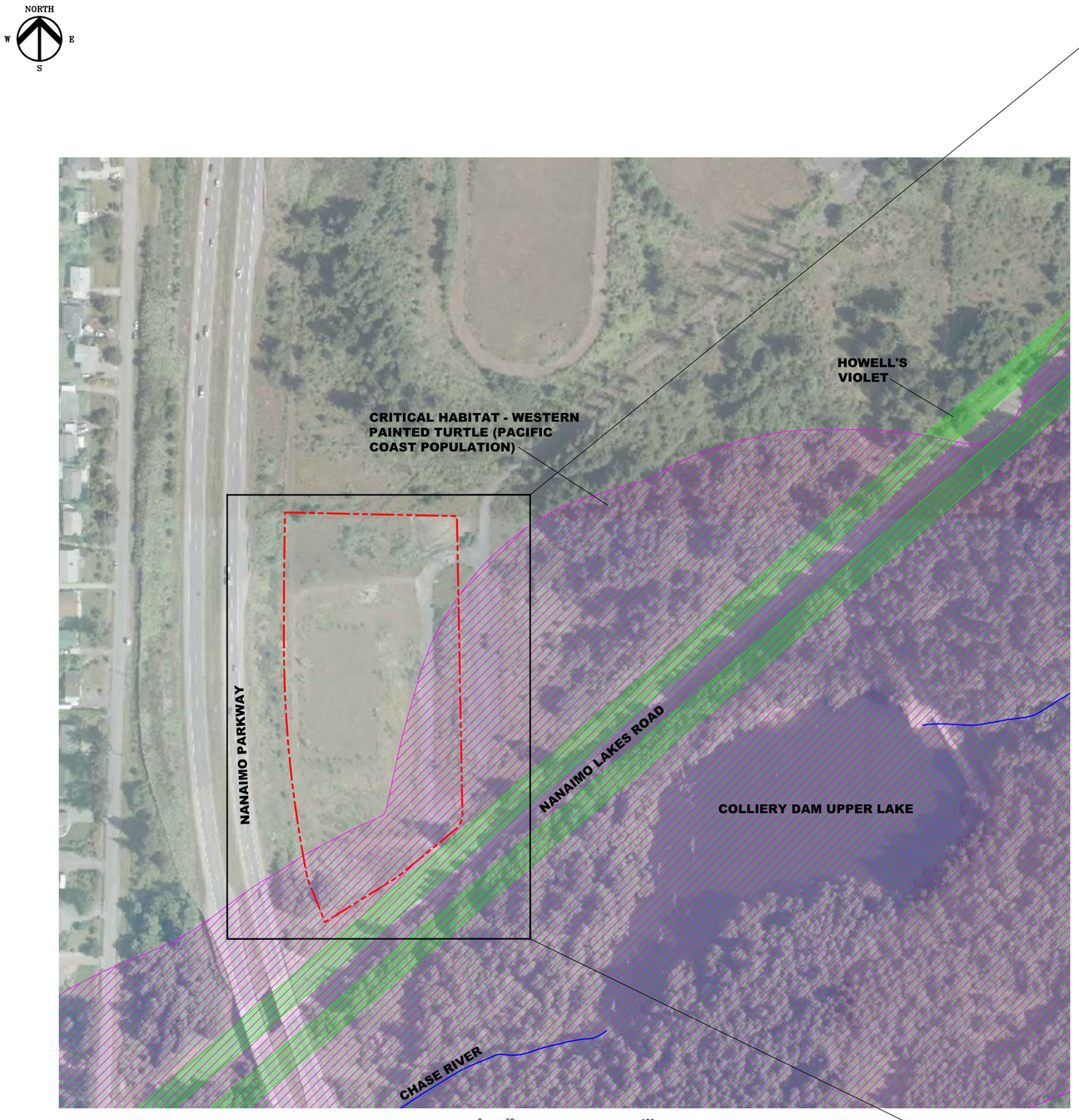
Drawing
› 626692-501 – Environmental Overview

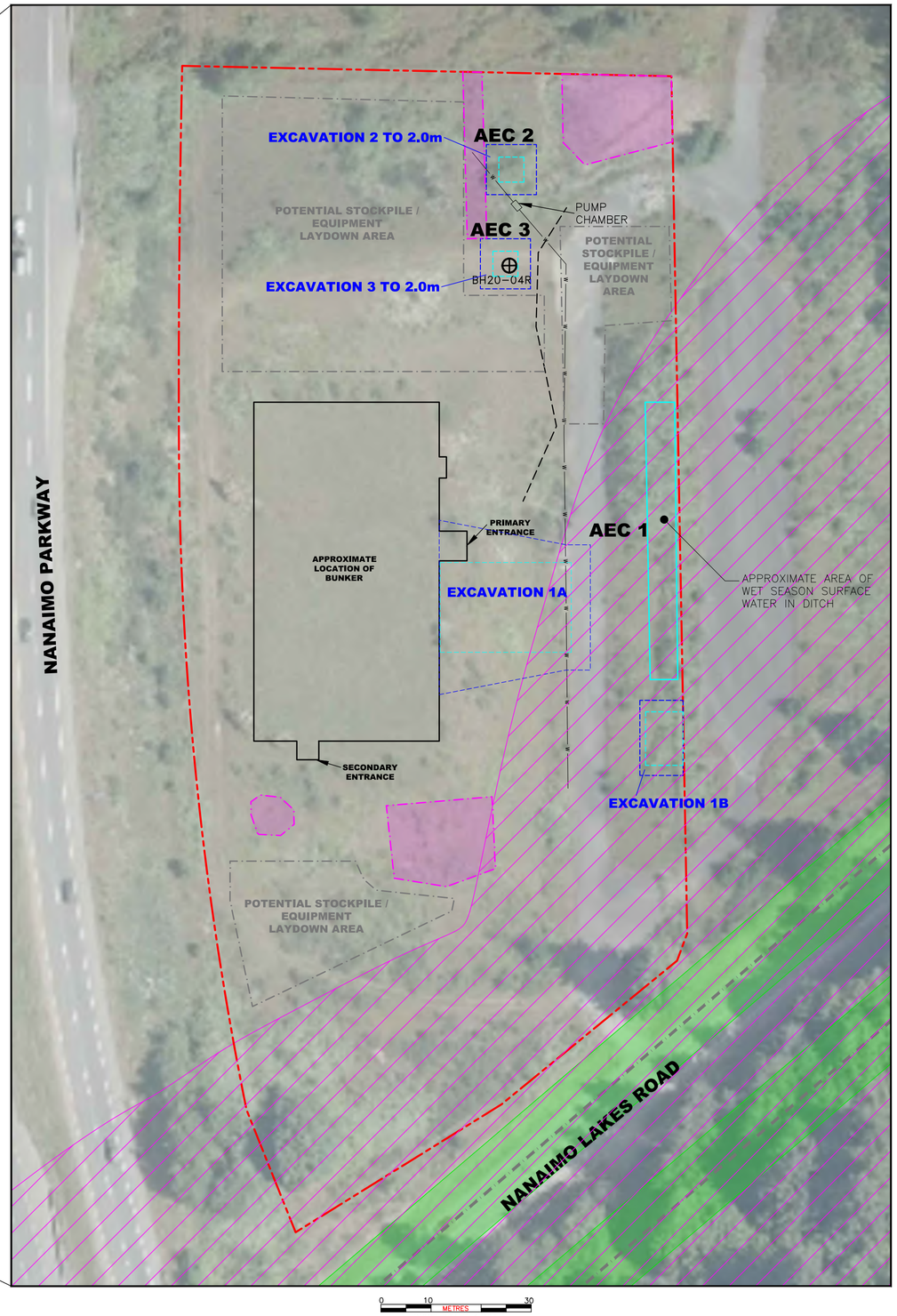
Photographs

Attachment 1: Biolinx WPT Survey

Drawing

› 626692-501 – Environmental Overview





LEGEND

- SUBJECT PROPERTY LIMITS
- SITE FEATURES
- WATER LINE
- COMMUNICATION LINE
- APPROXIMATE TOP OF LIMITS OF EXCAVATION
- APPROXIMATE BASE OF EXCAVATION
- CRITICAL HABITAT – WESTERN PAINTED TURTLE (PACIFIC COAST POPULATION)
- HOWELL'S VIOLET
- MEDIUM QUALITY NESTING HABITAT AREA

NOTES

1. ORIGINAL DRAWING IN COLOUR.
2. LOCATION OF EXISTING UTILITIES SHOWN ARE APPROXIMATE ONLY AND SHOULD BE CONFIRMED ON SITE. NOT ALL UTILITIES MAY BE SHOWN.

REFERENCE DRAWINGS

DWG. NO.	DATE	DESCRIPTION
–	–	–

REVISIONS

REV.	DATE	DESCRIPTION	BY	CHK
1	2021-11-24	ISSUED TO CLIENT	PRT	IM
0	2021-10-21	ISSUED TO CLIENT	AJK	IM

CLIENT NAME: PUBLIC SERVICES AND PROCUREMENT CANADA

PROJECT LOCATION: NANAIMO BUNKER, NANAIMO, B.C.

SNC·LAVALIN

TITLE: **ENVIRONMENTAL OVERVIEW**

DWN BY: PRT	SCALE: AS SHOWN	DATE: 2021-06-17	DWG No: REV.: 1
CHK'D: JJ	PLOT: 20211124,1135	CADFILE: 626692R11	626692-501

PATH: P:\CURRENT PROJECTS\PWGSC\626692 – BUNKER SITE\4.0 EXECUTION\4.5 GIS AND DRAWINGS\CAD\626692R11.DWG

Photographs

Photograph 1: Western painted turtle (G Stolz, USFWS, public domain).

Photograph 2: Paved road and riprap ditch.

Photograph 3: Dense vegetation and chain-link fence at margin of Site.

Photograph 4: Paved area and typical vegetation at the Site.

Attachment 1

› Biolinx WPT Survey

Biolinx Environmental Research Ltd.

1759 Colburne Place, North Saanich, BC V8L 5A2
Tel: (250) 655-4602 Cell: 250 634-8909 Email: lennart@biolinx.ca

Surveys and Mitigation Recommendations for Western Painted Turtle on DND Lands Subjected to Soil Remediation at Nanaimo Bunker Property, Vancouver Island

Prepared by Kristiina Ovaska, PhD and Lennart Sopuck, MSc., RPBio.

August 2021

1.0 INTRODUCTION

SNC Lavalin, on behalf of the Department of National Defence, is planning to conduct a soil remediation project at the Nanaimo Bunker (NMC) property. The project involves the removal of contaminated soil and engaging in other remediation activities at a former military site (Figure 1). These activities may potentially impact Western Painted Turtle (*Chrysemys picta bellii*), Pacific Coast Population, which is listed as Endangered under the federal *Species at Risk Act*.

A Critical Habitat polygon overlaps the remediation site (ECCC 2021). Critical Habitat identification for Western Painted Turtle is based on the general principle of applying a 3 km radius buffer around known occurrences (in this case Morrell Lake about 1 km away from the Nanaimo Bunker), and application of a 150 m radius buffer around known and potentially suitable wetlands within this zone (potential habitat in Colliery Dam Lakes in this case). Areas that are clearly isolated by insurmountable barriers are excluded; in this case, the roads are not considered such barriers. Within the polygons so derived, terrestrial habitats that contain the following features are designated as Critical Habitat (ECCC 2021):

- "Open terrestrial habitat types, i.e.: areas with exposed soil and little to no vegetation, e.g., beaches, shoreline, sandy/loamy riparian edges or banks, natural islands, rocky bluffs, canopy gaps in forested habitats, where features include any of the following attributes:
    - flat or gently sloping ground (no pooling water)
    - substrates: sand, gravel, or silt; low organic content
- Additional types of natural terrestrial habitat features, e.g.: forest, shrublands, grasslands, fields".

This report presents the results of a nesting habitat assessment for Western Painted Turtles conducted on 9 August 2021 and provides recommendations to minimize potential impacts on this species. We also surveyed the nearest aquatic habitats for turtles, including Morrell Lake with the nearest known occurrence of the species (see Table 1 for records from the Nanaimo area).

Table 1. Summary of Western Painted Turtles sites from the Nanaimo area.

Site	Latitude	Longitude	Source
Buttertubs Marsh	49.17155	-123.976012	COSEWIC (2016)
Diver Lake	49.202503	-124.013714	COSEWIC (2016)
Long Lake, NW shore	49.2135	-124.02142	iMapBC (accessed Aug 2021)
Morrell Lake	49.1533	-123.9886	ECCC (2021); C. Engelstoft pers. comm. 2021

2.0 STUDY AREA

The NMC Bunker property is located on the north side of Nanaimo Lakes Road and east of the Nanaimo Parkway, in the City of Nanaimo. The approximately 2-ha site is enclosed with chain link fencing. It contains a currently vacant two-storey bunker that was decommissioned and sealed in the late 1990s. The study area area is demarcated by the dotted yellow line in Figure 1.

Also on 9 August 2021, we conducted turtle surveys in wetland habitats up to 1.5 km from the remediation area, including Colliery Dam Lakes (Upper and Lower), Upper Chase River wetlands, and Morrell Lake Nature Sanctuary. We scanned the water bodies with a spotting scope and binoculars from vantage points along the shoreline.

The project will consist of the remediation of contaminated soil in four areas (1a,b, 2, 3; Figure 1). The following description of project activities is as per communication with Janet Jeffery (2021). Contaminants of Concern (COC) in soil identified in previous investigations include ethylbenzene, naphthalene, phenanthrene, Index of Additive Cancer Risk (IACR), trichloroethylene, lead, hydrocarbon fraction F2, and copper. The goal of remediation is to reduce future liability related to environmental conditions. A remedial excavation of the contaminated soils will be completed with the aim to achieve confirmatory results that satisfy the appropriate federal guidelines for the site. The contaminated soil is to be excavated for transport and disposal at an approved off-site facility. Following the completion of the excavations, the disturbed areas will be backfilled and restored to their current grade.

The site is open, and vegetation consists of grasses, shrubs, and scattered small trees. Introduced shrubs including Himalayan Blackberry (*Rubus armeniacus*) and English Hawthorn (*Crataegus monogyna*) are common. A dense cover of planted grasses occurs on top of the bunker and throughout most of the site. A few patches of bare ground are present along old trails and tracks, the access road, and in recently disturbed areas.

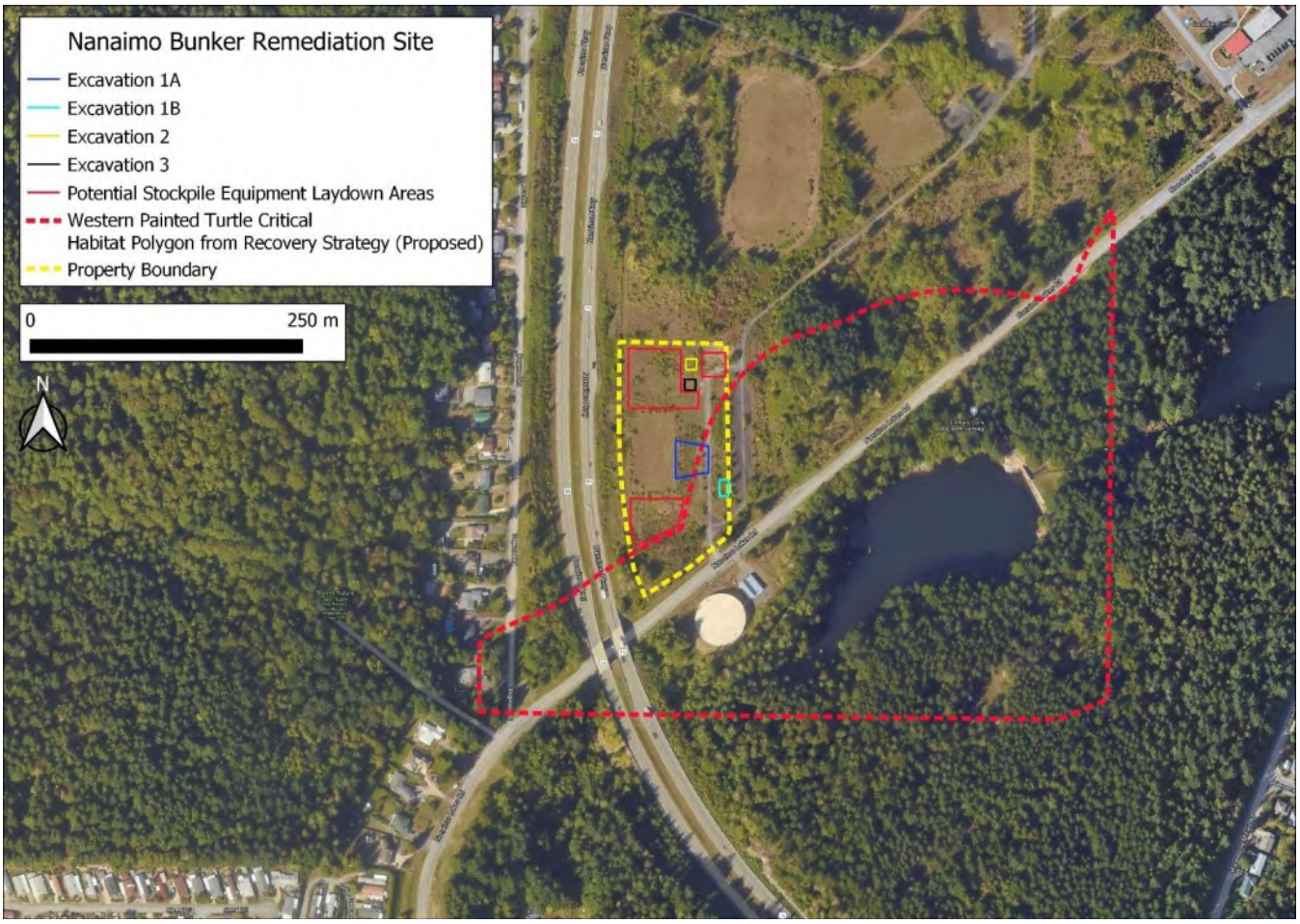
3.0 METHODS

We conducted detailed mapping of potential turtle nesting habitat and an assessment of its suitability within the remediation area, based on a site visit on 9 August 2021. Both observers (Kristiina Ovaska and Lennart Sopuck) are experienced in turtle surveys. We slowly walked throughout the remediation site and examined the vegetation, substrate type, and the presence of turtle nesting activity such as scrapes and hatchling emergent holes. We assessed nesting habitat suitability based on the degree of openness, substrate features, and

exposure to the sun. Potentially suitable habitats were rated from low to high. In addition to ratings based on nesting habitat suitability, we investigated accessibility of the remediation area by turtles and distance to the nearest suitable wetland habitat.

Also on 9 August 2021, we conducted turtle surveys in wetland habitats up to 1.5 km from the remediation area, including Colliery Dam Lakes (Upper and Lower), Upper Chase River wetlands, and Morrell Lake Nature Sanctuary. We scanned the water bodies with a spotting scope and binoculars from vantage points along the shoreline.

Figure 1. Map of the Nanaimo Bunker property in Nanaimo, Vancouver Island. The soil remediation site is demarcated by the yellow dotted line and the Critical Habitat polygon for Western Painted Turtle is shown by the red dotted line.



4. RESULTS AND DISCUSSION

4.1 Nesting Habitat Assessment within the Study Area

Female Western Painted Turtles select bare (unvegetated) patches of substrate in areas with good exposure to the sun for nesting, such as along warm southernly aspects in gently sloping terrain (COSEWIC 2016). Important features include good drainage and fairly compact substrate with low organic content, often composed of a mixture of sand, gravel, and soil. While walking through the study area along meandering transects, we searched for such features (see Figure 2 for survey tracks).

Most of the study area was covered by dense shrubs or grass, unsuitable for turtle nesting. However, we identified several sites that contained potentially suitable patches with bare ground and suitable substrate and exposure (Figure 3; see Appendix 1 for field notes and Appendix 2 for images). These were rated either as medium or low quality. The best habitat occurred in the northeast corner and in the south-central and southwest parts of the study area. In these areas, the potential nesting habitat overlapped with the proposed equipment and stockpile laydown areas (Figure 3).

We did not find any evidence of recent nesting activity by turtles within the remediation area. While new nests can sometimes be identified from scrapes (small patches of disturbed soil), they are notoriously difficult to detect unless recently constructed. On Vancouver Island, the peak nesting season is from late May to late June (e.g., Ovaska and Engelstoft 2018 and annual reports for Habitat Acquisition Trust). Emergence of hatchlings typically takes place in the spring following egg-laying the previous year, after an overwintering period in the nest. The holes indicating emergence are often visible long after hatchlings have departed. The absence of any evidence of such holes in the remediation area suggests that it was not used by turtles for nesting in 2020.

4.2 Turtle Surveys in Adjacent Wetlands

Western Painted Turtles spend most of their time in aquatic habitats, and only come to land when nesting or when dispersing between water bodies. Nesting sites are usually within 200 m of water bodies, but longer movements have been occasionally documented (COSEWIC 2016); in British Columbia movement distances between aquatic and nesting habitats are typically less than 150 m (BC FLNRO). Aquatic habitats include various stagnant or slow-moving water bodies, usually with shallow areas with emergent or floating vegetation and muddy substrates (COSEWIC 2016; ECCC 2021).

We conducted a turtle survey and assessed suitability of aquatic habitats within 1.5 km from the remediation site. The closest water bodies were located to the east (Colliery Dam Lakes) and southwest (Upper Chase River Wetlands) (see Figure 4 for survey routes). There are no previous records of Western Painted Turtles from any of these water bodies. The closest water bodies to the study area, Middle and Upper Colliery Dam Lakes, across Nanaimo Lakes Road, contained poor quality habitat for turtles. Middle Colliery Lake was mostly treed to the shoreline and lacked vegetated shallows preferred by turtles; it was within an off-leash dog park, which appeared to be heavily used for this purpose. Upper (northernmost) Colliery Lake contained some potential shallow turtle habitat at the southwest end, including a small patch of emergent vegetation and a few basking logs. However, it also received heavy recreational use by people and pets and overall provided poor turtle habitat. Lower Colliery Lake was steep-sided and highly modified; it was completely dry during our visit. Small shallow vegetated wetlands to the south of the Colliery Dam Lakes and on the west side of Nanaimo Lakes Road (referred to as Upper Chase River wetlands) contained better quality potential turtle habitat than the above lakes, but we observed no turtles during the visit.

The nearest record of Western Painted Turtle to the remediation area is from Morrell Lake, located ~1.1. km to the northwest (straight-line distance from edge to edge). An adult Western Painted Turtle has been documented from the lake on two occasions, last time in September 2014; C. Engelstoft pers. comm. 2021). The north end of the lake contained high-quality turtle habitat, including shallows with abundant emergent vegetation and basking logs. During our visit we observed two adult Red-eared Sliders (*Trachemys scripta*) there (basking on separate logs ~30 m apart) but no Western Painted Turtles.

Figure 2. Turtle nesting survey coverage within the Nanaimo Bunker study area.

Figure 3. Turtle nesting habitat assessment within the Nanaimo Bunker study area. Reference numbers match those in the appendices.

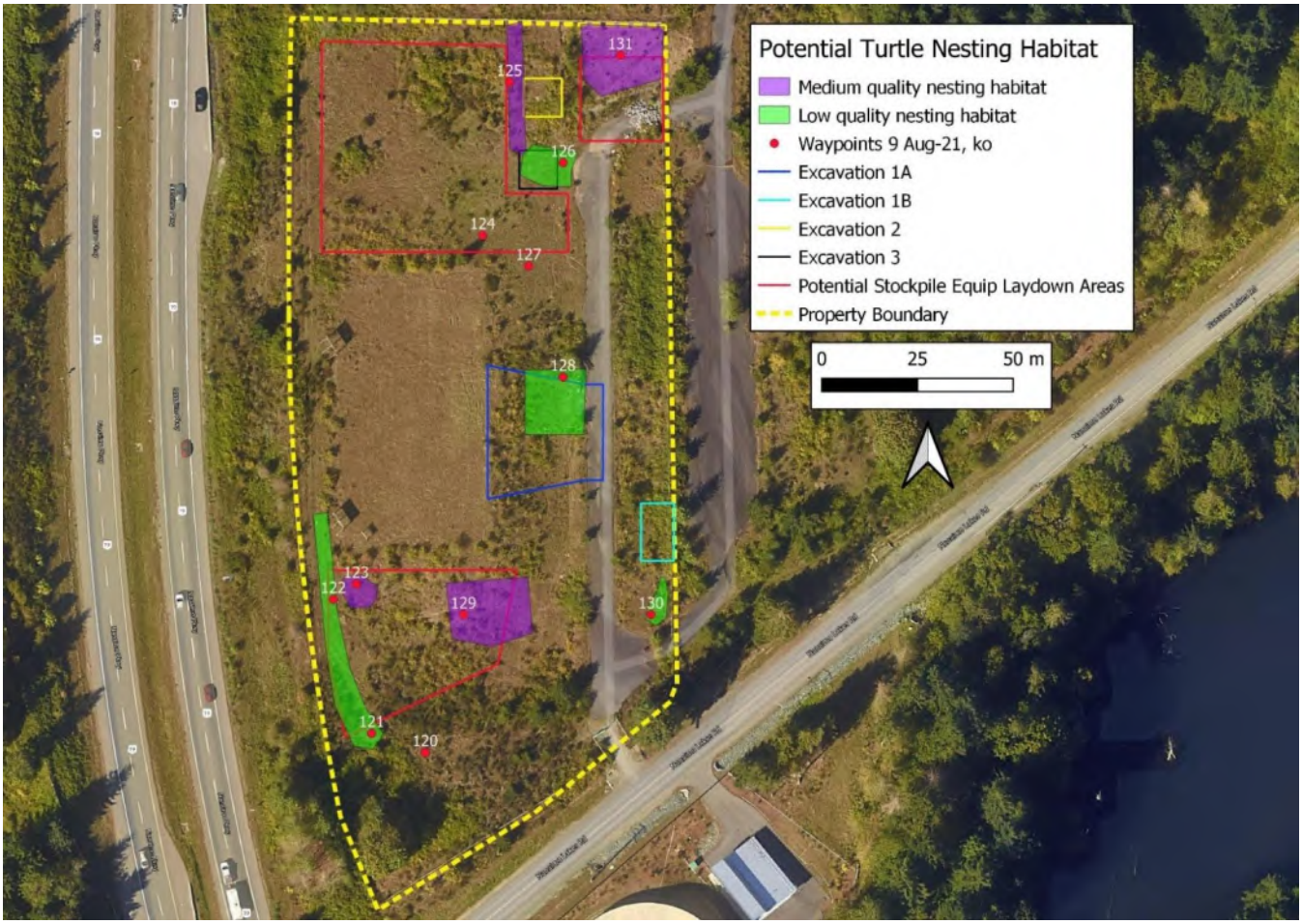
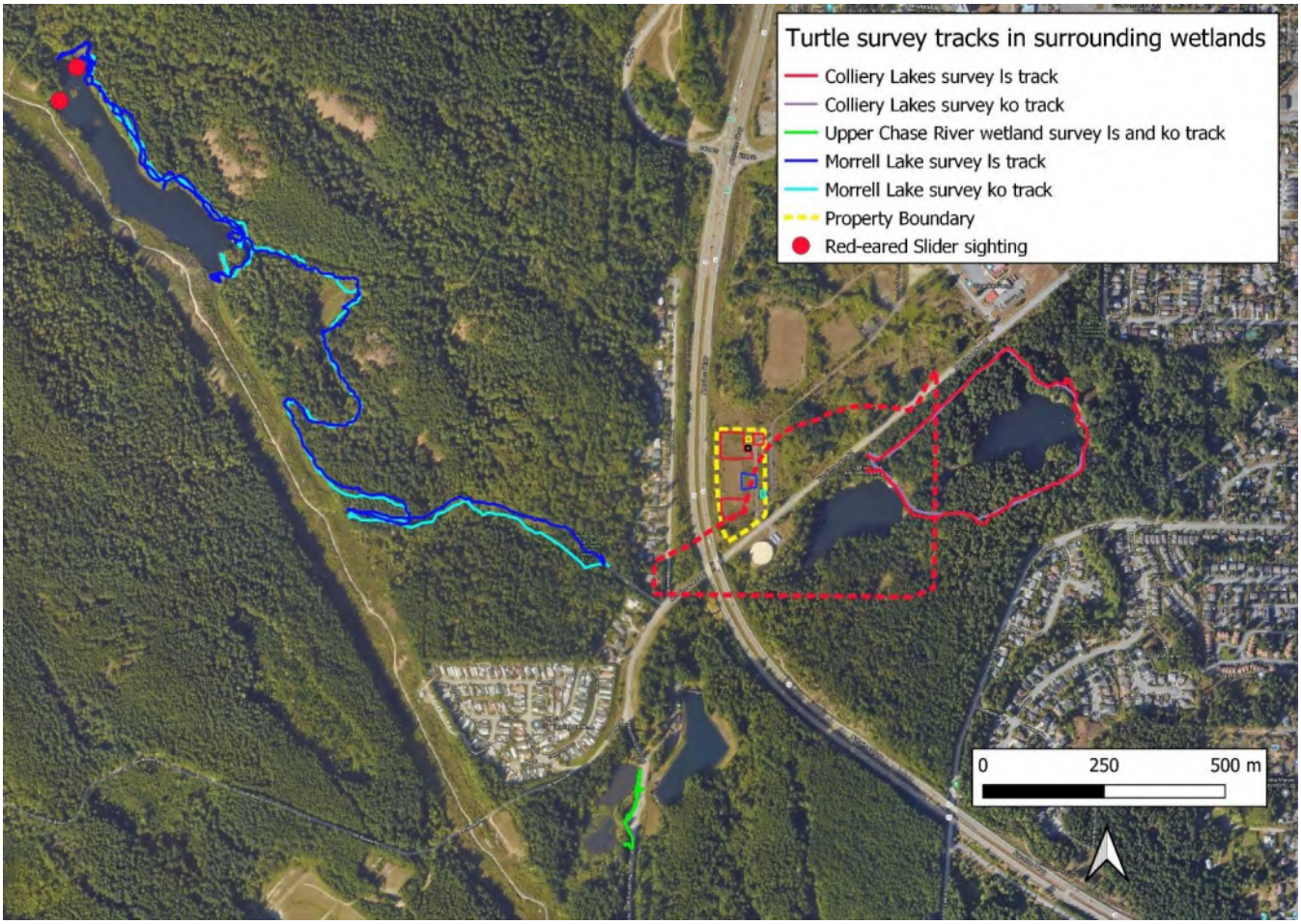


Figure 4. Turtle survey coverage in wetland areas up to 1.5 km from remediation area, showing observations of two Red-eared Sliders in Morrell Lake, 9 August 2021.



4.3 Accessibility by Turtles to the Remediation Area

Habitat connectivity between aquatic and terrestrial nesting habitats is an important component of turtle habitat requirements (COSEWIC 2016). Turtles may travel along water courses or overland, including crossing roads, while moving between the two habitats.

During the site visit, we investigated access routes by turtles to the remediation area from nearby wetlands. From the nearest aquatic habitats in Colliery Dam Lakes, turtles would have to cross the busy, paved Nanaimo Lakes Road. Although mortality risk is high, a crossing would be plausible. From the higher quality aquatic habitat in the Upper Chase River Wetlands, turtles would have to cross the even busier HWY 19, placing them at greater risk from road mortality. The remediation site is enclosed by a chain-link fence that for the most part is flush to the ground; however, there are several gaps, including a few larger unauthorized holes clipped with wire cutters. It is plausible that any turtles that made it across the roads and attempting to access the remediation area could do so, albeit with difficulty.

It is highly unlikely that turtles would enter the remediation area from the nearest known Western Painted Turtle site in Morrell Lake. To do so, turtles would have to travel through densely wooded second growth forest for a distance of over 1 km and then cross the busy HWY 19.

4.4 Conclusions

The remediation site contains patches of potential turtle nesting habitat rated as medium or low suitability. However, the aquatic habitat in the nearest wetlands (Colliery Dam Lakes) that would provide a source population is of poor quality, and there are no records of Western Painted Turtles from there. If turtles occurred in these lakes or the better-quality aquatic habitat farther south (Upper Chase River Wetlands), they would have to cross a busy road and negotiate the fence surrounding the remediation site. Use of the remediation site by turtles from the nearest known Western Painted Turtle occurrence in Morrell Lake is highly unlikely due to access concerns through unfavourable habitat and a required four-lane highway crossing.

Nesting habitat is typically in short supply for turtles on Vancouver Island, where open habitats with bare ground and suitable substrates for digging nests are limited around wetlands. A precautionary approach is to minimize disturbance to the medium suitability habitats within the remediation area, as discussed below, in the unlikely event that they are or might be used by Western Painted Turtles in the future.

5.0 RECOMMENDED MITIGATION MEASURES

The following measures are intended to minimize potential impacts for nesting Western Turtles, were they to use the remediation area:

- Avoid soil disturbance in areas rated as medium suitability for the species (see Figure 3). This may include re-routing of access roads and turn-around areas in the soil remediation area, if required; avoid widening existing access roads into the site; all new roads should be restored after completion of remediation activities. Avoid using those portions of equipment and stockpile laydown areas that overlap with medium quality nesting habitat.
- Maintain patches of bare ground in the habitat rated as medium suitability by removing dense grasses to expose the soil, if needed. This activity should be carried out during a brief window of opportunity in mid-late May before nesting season commences but after turtle hatchlings from previous year's nests have emerged.
- Maintain or create gaps (e.g., 10 cm high) at the bottom of the chain link fence surrounding the property on the south side (facing Nanaimo Lakes Road) to allow turtles access to the property.
- Monitor the site periodically over time to ensure that native vegetation and soil conditions have been restored, and nesting habitat remains in functional condition.

6.0 LITERATURE CITED

B.C. Ministry of Forests, Lands and Natural Resource Operations (BC FLNRO). 2014. Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia.

COSEWIC. 2016. COSEWIC assessment and status report on the Western Painted Turtle *Chrysemys picta bellii*, Pacific Coast population, Intermountain – Rocky Mountain

population and Prairie/Western Boreal – Canadian Shield population,in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxi + 95 pp.

Engelstoft, C., pers. comm. 2021. *Email communication to Kristiina Ovaska, August 2021*. Biologist, South Pender Island.

Environment and Climate Change Canada (ECCC). 2021. Recovery Strategy for the Western Painted Turtle (*Chrysemys picta bellii*) Pacific Coast population in Canada. *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. 2 parts, 31 pp. + 59 pp.

Jeffery, J., pers. comm. 2021. *Email communication to Lennart Sopuck, August 2021*. Project Scientist, Environment & Geoscience, Engineerinf, Design and Project Management, SNC Lavalin.

Ovaska, K. and C. Engelstoft. Western Painted Turtle surveys and stewardship activities on Vancouver Island, April 2017 – March 2018. Report prepared for Habitat Acquisition Trust, Victoria, B.C. 11 pp. Website (for this and other annual reports): http://hat.bc.ca/focal-species-publications/western-painted-turtle-publications (accessed August 2021).

Appendix 1. Turtle nesting habitat assessment within the Nanaimo Bunker remediation area, 9 August 2021. Reference points correspond to those in Figure 3. All potential nesting areas were in open-canopy habitats and contained bare patches of soil. Coordinates shown were taken with handheld Garmin GPS unit (accuracy 3 m; NAD83)

Reference point	UTM zone	UTM E	UTM N	Aspect	Comments	Suitability
120	10	429146	5444311	SE	very small patches of compact bare soil among grasses & low shrubs	marginal
121	10	429132	5444317	SE	several patches of compact bare soil among grasses	low
122	10	429122	5444353	SE	old track with bare soil and gravel	low
123	10	429128	5444356	S	larger patch of bare soil among grasses	medium
124	10	429160	5444447	NE	suitable bare soil patches but with unfavourable northern exposure	marginal
125	10	429168	5444487	SSW	slope along old track with compact bare soil, which extends north almost to the perimeter fence	medium
126	10	429133	5444466	level	disturbed area with bare compact soil adjacent to access road	low
127	10	429173	5444439	NE	slope by access road; some bare soil but with unfavourable northern exposure	marginal
128	10	429165	5444409	SE	many patches of bare, compact soil, sloping down to the access road	low
129	10	429155	5444349	S	abundant, compact but fine textured bare ground within an area of ~15x15 m; best potential turtle nesting habitat at the site	medium
130	10	429205	5444348	E	open habitat with bare soil along access tract and newly created soil sampling site; somewhat shaded	low
131	10	429197	5444494	SSW	relatively large (~18x14 m) area of exposed, hard-packed soil on a gentle (5º) slope	medium

Appendix 2. Images of potential turtle nesting habitat rated as medium suitability within the remediation area and a road that turtles would need to cross to access the sites. Site numbers correspond to those in Figure 3 and Appendix 1.

Site 123

Site 131

Site 129

Site 125

Access to the remediation area by turtes from the nearest wetlands (Colliery Dam Lakes) would necessiate crossing the Nanaimo Lakes Road. The remediation site is on the right, bordered by Himalayan Blackberry bushes and enclosed by a chain link fence.

Annex F. Health and Safety

- Fire Orders and Regulations for Contractors
- Base Fire Safety Policy
- CFB Esquimalt – Safety & Environment for Contractors

CFB Esquimalt Fire Rescue
Fire Prevention Division

Project: _____ **Location: CFB Esquimalt** _____

Fire Orders and Regulations for Contractors

All personnel are to be thoroughly familiar with the contents of this order and in addition are to be conversant with relevant regulations pertaining to:

Fire Safety Plans

- Prior to commencement of construction or demolition, the Contractor shall prepare for the site a Fire Safety Plan conforming to the *National Fire Code of Canada Section 2.8 Emergency Planning*.

- Prior to commencement of construction or demolition, the Contractor and their personnel shall be familiar with the *National Building Code of Canada Section 8.2 Protection of the Public and Fire Safety* or *British Columbia Building Codes section* 8.2.

Reporting Fires

- Report immediately all fire incidents to the Fire Department as follows:
  - Activate nearest fire alarm and
  - Telephone 911
  - Telephone the Fire Department 363-1990/1991

- When reporting a fire by telephone, give location of fire, name or number of building and be prepared to verify the location.
  - When reporting by cellular phone, inform the operator your location as CFB Esquimalt**,** (Bldg #) Colwood, Wilfert Road. You may initially receive a 911 operator from another jurisdiction depending on your cellular phone.

Fire Precautions

- Fire safety will be maintained in accordance with Canadian Forces Base (CFB) Esquimalt Fire Orders.

- Fire watchers provided with sufficient fire equipment (Company Owned) to control or extinguish fire shall be provided:
  - Whenever work is being carried out in dangerous or hazardous areas involving the use of heat.
  - For the duration of cutting, welding, and roofing operations and for a period of 1 HR thereafter…2 HR for roofing. Before leaving, he/she shall inspect the site to ensure that all is in order.

- On a scale established in conjunction with the engineer prior to commencing work.

- Hot works permits are required from the Fire Prevention Division, **363-1911 or 250-213-8250** in all cases involving welding, cutting, grinding, roofing or the use of blowtorches, salamanders, etc. Regulations in the Hot Works permit will be strictly adhered to.

- The contractor shall supply fire extinguishers, as scaled by the Chief Fire Inspector, necessary to protect the work in progress and the contractor's physical plant on site.

Interior and Exterior Fire Protection Systems and Alarm Systems

- Fire hydrants, sprinklers systems, and fire protection and alarm systems will not be:
  - Obstructed;
  - Tampered with, shut-off; or
  - Left inactive at the end of a working day or shift without authorization from the Chief Fire Inspector.
  - The Chief Fire Inspector must be notified before disconnecting the power to buildings with fire alarm systems.

- Fire hydrants, standpipes and hose systems will not be used for other than firefighting purposes unless authorized by the Chief Fire Inspector **363-1911**.

Blocking of Roadways or Access/Egress

- Blocking of Roadways: in all area the Chief Fire Inspector is to be advised prior to the erection of barricades or the digging of trenches which might impede fire apparatus. The Contractor shall provide an emergency access road as required and as directed by the Chief Fire Inspector.

- Blocking of Access/Egress: The Chief Fire Inspector shall be advised of any work that would restrict access/egress or block a door to an area of the building. The Contractor shall provide an emergency access route as directed by the Chief Fire Inspector.

Flammable Liquids

- Flammable liquids such as gasoline, kerosene, naphtha, etc., may be kept for ready use in quantities not exceeding 45 litres provided they are stored in approved safety cans bearing the Underwriters Laboratory or Factory Mutual Seal of Approval.

- Transfer of flammable liquids is prohibited within buildings. In all cases where the transfer of such liquids is necessary, care is to be taken to provide adequate bonding between containers and ground.

- The transfer of flammable liquids shall not be carried out in the vicinity of open flame or any type of heat producing devices.

- Storage of quantities of flammable liquids exceeding 45 litres for work purposes requires the permission of the Chief Fire Inspector. Flammable liquids having a flash point below 38°C (100°F) such as gasoline or naphtha, etc., shall not be used in solvents or cleaning agents.

- Disposal of flammable liquids shall be in a safe approved manner.

Smoking Precautions

- Although smoking is not permitted in hazardous areas, care must still be exercised in the use of smoking materials in non-restricted areas. Smoking is not permitted in Department of National Defence buildings.

Storage and Removal of Rubbish and Waste Materials

- Accumulations of rubbish and waste materials are to be kept to a minimum, and removed from buildings at the end of the workday or shift.

- Flammable waste materials shall not be stored in the work area without the consent of the Chief Fire Inspector.

- The burning of rubbish is prohibited

Quality Control
Automatic Fire Protection and Detection Systems (AFP and DS)

- The Chief Fire Inspector, Fire Prevention Division, CFB Esquimalt Fire Rescue, shall be informed in advance of acceptance inspections or tests of new AFP and DS.

- A copy of the applicable manufacturer's operating maintenance, parts list manual, one set of keys for new alarm panels in addition to any other manuals, and keys called for in this specification, shall be provided to the Chief Fire Inspector at the time of acceptance.

- The Contractor shall arrange a briefing from a manufacturer's representative for the Chief Fire Inspector prior to or at the time of acceptance of new AFP and DS.

- When existing AFP and DS are modified, required repair, or are being expanded, the Chief Fire Inspector shall be notified prior to commencement of work and kept informed of progress. On completion, the Chief Fire Inspector shall be informed to enable Fire Department staff to test the system.

I acknowledge I am aware of these regulations requiring compliance with CFB Esquimalt Fire Safety Orders and Directives in connection with the work to be performed.

Inspector: _____ Date: _____

Contractor: Date:
Phone # _____ _____

BSO 7665-0
Base Fire Safety Policy

1. Identification

Date of Issue	27-04-2018
Date of Modification	27-04-2018
Application	This order and directive applies to those members of the Canadian Armed Forces (CAF) and employees of the Department of National Defence (DND), NPF employees, contractors and all individuals that reside in Canadian Forces Base Esquimalt. This is inclusive of Lodger units and all properties for which the Base Commander is responsible.
Supersession	This Base Standing Order (BSO) supersedes BSO 2-314 through 322 inclusive.
Approval Authority	This BSO is issued pursuant to the authority of the Commanding Officer Canadian Forces Base Esquimalt.
Enquiries	Commanding Officer Port Operations and Emergency Services

2. Definitions

Building Custodian	The person in charge (CF or DND) of real property for the department. The Commanding Officer or the senior officer responsible for the building.
Emergency Operations	Activities of fire protection services which relate to, but are not limited to: infrastructure, aircraft, shipboard, wild land, rescue, hazardous materials, CBRN and emergency medical response.
Fire Prevention	Fire Protection Services and enforcement dealing with preventing the outbreak of fire through identification and recommendations to eliminate fire hazards through activities such as inspection, code enforcement, education, training, and investigation programs.
Fire Warden	The official tasked with ensuring that workplace fire hazards are identified, reported and corrected.

3. Direction/Policy

Context **3.1**	The Fire Protection Program (FPP) rests on the pillars of prevention and intervention. Fire protection is a continuous risk management process which focuses on identifying and reducing risks to federal real property and to the public; minimizing and containing the costs and consequences of harmful or damaging incidents.
Policy **3.2**	All personnel employed at CFB Esquimalt are required to comply with the requirements of this order. All fires must be reported to the Base Fire Department regardless of size or if extinguished. The Fire Department will investigate the circumstances and recommend appropriate action as required. The non-emergency number is 363-1990 or 363-1991.

4. Requirements

Fire protection for CFB Esquimalt and its integral lodger units is

Fire Protection Stations
4.1

provided by the DND (Civilian) Base Fire Department with a central fire station at Naden 141, district fire stations at CFMETR and the Canadian Forces Ammunition Depot, Rocky Point.

Building Fire Safety Plans
4.2

Occupied buildings are required to have posted Fire Safety Plans (FSP) and Fire Emergency Evacuation Plans (FEEP) in accordance with the Canadian Occupational Health and Safety Regulations.

Fire Reporting
4.3

For any emergency call 911. Using an office/building phone (pre-fix 363), will come directly to CFB Esquimalt Fire Dispatch Centre. Cell phones will be connected to Victoria Dispatch Centre. Explain to Dispatch Centre you are at CFB Esquimalt and you will be transferred to the CFB Esquimalt Fire Dispatch Centre. If possible, meet the Fire Department on arrival.

Fire Precautions in Buildings – Building Custodian and Fire Warden
4.4

Building custodians are responsible for safeguarding each building and fixed installations from fire. They are responsible for appointing the fire emergency organization for their building and monthly fire warden reports (CF-1416), which are to be completed and provided to the fire prevention division. Those duties can be delegated to fire wardens.

Evacuation Procedures

4.5.

Upon Discovery of a Fire:

- Leave fire area immediately (only attempt to fight the fire with an extinguisher, if safe to do so)
- Close (do not lock) doors behind you. Close windows if possible
- Sound the fire alarm via manual station (if applicable) or "Fire-Fire-Fire!"
- Call the fire department – 911
- Leave building via nearest and safest exit towards the assembly area
- Do **not** use elevators!
- Upon Hearing Fire Alarm
- Leave building via nearest and safest exit towards the assembly area
- Close (do not lock) doors behind you. Close windows if possible
- Remain calm

Electrical Equipment and Appliances
4.6

All electrical equipment and appliances shall be listed by an organization recognized by the Standards Council of Canada.

Electrical installations or modifications to existing installations shall not be carried out by personnel other than authorized electricians.

Privately owned electrical appliances shall not be installed in DND Buildings. Real Property Operations electricians or fire protection personnel on inspection duties shall order unsafe electrical appliances removed.

The use of extension (flexible) cords shall not be used as a substitute for the fixed wiring of structures, permanently secured to any structural member, run through holes in walls, ceilings, floors,

doorways, windows or similar openings. Extension cords are to be unplugged at the end of each work day.

Personal portable electrical heaters are only permitted on an interim basis. While in use, they shall not be placed under furnishings or in a location where clothing, paper, or other combustible material may come in contact with them. They must be listed by an approved company from the Standards Council of Canada, have an automatic shut-off switch in the event of an accidental tip-over and unplugged at the end of each work day.

Permanent Decorations

4.7

Draperies, curtains and similar furnishings used in buildings shall meet the requirements for flame resistance as specified in the National Fire Code of Canada (NFCC). Furnishings, decorations and other objects shall not be placed so as to obstruct, conceal or obscure exits, access to or egress there from. Flame-proofing treatment of decorations shall follow the guidelines of the NFCC.

Temporary Decorations
4.8

Decorations which are readily combustible shall not be used on DND Property unless suitably flame proofed.

Decorations shall not be placed on electric fixtures or within 3 feet (1 meter) of electric lamps or heating appliances.

Decorations shall not impede any egress or access.

Decorations shall not obstruct any fire protection systems or their components.

Only artificial trees are to be used in any DND facility.

Hot Work

4.9

Whenever possible, hot work operations shall be carried out in a designated area such as a machine shop or similar safe location.

Ensure the hot work permit procedure for your building, ship or work space is followed. If unsure what your procedure is, give the Chief Fire Prevention Officer a call at 250-363-1911.

Portable Fire Extinguishers
4.10

Portable Fire Extinguishers shall be installed in buildings in accordance with CFS-12 D12-102 Scales of Issue, and NFPA Standard No. 10.

Extinguishers shall be conspicuously located and distributed so as to be readily accessible. They shall be hung on hangers or set on brackets or shelves so that the top of the extinguisher is not more than five feet above the floor. Extinguishers may also be placed in special cabinets. Extinguishers are not to be moved or relocated without authorization of the CFB Esquimalt Base Fire Prevention Division. Tampering with firefighting equipment and fire protection systems is a chargeable offence under the Criminal Code section 430 (mischief).

The Building Custodian, Fire Warden or vehicle operator shall inspect all portable extinguishers under their control at intervals not exceeding one month to ensure that the extinguishers:

- are unobstructed and accessible
- are in clean and serviceable condition
- have not been subject to physical damage

Défense nationale | National Defence

CFB ESQUIMALT

Safety & Environment for Contractors

Produced: February 2015

Canada

EMERGENCY SERVICES - 911

Formation Level Contacts	
Base Construction Engineering Help Desk	250-363-2009
Base Logistics Hazardous Material Facility	250-363-2654
Harbour Control Office	250-363-2160
Queen's Harbour Master (duty cell)	250-889-0444
Formation Safety Officer Ionizing Radiation Safety Laser System Safety Radio Frequency Safety (RadHaz)	250-363-7500 250-363-7500 250-363-7500 250-363-7500
Formation Environment Officer	250-363-5063
Military Police Dispatch (non-emergency)	250-363-4032
External Contacts	
WorkSafe BC	1-888-WORKERS 1-888-967-5377
Provincial Emergency Program	1-800-663-3456

EMERGENCY SERVICES - 911

“Notwithstanding that contractual work is conducted on DND land, the work of private contractors and their employees is normally subject to the laws of the Province or Territory in which the work is being conducted. However, this does not relieve the Department of all responsibility and special provisions must be incorporated to safeguard our employees and protect DND’s and the CAF’s legal liability”.
DND General Safety Program Vol 1, Chap 2.

This infoflip® is designed to assist contractors and their employees in meeting their Safety and Environmental responsibilities as well as providing some guidance when working on DND property. It also contains information on when, how and who to contact for questions or guidance. It covers many facets of working with DND and can be used as a guide for commencement of work and a tool to contact the appropriate personnel for questions and advice.

General Safety Program

The Department of National Defence (DND) has a General Safety Program in place to ensure the safety and well-being of its employees and members. While a contractor is not considered an employee of DND, there are many aspects of the General Safety Program that will apply to non-employees, including contractors.

The General Safety program aims to:

- ❒ Minimize personal suffering and financial losses;
- ❒ Add to the efficiency of DND and the operational effectiveness of the Canadian Armed Forces (CAF); and
- ❒ Meet legislative requirements; and contributes to the morale and well-being of all DND employees and CAF members.

Formation/Ship Safety and Environment Management Systems

The Formation and Ship Class Safety and Environment Management Systems provide guidance to DND personnel on implementation of the Maritime Forces Pacific Safety and Environment policy that is specific to the Formation or Ship Class.

The Safety and Environment Management System (SEMS) manual is used to satisfy the requirements of DND, Command and Formation Safety and Environmental policies and directions. It also provides the guidance to ensure employees and workers are compliant with Formation, Base, Provincial and National policy and legislation for the protection and safety of all workers on DND property.

In most cases, contractors should request a full copy of any SEMS directive that relates to the type of work or hazards they may encounter. This infoflip® merely highlights the key points.

Injury Prevention

The goal of any safety program is the prevention of accidents and injuries. This infoflip® contains information on several of the programs covered by the Formation or Ship Safety and Environment Management Systems.

Many of these programs outline the use of specific **Personal Protective Equipment**. It is expected that contractors will comply with applicable legislation as well as DND standards where required.

Accessing DND Property

Most defence establishments have set procedures for accessing DND property. CFB Esquimalt is no exception. The security levels may change from time to time in response to potential threats, or as part of a training activity. Contractor ID cards may be required for access to most DND properties, and potentially building sites within it. Ensure you carry your Contractor ID with you at all times and be prepared to show it. **All personnel accessing DND property are subject to search.**

Parking

Vehicles require an access pass to enter most DND property. Be aware that there is little open parking on the base and you will be subject to ticketing/towing if you park improperly. Look for parking spots designated for contractors.

Secure Zones

Certain areas may be designated as Operations, Security, or High Security Zones and there are additional security requirements in these areas. For example, cell phones are not permitted in these areas and must be powered off, or secured elsewhere. You may also require a visitors pass or escort to access and move around these areas.

All contractor personnel should be aware of security requirements in the areas that they will be working in.

Designated or Controlled Materials

It is possible that your work as a contractor may require you to access documents or materials that are designated or controlled. This means there are additional requirements to protect the security of these documents or materials. For example, documents containing personal information on an individual may have a security designation of Protected A or Protected B. A user manual or set of schematics may be controlled if they are for systems that could affect national security if the details fell into the wrong hands. As well, ship equipment may be controlled and have special disposal requirements.

Be sure you are clear about the designation of documents or materials you have access to, and know whether it's a controlled item or document. Ask for direction on the standards for access, security and disclosure of these items

WorkSafeBC Workplace Inspections

If you or your organization is subject to a Worksafe BC inspection or investigation on CFB Esquimalt property, ensure you contact Formation Safety at 250-363-7500 so appropriate DND coordination is provided.

Although the goal is to eliminate accidents, there is still a chance one could happen, in spite of best efforts. When an accident happens, it's important to report it in a timely manner once the immediate requirement for first aid or emergency responders has been initiated.

First Aid

While contractors are responsible for providing their own first aid services for their workers, if immediate medical attention is required, there are first aid services available in many areas of CFB Esquimalt. It's advisable to enquire about the availability of first aid services in your work area so that you are familiar with its location and how to access it.

If emergency services are required, call **911**. **Note: many areas of the base have limited cell-phone coverage.** Ensure you indicate CFB Esquimalt when talking to the 911 operator. If calling from a DND landline, you will also dial **911**.

Automatic external defibrillator's (AEDs) are placed throughout CFB Esquimalt and in most cases, there is external signage on the buildings where they are located.

WorkSafeBC

All workers in BC are covered under the *Workers Compensation Act* and all accidents resulting in an injury must be reported to WorkSafeBC within three working days.

Refer to **WorkSafeBC.com** for detailed instructions on reporting an injury or death.

Hazardous Occurrence Reporting

In addition to the requirement to report an accident resulting in an injury to WorkSafe BC, accidents that result in a DND employee or military member being injured have additional reporting requirements under the General Safety Program. This also applies to accidents resulting in damage to DND property.

In the event of a severe injury, notify the Formation Safety Officer immediately at 250-363-7500.

While it isn't a contractor's responsibility to initiate the DND Hazardous Occurrence Reporting process, it's possible or likely that witness statements will be required, or the Hazardous Occurrence Investigator may contact you for more information. It is expected that contractors will cooperate to the best of their ability in all investigations.

Report all known or suspected injuries to the appropriate authorities.

Fall Arrest Systems

Canada Occupational Health and Safety Regulations state that fall protection equipment (FPE) must be worn by all workers working 2.4 meters or more above a permanent safe level. The harnesses shall be CSA approved and must be inspected prior to each use.

Ladder Safety

In some instances, portable ladders are the more practical way to carry out the work required. Used correctly, they can be a very handy tool; used incorrectly, they can be a source of injury. The following are some useful points for the correct use of a portable ladder.

1. The base of the ladder should be placed no less than one-quarter and no more than one-third of the length of the ladder from a point directly below the top of the ladder.
2. Where possible, the ladder should be secured in place.
3. A portable ladder that provides access from one level to another shall extend at least three rungs above the higher level.
4. No person shall work from any of the three top rungs of any single or extension portable ladder or from the two top rungs of any portable step ladder.
5. Metal or wire-bound portable ladders shall not be used where there is potential to come into contact with a live electrical circuit or equipment.

Mobile Elevated Work Structures

Caution is to be used when working from a mobile elevated work structure and in particular, when moving or repositioning the structure. There are many overhead obstructions and certain areas, such as dock yard, are very busy and often cluttered as supplies are moved on and off ships. FPE is required for all personnel.

Ship Safety

The same safety standards apply aboard any Royal Canadian Navy (RCN) vessel. If work must be done at height, the appropriate fall arrest system must be used. Ship's personnel can provide detailed guidance and direction specific to their ship.

Warning Signs

If any work at height poses a secondary danger to other personnel, warning signs shall be placed in a conspicuous place, and at a sufficient distance from the job.

All work done in a confined space is considered risky due to the many potential hazards that may be present. Under no circumstances should a contractor enter a confined space unless they have been authorized to do so and have been briefed on procedures.

Contractors are required to follow the requirements of the applicable regulatory body. (Canada Labour Code, Province).

The Entry Supervisor completes their assessment of the space and level of risk. This will include atmospheric testing to determine if a hazardous condition exists. The Entry Supervisor initiates a Confined Space Entry Permit and briefs the Entry Team prior to the commencement of any work.

The contractor's Emergency Response Team (ERT) is notified prior to and after the commencement of work. If the ERT is not available, the work may be postponed. If the ERT becomes unavailable while the confined space work is being done, the work must stop immediately and personnel must exit the confined space.

DND is not mandated to provide rescue teams for confined space entry, but will respond, if available. All confined space entries shall have a hazard assessment completed and a written safe to enter certificate completed by a qualified person.

Confined Space Entry Procedures

1. Ensure all energy sources have been isolated/locked out.
2. Ensure adequate ventilation is provided and the atmosphere tested.
3. Implement your company's confined space procedure.
4. Ensure entrant, rescue team and sentry are qualified.
5. Ensure hazard assessment completed.
6. Ensure entry plan completed.
7. Ensure rescue plan completed.
8. Ensure personnel are briefed on hazards and work to be conducted.
9. Ensure entry log is in place and used.
10. Ensure safe to enter certificate is completed and posted by qualified person.
11. Ensure rescue team and equipment are in place.

Report all known or suspected injuries to the appropriate authorities. Accident Reporting (3)

Radio Frequency (RF) radiation, also known as non-ionizing radiation, can pose a health hazard to personnel who are exposed to levels higher than Health Canada recommendations. These levels are individually known as the **Maximum Exposure Limit (MEL).**

Through measurement, the distances (MEL distances) one must remain away from any given radiating emitter have been determined. These distances are held by the ship or unit owning these RF emitters.

Contractor personnel will be briefed on the applicable MEL distances and emitter control procedures prior to accessing a site with RF emitters in it. This briefing will be given by the Officer of the Day on ships.

Buildings with RF emitters will have a DND/CAF employee appointed to grant access to the roof and this person will provide the briefing on RF hazards resident there.

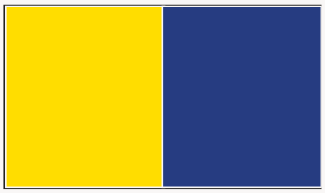
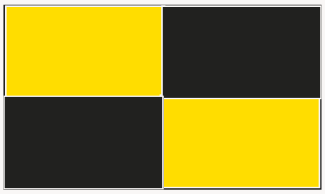
Sources of Radio Frequency (RF) Radiation

The more obvious source of RF radiation is from ship board equipment such as radar and communication antennas.

There are also RF emitters located on various buildings. These include D250, D199, D211, D100, D218, N92A, and N50. Proper roof access procedures, obtained from the contracting authority, must be described to personnel prior to commencing work on any roof.

Indicators for Radio Frequency (RF) Radiation Hazard

Ships will use a series of coloured flags to indicate the status of their RF transmitting capabilities.

FLAG ECHO Indicates that the vessel is rotating an antenna without radiating RF Energy.	
FLAG KILO Indicates that a person is working aloft and/or over the side.	
FLAG LIMA Indicates that the vessel is radiating RF Energy.	

Hazards of Electromagnetic Radiation

1. **Hazards of Electromagnetic Radiation to Fuel (HERF):** There is potential for **RF radiation** to cause spark ignition of volatile combustibles such as gasoline, fuels or solvents.
2. **Hazards of Electromagnetic Radiation to Ordnance (HERO): RF radiation** may cause ordnance or ammunition to inadvertently fire without notice or indication.
3. **Hazards of Electromagnetic Radiation to Personnel (HERP): RF radiation** can heat and burn body tissue and may occur through exposure to a nearby source, or through direct contact with an antenna wire, cable or metal railings that may be reradiating fields.

Suspected or Confirmed Exposure

Any personnel who suspect that they are being over exposed to radio frequency radiation should immediately move away from the source of radiation. **Any personnel who suspect or confirm they have been exposed to radio frequency radiation should seek immediate medical attention.** Medical personnel are to be advised that there may have been an RF over exposure.

Report all known or suspected injuries to the appropriate authorities. Accident Reporting (3)

Hot Work is defined as "any activity which has the potential of generating a source of ignition." This includes welding, burning, grinding, or the use of any spark-producing equipment.

Before any Hot Work can be carried out, a Hot Work Certificate must be issued. Contact the Base Fire Hall **250-363-1906** to receive a permit and a copy of **Fire Orders and Regulations for Contractors.**

Prior to the Hot Work Certificate being issued, a hazard assessment must occur, including the following:

- ❒ Remove all combustible or flammable materials
- ❒ Ensure fire cloth, smoke curtains and ventilation are in place
- ❒ Ensure all areas where a spark could land are protected
- ❒ If applicable, ensure the compartment(s) has been certified gas free
- ❒ Ensure electrical cables liable to be damaged have been covered with protective material

Once the Hot Work is to begin, the Fire Sentry(s) are to be briefed and will ensure the appropriate fire extinguisher(s) are on site.

Note: Gas free testing along with a new Hot Work Certificate must be conducted every 24 hours.

Completion of Hot Work

Once the Hot Work has been completed, the Fire Sentry(s) are required to stay on site for a minimum of 30 minutes. After inspecting the area, the Fire Sentry(s) will report to the customer or Fire Hall that the operation is complete.

Prohibited Hot Work

- ❒ In compartments containing unsealed flammable material
- ❒ On pipes containing any trace of fuel or lube oil
- ❒ Within two (2) meters of a magazine or fittings that enter the magazine
- ❒ On pipes containing any trace of sewage inside

In the event a fire is detected: Shout "FIRE, FIRE, FIRE" and exit the area in an orderly fashion. Notify the Base Fire Hall (911), no matter how small the fire.

Exposure to ionizing radiation can be harmful as it damages the internal structures of living cells. High doses can cause death over a short period of time, or other long term health issues from low doses over longer periods of time.

Sources of Ionizing Radiation

Potential sources of radiation can be specialized monitoring equipment, aircraft gauges, X-rays and even smoke detectors. The international symbol for ionizing radiation is the trefoil. In Canada, X-rays are identified by a different symbol.

Trefoil

X-Ray

Radiological Hazardous Occurrence (RHO) Procedures

- ❒ Hold your breath.
- ❒ **Attempt to breathe only once in fresh air!**
- ❒ Vacate the immediate area.
- ❒ Secure the area if possible.
- ❒ Call the Radiation Safety Officer.
- ❒ Remain nearby until released.

Report all known or suspected injuries to the appropriate authorities. Accident Reporting (3)

Suspected/Confirmed Contamination and/or Exposure

If there has been a suspected or confirmed over exposure, the person **MUST be sent to the hospital.** Ensure medical authorities are advised that the individual may have had a possible ionizing radiation over exposure and if applicable, that the source may be on the person's clothing.

As with any other injury or accident, the details must be reported to WorkSafe BC. It is the contractors responsibility to ensure this happens. **Accident Reporting (3).**

Containment and Clean-up

If DND/CAF personnel are not yet aware of the contamination, ensure they are notified immediately. Units holding radioactive materials will have a Unit Radiation Safety Officer who must be notified of the contamination.

Areas must be evacuated and cordoned off until the clean-up has been completed. Only qualified personnel are permitted to do the clean-up; contractors should not attempt to clean a contaminated area.

Industrial Radiography

Contractors must be licensed by the Canadian Nuclear Safety Commission (CNSC) for Nuclear Gauges (e.g. Troxler Gauges) and Gamma Radiography and they must be able to present these licenses upon demand when on DND/CAF property.

For X-ray Radiography, the contractor must have one person on staff who is a CGSB Level II radiographer (licensed by NRCan).

For Gamma Radiography, there must be one operator who is both CNSC - Certified Exposure Device Operator (CEDO) and NRCan - CGSB Level II certified.

XRF operators must be licensed by NRCan as at least a Level I XRF Operator.

All contractors must have an emergency plan that is accessible to the Base RadSO. Moreover, any contracted services intending to use ionizing radiation must inform the Base RadSO.

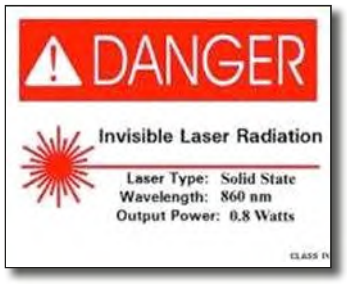
Report all known or suspected injuries to the appropriate authorities. Accident Reporting (3)

Exposure to high power laser light can be hazardous to eyes as well as skin. Lasers range from Class 1 to Class 4. Class 1 are not considered hazardous to skin, or eyes. Class 2 may be hazardous to the eyes but protection is normally afforded by the eye's natural aversion response to bright light. Class 3 lasers may be potentially harmful if under direct and specular viewing conditions. Class 4 lasers are capable of causing serious injury to both eye and skin, and could cause combustion of flammable materials.

Ships such as the Halifax Class contain a Class 4 laser system. Where a ship or unit has Class 3B or 4 laser systems, they will have a Unit Laser System Safety Officer (ULSSO) appointed who will ensure personnel are trained and briefed and that all laser safety policies, standards and procedures are adhered to. Contractor personnel should ensure they are familiar with these policies and procedures prior to commencement of work.

Area Control Where Laser Hazard Exists

Any area where a laser will be operated shall be well defined. In most situations, a laser warning sign such as the one shown here should be in place. All personnel must follow posted instructions and use appropriate Personal Protective Equipment (PPE) as required.



Optical Viewing Devices

Optical viewing devices such as binoculars, big eyes or telescopes shall not be carried or used in any controlled area without prior approval of the ULSSO. If laser operations are to be viewed with such devices, appropriate attenuating filters must be used in the optical viewing device.

Suspected or Confirmed Over Exposure

If there has been a suspected or confirmed over exposure involving laser radiation, the person **MUST be examined by a physician**. Ensure the medical authorities treating the person have been advised that there may have been a laser over exposure.

Report all known or suspected injuries to the appropriate authorities. Accident Reporting (3)

Spill Response and Reporting

All contractors who will have their own vehicles on DND property and/or will be using hazardous materials, must have response equipment, such as a spill kit, and personnel trained in their location and use. In the event of a spill, the contractor is responsible for immediately implementing spill response procedures. If a spill cannot be easily contained or cleaned up, the contractor must call the Base Fire Hall at **911**. Contractors must also report all spills to their contract authorities and the Formation Environment Officer at 250-363-5063, as soon as possible

Contractors are responsible for the cost of cleaning up a spill they generated.

Sick, Injured or Abandoned Wildlife

Do not touch or disturb wildlife on DND properties, including wildlife that appear dead or injured. If you encounter:

- ❒ dangerous animals, such as a bear or a cougar, report it to the Military Police at 250-363-4032 immediately; and
- ❒ sick, injured, abandoned or dead wildlife, report it to the Base CE Help Desk at 250-363-2009.

Waste Disposal

Contractors are responsible for removing and appropriately treating/ disposing of all wastes in accordance with contract documentation. This includes all liquid wastes generated during project activities. Disposal of any waste in DND waste bins is prohibited. Disposal of untreated liquid wastes to the environment and/or storm/ sanitary sewers is prohibited.

Archaeological Features

Contractor personnel should be aware of the mitigation measures prior to commencement of work and ensure they are being implemented throughout the duration of the project. Prior to commencing any land alteration activities, contractor personnel should receive an archaeological briefing which their contract authority will coordinate.

Contractors working on systems requiring lockout or tagout procedures will be expected to follow the existing policy as outlined in **Formation Safety and Environment Systems (FSEMS) Directive S14** The lockout / tagout procedures will be used in conjunction with other work safety standards (**Confined Space Entry (5), Burning and Welding (8)**) but not in lieu of their safety standards.

Approved Padlocks or Lockout Devices

Locks shall be sequentially numbered and will be identified as belonging to the contractor. The customer will have locks meeting the same standard and identified as belonging to them. The contractor must coordinate LOTO requirements with the applicable unit owning the equipment and keep a register of locks issued, including the date, person's name, contractor name, system worked on and the location of the lock or device.

Only one key shall be issued with a padlock and in the event of a lost key, the lock must be destroyed once it has been removed in accordance with procedures. Replacement keys will not be produced.

Zero Energy Checks must be completed before starting work to ensure the lockout is effective.

Removal of Locks

Normally the person who applied a lock is the only one who can remove it. In exceptional circumstances, the MSE and CSE Department Heads (or their delegates) may authorize the removal of the lock under the following circumstances:

- ❒ The machinery / equipment / system shall be verified safe to operate
- ❒ The owner identified on the tag shall be contacted for permission to remove his/her lock
- ❒ Details shall be entered in the Lockout Register

In the case of critical systems onboard the submarines, the owner of a lock will leave the key for his/her lock with the LOTO Coordinator if they leave the sub (ie, leave after working hours), and will draw the key prior to commencing work the following shift.

Contractor Responsibilities

"The unit Contract Officer/Coordinator is to ensure the contractor is aware of the Lockout/Tagout procedures detailed in this Directive. Contractors shall report immediately to the relevant department to be provided a Point of Contact and to be briefed on the procedure to be followed while working onboard."
FSEMS Directive SD14

Due to the risk of a significant emergency occurring such as an earthquake or tsunami, the base has stood up a **Mass Notification System** to give warning to all personnel. In the event that the Tsunami Warning System has detected a tsunami threat, an audible warning system will sound throughout the base. Immediately head for higher ground. Look for signs to indicate tsunami evacuation routes:

There is more than one tsunami evacuation site; be sure you are familiar with the one closest, and most accessible to your location. It's important to remember that personnel are expected to travel to the evacuation sites by foot except in cases when an individual is physically unable to walk. Roads will become congested very quickly otherwise.

Tsunami Hazard Zones

Areas most at risk for a tsunami are indicated by warning signs. These signs are marking what is referred to as the inundation zones, or the areas of lower elevation most likely to be affected by a tsunami.

Mass Notification System

The **Mass Notification System** is also intended to deliver an audible signal to indicate other emergency situations such as an active aggressor. The Mass Notification System will be tested on the first Wednesday of each month for approximately 1 minute commencing at 11:00 am.

Threat of Violence or Terrorism

In the event there is a threat of violence requiring lock-down procedures:

- ❒ Escape or hide out; call **911**.
- ❒ Secure self and location; lock doors, windows.
- ❒ Mitigate vulnerabilities; close blinds, turn off lights.
- ❒ Stay put; wait for authorities to release you.
- ❒ Take action as a last resort.

Situations that may trigger a requirement to call Emergency Services can include medical, fire or even a threat of violence. CFB Esquimalt Emergency Services works with municipal Emergency Services to support all locations occupied by DND. In the event of an emergency, call **911. If calling from a cell phone, inform the dispatcher that you are calling from Canadian Forces Base (CFB) Esquimalt.** Provincial Dispatchers will notify and dispatch the appropriate Emergency Services in your area. Emergency procedures must be discussed with the contracting authority prior to commencing work and be included in the contractor's safety plan.

Major Disasters

There are protocols in place to deal with large scale emergencies such as earthquakes. It's important in such a situation to follow the directions of DND/CAF personnel on muster points and protocols to follow. A full accounting of all personnel is to be completed after buildings have been evacuated, and this includes registering non-DND personnel such as contractors and cleaners.

In the absence of clear instructions, look for the closest E-Box and proceed there. The E-Boxes are placed throughout DND property and can easily be identified by their **orange colour and letter E on the side.**

NOTE: Do not depart your location until you have registered with one of the base's E-Boxes. If you fail to do so, valuable time may be spent searching for you.

Building Evacuations

All personnel, including contractors, should be familiar with the evacuation procedures for the site they are working in. Diagrams will be found in all buildings showing exits and locations of emergency equipment such as fire extinguishers and first aid kits. Take the time to review the diagrams and ask questions if you're unsure of local procedures.

Workplace violence constitutes any action, conduct, threat or gesture of a person towards an employee in their workplace that can reasonably be expected to cause harm, injury or illness to that employee. It includes, but is not limited to, the following:

Threatening behaviour - such as shaking fists, destroying property or throwing objects.

Verbal or written threats - any expression of an intent to inflict harm, including:

- **Direct threats** - clear and explicit communication which distinctly indicates that the potential offender intends to do harm, for example: "I am going to make you pay for what you did to me".
- **Conditional threats** - involves a condition, for example: "If you don't get off my back, you'll regret it".
- **Veiled threats** - usually involves body language or behaviours that leave little doubt in the mind of the victim that the perpetrator intends harm, for example: "Do you think anyone would care if someone beats up the boss?"

Harassment - any behaviour that demeans, embarrasses, humiliates, annoys, alarms, or verbally abuses a person and that is known to be, or would be expected to be unwelcome. This includes words, gestures, intimidation, bullying, or other inappropriate behaviours.

Verbal abuse - including swearing, insults, or condescending language.

Physical attacks - including hitting, shoving, pushing or kicking the victim, or inciting a dog to attack.

National Defence Policy

"The Canadian Forces and the Department of National Defence have a zero tolerance for all forms of work place violence."

"Incidents of work place violence, should they occur, will be responded to promptly by responsible and competent authorities to ensure that the work place remains a respectful and safe environment for everyone."

National Defence Occupational Health and Safety - Prevention of Violence in the Work Place Policy Statement.

Report all known or suspected injuries to the appropriate authorities. Accident Reporting (3)

This publication was produced for Contractors and their employees as a guide to Department of National Defence and CFB Esquimalt Safety and Environment programs. While every effort has been made to provide current and relevant information, Contractors must remain vigilant about ensuring they are fully informed of current legislation as it pertains to worker safety; occupational health and safety; and environmental controls.

This infoflip® is intended to be a quick reference and in many cases, Contractors will require access to the full directives or procedures to ensure they are compliant.

Produced under the authority of Formation Safety and Environment, CFB Esquimalt.

Recommendations for changes or improvements can be directed to:

Formation Safety and Environment
CFB Esquimalt
PO Box 17000 Stn Forces
+ESQ FSE Safety@FSE@Esquimalt (internal email)
250-363-7500

CFB Esquimalt Fire Rescue
Fire Prevention Division

Project: _____ **Location: CFB Esquimalt** _____

Fire Orders and Regulations for Contractors

All personnel are to be thoroughly familiar with the contents of this order and in addition are to be conversant with relevant regulations pertaining to:

Fire Safety Plans

- Prior to commencement of construction or demolition, the Contractor shall prepare for the site a Fire Safety Plan conforming to the *National Fire Code of Canada Section 2.8 Emergency Planning*.

- Prior to commencement of construction or demolition, the Contractor and their personnel shall be familiar with the *National Building Code of Canada Section 8.2 Protection of the Public and Fire Safety* or *British Columbia Building Codes section* 8.2.

Reporting Fires

- Report immediately all fire incidents to the Fire Department as follows:
  - Activate nearest fire alarm and
  - Telephone 911
  - Telephone the Fire Department 363-1990/1991

- When reporting a fire by telephone, give location of fire, name or number of building and be prepared to verify the location.
  - When reporting by cellular phone, inform the operator your location as CFB Esquimalt**,** (Bldg #) Colwood, Wilfert Road. You may initially receive a 911 operator from another jurisdiction depending on your cellular phone.

Fire Precautions

- Fire safety will be maintained in accordance with Canadian Forces Base (CFB) Esquimalt Fire Orders.

- Fire watchers provided with sufficient fire equipment (Company Owned) to control or extinguish fire shall be provided:
  - Whenever work is being carried out in dangerous or hazardous areas involving the use of heat.
  - For the duration of cutting, welding, and roofing operations and for a period of 1 HR thereafter…2 HR for roofing. Before leaving, he/she shall inspect the site to ensure that all is in order.

- On a scale established in conjunction with the engineer prior to commencing work.

- Hot works permits are required from the Fire Prevention Division, **363-1911 or 250-213-8250** in all cases involving welding, cutting, grinding, roofing or the use of blowtorches, salamanders, etc. Regulations in the Hot Works permit will be strictly adhered to.

- The contractor shall supply fire extinguishers, as scaled by the Chief Fire Inspector, necessary to protect the work in progress and the contractor's physical plant on site.

Interior and Exterior Fire Protection Systems and Alarm Systems

- Fire hydrants, sprinklers systems, and fire protection and alarm systems will not be:
  - Obstructed;
  - Tampered with, shut-off; or
  - Left inactive at the end of a working day or shift without authorization from the Chief Fire Inspector.
  - The Chief Fire Inspector must be notified before disconnecting the power to buildings with fire alarm systems.

- Fire hydrants, standpipes and hose systems will not be used for other than firefighting purposes unless authorized by the Chief Fire Inspector **363-1911**.

Blocking of Roadways or Access/Egress

- Blocking of Roadways: in all area the Chief Fire Inspector is to be advised prior to the erection of barricades or the digging of trenches which might impede fire apparatus. The Contractor shall provide an emergency access road as required and as directed by the Chief Fire Inspector.

- Blocking of Access/Egress: The Chief Fire Inspector shall be advised of any work that would restrict access/egress or block a door to an area of the building. The Contractor shall provide an emergency access route as directed by the Chief Fire Inspector.

Flammable Liquids

- Flammable liquids such as gasoline, kerosene, naphtha, etc., may be kept for ready use in quantities not exceeding 45 litres provided they are stored in approved safety cans bearing the Underwriters Laboratory or Factory Mutual Seal of Approval.

- Transfer of flammable liquids is prohibited within buildings. In all cases where the transfer of such liquids is necessary, care is to be taken to provide adequate bonding between containers and ground.

- The transfer of flammable liquids shall not be carried out in the vicinity of open flame or any type of heat producing devices.

- Storage of quantities of flammable liquids exceeding 45 litres for work purposes requires the permission of the Chief Fire Inspector. Flammable liquids having a flash point below 38°C (100°F) such as gasoline or naphtha, etc., shall not be used in solvents or cleaning agents.

- Disposal of flammable liquids shall be in a safe approved manner.

Smoking Precautions

- Although smoking is not permitted in hazardous areas, care must still be exercised in the use of smoking materials in non-restricted areas. Smoking is not permitted in Department of National Defence buildings.

Storage and Removal of Rubbish and Waste Materials

- Accumulations of rubbish and waste materials are to be kept to a minimum, and removed from buildings at the end of the workday or shift.

- Flammable waste materials shall not be stored in the work area without the consent of the Chief Fire Inspector.

- The burning of rubbish is prohibited

Quality Control
Automatic Fire Protection and Detection Systems (AFP and DS)

- The Chief Fire Inspector, Fire Prevention Division, CFB Esquimalt Fire Rescue, shall be informed in advance of acceptance inspections or tests of new AFP and DS.

- A copy of the applicable manufacturer's operating maintenance, parts list manual, one set of keys for new alarm panels in addition to any other manuals, and keys called for in this specification, shall be provided to the Chief Fire Inspector at the time of acceptance.

- The Contractor shall arrange a briefing from a manufacturer's representative for the Chief Fire Inspector prior to or at the time of acceptance of new AFP and DS.

- When existing AFP and DS are modified, required repair, or are being expanded, the Chief Fire Inspector shall be notified prior to commencement of work and kept informed of progress. On completion, the Chief Fire Inspector shall be informed to enable Fire Department staff to test the system.

I acknowledge I am aware of these regulations requiring compliance with CFB Esquimalt Fire Safety Orders and Directives in connection with the work to be performed.

Inspector: _____ Date: _____

Contractor: Date:
Phone # _____ _____

BSO 7665-0
Base Fire Safety Policy

1. Identification

Date of Issue	27-04-2018
Date of Modification	27-04-2018
Application	This order and directive applies to those members of the Canadian Armed Forces (CAF) and employees of the Department of National Defence (DND), NPF employees, contractors and all individuals that reside in Canadian Forces Base Esquimalt. This is inclusive of Lodger units and all properties for which the Base Commander is responsible.
Supersession	This Base Standing Order (BSO) supersedes BSO 2-314 through 322 inclusive.
Approval Authority	This BSO is issued pursuant to the authority of the Commanding Officer Canadian Forces Base Esquimalt.
Enquiries	Commanding Officer Port Operations and Emergency Services

2. Definitions

Building Custodian	The person in charge (CF or DND) of real property for the department. The Commanding Officer or the senior officer responsible for the building.
Emergency Operations	Activities of fire protection services which relate to, but are not limited to: infrastructure, aircraft, shipboard, wild land, rescue, hazardous materials, CBRN and emergency medical response.
Fire Prevention	Fire Protection Services and enforcement dealing with preventing the outbreak of fire through identification and recommendations to eliminate fire hazards through activities such as inspection, code enforcement, education, training, and investigation programs.
Fire Warden	The official tasked with ensuring that workplace fire hazards are identified, reported and corrected.

3. Direction/Policy

Context **3.1**	The Fire Protection Program (FPP) rests on the pillars of prevention and intervention. Fire protection is a continuous risk management process which focuses on identifying and reducing risks to federal real property and to the public; minimizing and containing the costs and consequences of harmful or damaging incidents.
Policy **3.2**	All personnel employed at CFB Esquimalt are required to comply with the requirements of this order. All fires must be reported to the Base Fire Department regardless of size or if extinguished. The Fire Department will investigate the circumstances and recommend appropriate action as required. The non-emergency number is 363-1990 or 363-1991.

4. Requirements

Fire protection for CFB Esquimalt and its integral lodger units is

Fire Protection Stations
4.1

provided by the DND (Civilian) Base Fire Department with a central fire station at Naden 141, district fire stations at CFMETR and the Canadian Forces Ammunition Depot, Rocky Point.

Building Fire Safety Plans
4.2

Occupied buildings are required to have posted Fire Safety Plans (FSP) and Fire Emergency Evacuation Plans (FEEP) in accordance with the Canadian Occupational Health and Safety Regulations.

Fire Reporting
4.3

For any emergency call 911. Using an office/building phone (pre-fix 363), will come directly to CFB Esquimalt Fire Dispatch Centre. Cell phones will be connected to Victoria Dispatch Centre. Explain to Dispatch Centre you are at CFB Esquimalt and you will be transferred to the CFB Esquimalt Fire Dispatch Centre. If possible, meet the Fire Department on arrival.

Fire Precautions in Buildings – Building Custodian and Fire Warden
4.4

Building custodians are responsible for safeguarding each building and fixed installations from fire. They are responsible for appointing the fire emergency organization for their building and monthly fire warden reports (CF-1416), which are to be completed and provided to the fire prevention division. Those duties can be delegated to fire wardens.

Evacuation Procedures

4.5.

Upon Discovery of a Fire:

- Leave fire area immediately (only attempt to fight the fire with an extinguisher, if safe to do so)
- Close (do not lock) doors behind you. Close windows if possible
- Sound the fire alarm via manual station (if applicable) or "Fire-Fire-Fire!"
- Call the fire department – 911
- Leave building via nearest and safest exit towards the assembly area
- Do **not** use elevators!
- Upon Hearing Fire Alarm
- Leave building via nearest and safest exit towards the assembly area
- Close (do not lock) doors behind you. Close windows if possible
- Remain calm

Electrical Equipment and Appliances
4.6

All electrical equipment and appliances shall be listed by an organization recognized by the Standards Council of Canada.

Electrical installations or modifications to existing installations shall not be carried out by personnel other than authorized electricians.

Privately owned electrical appliances shall not be installed in DND Buildings. Real Property Operations electricians or fire protection personnel on inspection duties shall order unsafe electrical appliances removed.

The use of extension (flexible) cords shall not be used as a substitute for the fixed wiring of structures, permanently secured to any structural member, run through holes in walls, ceilings, floors,

doorways, windows or similar openings. Extension cords are to be unplugged at the end of each work day.

Personal portable electrical heaters are only permitted on an interim basis. While in use, they shall not be placed under furnishings or in a location where clothing, paper, or other combustible material may come in contact with them. They must be listed by an approved company from the Standards Council of Canada, have an automatic shut-off switch in the event of an accidental tip-over and unplugged at the end of each work day.

Permanent Decorations

4.7

Draperies, curtains and similar furnishings used in buildings shall meet the requirements for flame resistance as specified in the National Fire Code of Canada (NFCC). Furnishings, decorations and other objects shall not be placed so as to obstruct, conceal or obscure exits, access to or egress there from. Flame-proofing treatment of decorations shall follow the guidelines of the NFCC.

Temporary Decorations
4.8

Decorations which are readily combustible shall not be used on DND Property unless suitably flame proofed.

Decorations shall not be placed on electric fixtures or within 3 feet (1 meter) of electric lamps or heating appliances.

Decorations shall not impede any egress or access.

Decorations shall not obstruct any fire protection systems or their components.

Only artificial trees are to be used in any DND facility.

Hot Work

4.9

Whenever possible, hot work operations shall be carried out in a designated area such as a machine shop or similar safe location.

Ensure the hot work permit procedure for your building, ship or work space is followed. If unsure what your procedure is, give the Chief Fire Prevention Officer a call at 250-363-1911.

Portable Fire Extinguishers
4.10

Portable Fire Extinguishers shall be installed in buildings in accordance with CFS-12 D12-102 Scales of Issue, and NFPA Standard No. 10.

Extinguishers shall be conspicuously located and distributed so as to be readily accessible. They shall be hung on hangers or set on brackets or shelves so that the top of the extinguisher is not more than five feet above the floor. Extinguishers may also be placed in special cabinets. Extinguishers are not to be moved or relocated without authorization of the CFB Esquimalt Base Fire Prevention Division. Tampering with firefighting equipment and fire protection systems is a chargeable offence under the Criminal Code section 430 (mischief).

The Building Custodian, Fire Warden or vehicle operator shall inspect all portable extinguishers under their control at intervals not exceeding one month to ensure that the extinguishers:

- are unobstructed and accessible
- are in clean and serviceable condition
- have not been subject to physical damage

Défense nationale | National Defence

CFB ESQUIMALT

Safety & Environment for Contractors

Produced: February 2015

Canada

EMERGENCY SERVICES - 911

Formation Level Contacts	
Base Construction Engineering Help Desk	250-363-2009
Base Logistics Hazardous Material Facility	250-363-2654
Harbour Control Office	250-363-2160
Queen's Harbour Master (duty cell)	250-889-0444
Formation Safety Officer Ionizing Radiation Safety Laser System Safety Radio Frequency Safety (RadHaz)	250-363-7500 250-363-7500 250-363-7500 250-363-7500
Formation Environment Officer	250-363-5063
Military Police Dispatch (non-emergency)	250-363-4032
External Contacts	
WorkSafe BC	1-888-WORKERS 1-888-967-5377
Provincial Emergency Program	1-800-663-3456

EMERGENCY SERVICES - 911

“Notwithstanding that contractual work is conducted on DND land, the work of private contractors and their employees is normally subject to the laws of the Province or Territory in which the work is being conducted. However, this does not relieve the Department of all responsibility and special provisions must be incorporated to safeguard our employees and protect DND’s and the CAF’s legal liability”.
DND General Safety Program Vol 1, Chap 2.

This infoflip® is designed to assist contractors and their employees in meeting their Safety and Environmental responsibilities as well as providing some guidance when working on DND property. It also contains information on when, how and who to contact for questions or guidance. It covers many facets of working with DND and can be used as a guide for commencement of work and a tool to contact the appropriate personnel for questions and advice.

General Safety Program

The Department of National Defence (DND) has a General Safety Program in place to ensure the safety and well-being of its employees and members. While a contractor is not considered an employee of DND, there are many aspects of the General Safety Program that will apply to non-employees, including contractors.

The General Safety program aims to:

- ❒ Minimize personal suffering and financial losses;
- ❒ Add to the efficiency of DND and the operational effectiveness of the Canadian Armed Forces (CAF); and
- ❒ Meet legislative requirements; and contributes to the morale and well-being of all DND employees and CAF members.

Formation/Ship Safety and Environment Management Systems

The Formation and Ship Class Safety and Environment Management Systems provide guidance to DND personnel on implementation of the Maritime Forces Pacific Safety and Environment policy that is specific to the Formation or Ship Class.

The Safety and Environment Management System (SEMS) manual is used to satisfy the requirements of DND, Command and Formation Safety and Environmental policies and directions. It also provides the guidance to ensure employees and workers are compliant with Formation, Base, Provincial and National policy and legislation for the protection and safety of all workers on DND property.

In most cases, contractors should request a full copy of any SEMS directive that relates to the type of work or hazards they may encounter. This infoflip® merely highlights the key points.

Injury Prevention

The goal of any safety program is the prevention of accidents and injuries. This infoflip® contains information on several of the programs covered by the Formation or Ship Safety and Environment Management Systems.

Many of these programs outline the use of specific **Personal Protective Equipment**. It is expected that contractors will comply with applicable legislation as well as DND standards where required.

Accessing DND Property

Most defence establishments have set procedures for accessing DND property. CFB Esquimalt is no exception. The security levels may change from time to time in response to potential threats, or as part of a training activity. Contractor ID cards may be required for access to most DND properties, and potentially building sites within it. Ensure you carry your Contractor ID with you at all times and be prepared to show it. **All personnel accessing DND property are subject to search.**

Parking

Vehicles require an access pass to enter most DND property. Be aware that there is little open parking on the base and you will be subject to ticketing/towing if you park improperly. Look for parking spots designated for contractors.

Secure Zones

Certain areas may be designated as Operations, Security, or High Security Zones and there are additional security requirements in these areas. For example, cell phones are not permitted in these areas and must be powered off, or secured elsewhere. You may also require a visitors pass or escort to access and move around these areas.

All contractor personnel should be aware of security requirements in the areas that they will be working in.

Designated or Controlled Materials

It is possible that your work as a contractor may require you to access documents or materials that are designated or controlled. This means there are additional requirements to protect the security of these documents or materials. For example, documents containing personal information on an individual may have a security designation of Protected A or Protected B. A user manual or set of schematics may be controlled if they are for systems that could affect national security if the details fell into the wrong hands. As well, ship equipment may be controlled and have special disposal requirements.

Be sure you are clear about the designation of documents or materials you have access to, and know whether it's a controlled item or document. Ask for direction on the standards for access, security and disclosure of these items

WorkSafeBC Workplace Inspections

If you or your organization is subject to a Worksafe BC inspection or investigation on CFB Esquimalt property, ensure you contact Formation Safety at 250-363-7500 so appropriate DND coordination is provided.

Although the goal is to eliminate accidents, there is still a chance one could happen, in spite of best efforts. When an accident happens, it's important to report it in a timely manner once the immediate requirement for first aid or emergency responders has been initiated.

First Aid

While contractors are responsible for providing their own first aid services for their workers, if immediate medical attention is required, there are first aid services available in many areas of CFB Esquimalt. It's advisable to enquire about the availability of first aid services in your work area so that you are familiar with its location and how to access it.

If emergency services are required, call **911**. **Note: many areas of the base have limited cell-phone coverage.** Ensure you indicate CFB Esquimalt when talking to the 911 operator. If calling from a DND landline, you will also dial **911**.

Automatic external defibrillator's (AEDs) are placed throughout CFB Esquimalt and in most cases, there is external signage on the buildings where they are located.

WorkSafeBC

All workers in BC are covered under the *Workers Compensation Act* and all accidents resulting in an injury must be reported to WorkSafeBC within three working days.

Refer to **WorkSafeBC.com** for detailed instructions on reporting an injury or death.

Hazardous Occurrence Reporting

In addition to the requirement to report an accident resulting in an injury to WorkSafe BC, accidents that result in a DND employee or military member being injured have additional reporting requirements under the General Safety Program. This also applies to accidents resulting in damage to DND property.

In the event of a severe injury, notify the Formation Safety Officer immediately at 250-363-7500.

While it isn't a contractor's responsibility to initiate the DND Hazardous Occurrence Reporting process, it's possible or likely that witness statements will be required, or the Hazardous Occurrence Investigator may contact you for more information. It is expected that contractors will cooperate to the best of their ability in all investigations.

Report all known or suspected injuries to the appropriate authorities.

Fall Arrest Systems

Canada Occupational Health and Safety Regulations state that fall protection equipment (FPE) must be worn by all workers working 2.4 meters or more above a permanent safe level. The harnesses shall be CSA approved and must be inspected prior to each use.

Ladder Safety

In some instances, portable ladders are the more practical way to carry out the work required. Used correctly, they can be a very handy tool; used incorrectly, they can be a source of injury. The following are some useful points for the correct use of a portable ladder.

1. The base of the ladder should be placed no less than one-quarter and no more than one-third of the length of the ladder from a point directly below the top of the ladder.
2. Where possible, the ladder should be secured in place.
3. A portable ladder that provides access from one level to another shall extend at least three rungs above the higher level.
4. No person shall work from any of the three top rungs of any single or extension portable ladder or from the two top rungs of any portable step ladder.
5. Metal or wire-bound portable ladders shall not be used where there is potential to come into contact with a live electrical circuit or equipment.

Mobile Elevated Work Structures

Caution is to be used when working from a mobile elevated work structure and in particular, when moving or repositioning the structure. There are many overhead obstructions and certain areas, such as dock yard, are very busy and often cluttered as supplies are moved on and off ships. FPE is required for all personnel.

Ship Safety

The same safety standards apply aboard any Royal Canadian Navy (RCN) vessel. If work must be done at height, the appropriate fall arrest system must be used. Ship's personnel can provide detailed guidance and direction specific to their ship.

Warning Signs

If any work at height poses a secondary danger to other personnel, warning signs shall be placed in a conspicuous place, and at a sufficient distance from the job.

All work done in a confined space is considered risky due to the many potential hazards that may be present. Under no circumstances should a contractor enter a confined space unless they have been authorized to do so and have been briefed on procedures.

Contractors are required to follow the requirements of the applicable regulatory body. (Canada Labour Code, Province).

The Entry Supervisor completes their assessment of the space and level of risk. This will include atmospheric testing to determine if a hazardous condition exists. The Entry Supervisor initiates a Confined Space Entry Permit and briefs the Entry Team prior to the commencement of any work.

The contractor's Emergency Response Team (ERT) is notified prior to and after the commencement of work. If the ERT is not available, the work may be postponed. If the ERT becomes unavailable while the confined space work is being done, the work must stop immediately and personnel must exit the confined space.

DND is not mandated to provide rescue teams for confined space entry, but will respond, if available. All confined space entries shall have a hazard assessment completed and a written safe to enter certificate completed by a qualified person.

Confined Space Entry Procedures

1. Ensure all energy sources have been isolated/locked out.
2. Ensure adequate ventilation is provided and the atmosphere tested.
3. Implement your company's confined space procedure.
4. Ensure entrant, rescue team and sentry are qualified.
5. Ensure hazard assessment completed.
6. Ensure entry plan completed.
7. Ensure rescue plan completed.
8. Ensure personnel are briefed on hazards and work to be conducted.
9. Ensure entry log is in place and used.
10. Ensure safe to enter certificate is completed and posted by qualified person.
11. Ensure rescue team and equipment are in place.

Report all known or suspected injuries to the appropriate authorities. Accident Reporting (3)

Radio Frequency (RF) radiation, also known as non-ionizing radiation, can pose a health hazard to personnel who are exposed to levels higher than Health Canada recommendations. These levels are individually known as the **Maximum Exposure Limit (MEL).**

Through measurement, the distances (MEL distances) one must remain away from any given radiating emitter have been determined. These distances are held by the ship or unit owning these RF emitters.

Contractor personnel will be briefed on the applicable MEL distances and emitter control procedures prior to accessing a site with RF emitters in it. This briefing will be given by the Officer of the Day on ships.

Buildings with RF emitters will have a DND/CAF employee appointed to grant access to the roof and this person will provide the briefing on RF hazards resident there.

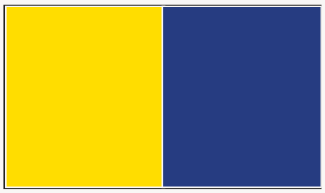
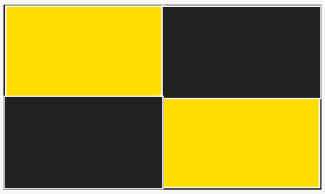
Sources of Radio Frequency (RF) Radiation

The more obvious source of RF radiation is from ship board equipment such as radar and communication antennas.

There are also RF emitters located on various buildings. These include D250, D199, D211, D100, D218, N92A, and N50. Proper roof access procedures, obtained from the contracting authority, must be described to personnel prior to commencing work on any roof.

Indicators for Radio Frequency (RF) Radiation Hazard

Ships will use a series of coloured flags to indicate the status of their RF transmitting capabilities.

FLAG ECHO Indicates that the vessel is rotating an antenna without radiating RF Energy.	
FLAG KILO Indicates that a person is working aloft and/or over the side.	
FLAG LIMA Indicates that the vessel is radiating RF Energy.	

Hazards of Electromagnetic Radiation

1. **Hazards of Electromagnetic Radiation to Fuel (HERF):** There is potential for **RF radiation** to cause spark ignition of volatile combustibles such as gasoline, fuels or solvents.
2. **Hazards of Electromagnetic Radiation to Ordnance (HERO): RF radiation** may cause ordnance or ammunition to inadvertently fire without notice or indication.
3. **Hazards of Electromagnetic Radiation to Personnel (HERP): RF radiation** can heat and burn body tissue and may occur through exposure to a nearby source, or through direct contact with an antenna wire, cable or metal railings that may be reradiating fields.

Suspected or Confirmed Exposure

Any personnel who suspect that they are being over exposed to radio frequency radiation should immediately move away from the source of radiation. **Any personnel who suspect or confirm they have been exposed to radio frequency radiation should seek immediate medical attention.** Medical personnel are to be advised that there may have been an RF over exposure.

Report all known or suspected injuries to the appropriate authorities. Accident Reporting (3)

Hot Work is defined as "any activity which has the potential of generating a source of ignition." This includes welding, burning, grinding, or the use of any spark-producing equipment.

Before any Hot Work can be carried out, a Hot Work Certificate must be issued. Contact the Base Fire Hall **250-363-1906** to receive a permit and a copy of **Fire Orders and Regulations for Contractors.**

Prior to the Hot Work Certificate being issued, a hazard assessment must occur, including the following:

- ❒ Remove all combustible or flammable materials
- ❒ Ensure fire cloth, smoke curtains and ventilation are in place
- ❒ Ensure all areas where a spark could land are protected
- ❒ If applicable, ensure the compartment(s) has been certified gas free
- ❒ Ensure electrical cables liable to be damaged have been covered with protective material

Once the Hot Work is to begin, the Fire Sentry(s) are to be briefed and will ensure the appropriate fire extinguisher(s) are on site.

Note: Gas free testing along with a new Hot Work Certificate must be conducted every 24 hours.

Completion of Hot Work

Once the Hot Work has been completed, the Fire Sentry(s) are required to stay on site for a minimum of 30 minutes. After inspecting the area, the Fire Sentry(s) will report to the customer or Fire Hall that the operation is complete.

Prohibited Hot Work

- ❒ In compartments containing unsealed flammable material
- ❒ On pipes containing any trace of fuel or lube oil
- ❒ Within two (2) meters of a magazine or fittings that enter the magazine
- ❒ On pipes containing any trace of sewage inside

In the event a fire is detected: Shout "FIRE, FIRE, FIRE" and exit the area in an orderly fashion. Notify the Base Fire Hall (911), no matter how small the fire.

Exposure to ionizing radiation can be harmful as it damages the internal structures of living cells. High doses can cause death over a short period of time, or other long term health issues from low doses over longer periods of time.

Sources of Ionizing Radiation

Potential sources of radiation can be specialized monitoring equipment, aircraft gauges, X-rays and even smoke detectors. The international symbol for ionizing radiation is the trefoil. In Canada, X-rays are identified by a different symbol.

Trefoil

X-Ray

Radiological Hazardous Occurrence (RHO) Procedures

- ❒ Hold your breath.
- ❒ **Attempt to breathe only once in fresh air!**
- ❒ Vacate the immediate area.
- ❒ Secure the area if possible.
- ❒ Call the Radiation Safety Officer.
- ❒ Remain nearby until released.

Report all known or suspected injuries to the appropriate authorities. Accident Reporting (3)

Suspected/Confirmed Contamination and/or Exposure

If there has been a suspected or confirmed over exposure, the person **MUST be sent to the hospital.** Ensure medical authorities are advised that the individual may have had a possible ionizing radiation over exposure and if applicable, that the source may be on the person's clothing.

As with any other injury or accident, the details must be reported to WorkSafe BC. It is the contractors responsibility to ensure this happens. **Accident Reporting (3).**

Containment and Clean-up

If DND/CAF personnel are not yet aware of the contamination, ensure they are notified immediately. Units holding radioactive materials will have a Unit Radiation Safety Officer who must be notified of the contamination.

Areas must be evacuated and cordoned off until the clean-up has been completed. Only qualified personnel are permitted to do the clean-up; contractors should not attempt to clean a contaminated area.

Industrial Radiography

Contractors must be licensed by the Canadian Nuclear Safety Commission (CNSC) for Nuclear Gauges (e.g. Troxler Gauges) and Gamma Radiography and they must be able to present these licenses upon demand when on DND/CAF property.

For X-ray Radiography, the contractor must have one person on staff who is a CGSB Level II radiographer (licensed by NRCan).

For Gamma Radiography, there must be one operator who is both CNSC - Certified Exposure Device Operator (CEDO) and NRCan - CGSB Level II certified.

XRF operators must be licensed by NRCan as at least a Level I XRF Operator.

All contractors must have an emergency plan that is accessible to the Base RadSO. Moreover, any contracted services intending to use ionizing radiation must inform the Base RadSO.

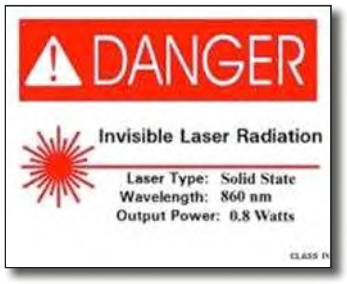
Report all known or suspected injuries to the appropriate authorities. Accident Reporting (3)

Exposure to high power laser light can be hazardous to eyes as well as skin. Lasers range from Class 1 to Class 4. Class 1 are not considered hazardous to skin, or eyes. Class 2 may be hazardous to the eyes but protection is normally afforded by the eye's natural aversion response to bright light. Class 3 lasers may be potentially harmful if under direct and specular viewing conditions. Class 4 lasers are capable of causing serious injury to both eye and skin, and could cause combustion of flammable materials.

Ships such as the Halifax Class contain a Class 4 laser system. Where a ship or unit has Class 3B or 4 laser systems, they will have a Unit Laser System Safety Officer (ULSSO) appointed who will ensure personnel are trained and briefed and that all laser safety policies, standards and procedures are adhered to. Contractor personnel should ensure they are familiar with these policies and procedures prior to commencement of work.

Area Control Where Laser Hazard Exists

Any area where a laser will be operated shall be well defined. In most situations, a laser warning sign such as the one shown here should be in place. All personnel must follow posted instructions and use appropriate Personal Protective Equipment (PPE) as required.



Optical Viewing Devices

Optical viewing devices such as binoculars, big eyes or telescopes shall not be carried or used in any controlled area without prior approval of the ULSSO. If laser operations are to be viewed with such devices, appropriate attenuating filters must be used in the optical viewing device.

Suspected or Confirmed Over Exposure

If there has been a suspected or confirmed over exposure involving laser radiation, the person **MUST be examined by a physician**. Ensure the medical authorities treating the person have been advised that there may have been a laser over exposure.

Report all known or suspected injuries to the appropriate authorities. Accident Reporting (3)

Spill Response and Reporting

All contractors who will have their own vehicles on DND property and/or will be using hazardous materials, must have response equipment, such as a spill kit, and personnel trained in their location and use. In the event of a spill, the contractor is responsible for immediately implementing spill response procedures. If a spill cannot be easily contained or cleaned up, the contractor must call the Base Fire Hall at **911**. Contractors must also report all spills to their contract authorities and the Formation Environment Officer at 250-363-5063, as soon as possible

Contractors are responsible for the cost of cleaning up a spill they generated.

Sick, Injured or Abandoned Wildlife

Do not touch or disturb wildlife on DND properties, including wildlife that appear dead or injured. If you encounter:

- ❒ dangerous animals, such as a bear or a cougar, report it to the Military Police at 250-363-4032 immediately; and
- ❒ sick, injured, abandoned or dead wildlife, report it to the Base CE Help Desk at 250-363-2009.

Waste Disposal

Contractors are responsible for removing and appropriately treating/ disposing of all wastes in accordance with contract documentation. This includes all liquid wastes generated during project activities. Disposal of any waste in DND waste bins is prohibited. Disposal of untreated liquid wastes to the environment and/or storm/ sanitary sewers is prohibited.

Archaeological Features

Contractor personnel should be aware of the mitigation measures prior to commencement of work and ensure they are being implemented throughout the duration of the project. Prior to commencing any land alteration activities, contractor personnel should receive an archaeological briefing which their contract authority will coordinate.

Contractors working on systems requiring lockout or tagout procedures will be expected to follow the existing policy as outlined in **Formation Safety and Environment Systems (FSEMS) Directive S14** The lockout / tagout procedures will be used in conjunction with other work safety standards (**Confined Space Entry (5), Burning and Welding (8)**) but not in lieu of their safety standards.

Approved Padlocks or Lockout Devices

Locks shall be sequentially numbered and will be identified as belonging to the contractor. The customer will have locks meeting the same standard and identified as belonging to them. The contractor must coordinate LOTO requirements with the applicable unit owning the equipment and keep a register of locks issued, including the date, person's name, contractor name, system worked on and the location of the lock or device.

Only one key shall be issued with a padlock and in the event of a lost key, the lock must be destroyed once it has been removed in accordance with procedures. Replacement keys will not be produced.

Zero Energy Checks must be completed before starting work to ensure the lockout is effective.

Removal of Locks

Normally the person who applied a lock is the only one who can remove it. In exceptional circumstances, the MSE and CSE Department Heads (or their delegates) may authorize the removal of the lock under the following circumstances:

- ❒ The machinery / equipment / system shall be verified safe to operate
- ❒ The owner identified on the tag shall be contacted for permission to remove his/her lock
- ❒ Details shall be entered in the Lockout Register

In the case of critical systems onboard the submarines, the owner of a lock will leave the key for his/her lock with the LOTO Coordinator if they leave the sub (ie, leave after working hours), and will draw the key prior to commencing work the following shift.

Contractor Responsibilities

"The unit Contract Officer/Coordinator is to ensure the contractor is aware of the Lockout/Tagout procedures detailed in this Directive. Contractors shall report immediately to the relevant department to be provided a Point of Contact and to be briefed on the procedure to be followed while working onboard."
FSEMS Directive SD14

Due to the risk of a significant emergency occurring such as an earthquake or tsunami, the base has stood up a **Mass Notification System** to give warning to all personnel. In the event that the Tsunami Warning System has detected a tsunami threat, an audible warning system will sound throughout the base. Immediately head for higher ground. Look for signs to indicate tsunami evacuation routes:

There is more than one tsunami evacuation site; be sure you are familiar with the one closest, and most accessible to your location. It's important to remember that personnel are expected to travel to the evacuation sites by foot except in cases when an individual is physically unable to walk. Roads will become congested very quickly otherwise.

Tsunami Hazard Zones

Areas most at risk for a tsunami are indicated by warning signs. These signs are marking what is referred to as the inundation zones, or the areas of lower elevation most likely to be affected by a tsunami.

Mass Notification System

The **Mass Notification System** is also intended to deliver an audible signal to indicate other emergency situations such as an active aggressor. The Mass Notification System will be tested on the first Wednesday of each month for approximately 1 minute commencing at 11:00 am.

Threat of Violence or Terrorism

In the event there is a threat of violence requiring lock-down procedures:

- ❒ Escape or hide out; call **911**.
- ❒ Secure self and location; lock doors, windows.
- ❒ Mitigate vulnerabilities; close blinds, turn off lights.
- ❒ Stay put; wait for authorities to release you.
- ❒ Take action as a last resort.

Situations that may trigger a requirement to call Emergency Services can include medical, fire or even a threat of violence. CFB Esquimalt Emergency Services works with municipal Emergency Services to support all locations occupied by DND. In the event of an emergency, call **911. If calling from a cell phone, inform the dispatcher that you are calling from Canadian Forces Base (CFB) Esquimalt.** Provincial Dispatchers will notify and dispatch the appropriate Emergency Services in your area. Emergency procedures must be discussed with the contracting authority prior to commencing work and be included in the contractor's safety plan.

Major Disasters

There are protocols in place to deal with large scale emergencies such as earthquakes. It's important in such a situation to follow the directions of DND/CAF personnel on muster points and protocols to follow. A full accounting of all personnel is to be completed after buildings have been evacuated, and this includes registering non-DND personnel such as contractors and cleaners.

In the absence of clear instructions, look for the closest E-Box and proceed there. The E-Boxes are placed throughout DND property and can easily be identified by their **orange colour and letter E on the side.**

NOTE: Do not depart your location until you have registered with one of the base's E-Boxes. If you fail to do so, valuable time may be spent searching for you.

Building Evacuations

All personnel, including contractors, should be familiar with the evacuation procedures for the site they are working in. Diagrams will be found in all buildings showing exits and locations of emergency equipment such as fire extinguishers and first aid kits. Take the time to review the diagrams and ask questions if you're unsure of local procedures.

Workplace violence constitutes any action, conduct, threat or gesture of a person towards an employee in their workplace that can reasonably be expected to cause harm, injury or illness to that employee. It includes, but is not limited to, the following:

Threatening behaviour - such as shaking fists, destroying property or throwing objects.

Verbal or written threats - any expression of an intent to inflict harm, including:

- **Direct threats** - clear and explicit communication which distinctly indicates that the potential offender intends to do harm, for example: "I am going to make you pay for what you did to me".
- **Conditional threats** - involves a condition, for example: "If you don't get off my back, you'll regret it".
- **Veiled threats** - usually involves body language or behaviours that leave little doubt in the mind of the victim that the perpetrator intends harm, for example: "Do you think anyone would care if someone beats up the boss?"

Harassment - any behaviour that demeans, embarrasses, humiliates, annoys, alarms, or verbally abuses a person and that is known to be, or would be expected to be unwelcome. This includes words, gestures, intimidation, bullying, or other inappropriate behaviours.

Verbal abuse - including swearing, insults, or condescending language.

Physical attacks - including hitting, shoving, pushing or kicking the victim, or inciting a dog to attack.

National Defence Policy

"The Canadian Forces and the Department of National Defence have a zero tolerance for all forms of work place violence."

"Incidents of work place violence, should they occur, will be responded to promptly by responsible and competent authorities to ensure that the work place remains a respectful and safe environment for everyone."

National Defence Occupational Health and Safety - Prevention of Violence in the Work Place Policy Statement.

Report all known or suspected injuries to the appropriate authorities. Accident Reporting (3)

This publication was produced for Contractors and their employees as a guide to Department of National Defence and CFB Esquimalt Safety and Environment programs. While every effort has been made to provide current and relevant information, Contractors must remain vigilant about ensuring they are fully informed of current legislation as it pertains to worker safety; occupational health and safety; and environmental controls.

This infoflip® is intended to be a quick reference and in many cases, Contractors will require access to the full directives or procedures to ensure they are compliant.

Produced under the authority of Formation Safety and Environment, CFB Esquimalt.

Recommendations for changes or improvements can be directed to:

Formation Safety and Environment
CFB Esquimalt
PO Box 17000 Stn Forces
+ESQ FSE Safety@FSE@Esquimalt (internal email)
250-363-7500