



**FINAL REPORT**

# Remedial and Risk Management Strategy

*Former Burgeo Rifle Range, Burgeo, NL*

*DND Project # N.002180.02*

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## 1.0 INTRODUCTION

WSP Canada Inc. (WSP) formerly Golder Associates Ltd. (Golder), is pleased to submit this Remedial and Risk Management Strategy (RRMS) to Defence Construction Canada (DCC), on behalf of the Department of National Defence (DND), for the Burgeo Range, Burgeo, NL, in accordance with the Contaminated Site Management Working Group's Federal Approach to Contaminated Sites (FACS). This report is based on the Statement of Work (SOW) provided by DCC, dated September 2021 (file number GR082101), and Golder's proposal dated July 8<sup>th</sup>, 2022.

### 1.1 Scope of Work

The RRMS includes the following main items:

- A summary of previous investigations, identifying substances of concern (SOCs), affected media, and quality of materials to be managed.
- A summary of the quantity and make-up of debris to be managed.
- A summary of the overall Site closure strategy.
- Details on remedial excavation, backfilling, sediment dredging, surface water pumping, and Site restoration. This includes an implementation plan for remediation which outlines control measures to minimize risks of contaminant release into the environment, and logistics management.
- Details on the process of debris clean-up.
- Details on regulatory and administrative requirements for the proposed undertaking.

## 2.0 BACKGROUND

### 2.1 Site Description

DND is responsible for a former small arms rifle range set up near the Town of Burgeo (the former Burgeo range). The property was leased from the Government of Newfoundland and Labrador (NL) (Crown lands) for use by the 5<sup>th</sup> Canadian Ranger Patrol Group (5CRPG) in 2008 (referred to as Location 1 – see Site plan provided in Figure 1). Use of the Burgeo range was discontinued by 5CRPG in approximately 2010. DND was contacted by the Province of NL (Water Resources Division) when it became apparent that part of this leased land encroached on the provincially protected watershed that forms part of the Town of Burgeo's municipal water supply. It is DND's intent to decommission the Range and obtain closure from the Province, if required. The actual firing range is located just to the south of the property boundary of the leased lands. The firing range and its immediate surroundings are referred to as the 'firing area' throughout this report (see Figure 1). A number of ponds/lakes and wetland areas are located within Location 1.

A second location (Location 2), near Location 1 but across the road, to the north and west, was also used as a firing range by 5CRPG. This range was originally put in place by the Local Wildlife Office and 5 CRPG planned to use a portion of this range. There is a small stream flowing through Location 2, as well as a few small ponds and marshes. Figure 1 shows the Site plan, including Locations 1 and 2.

In 2019, historical information was limited to anecdotal correspondence between Real Property Operations Detachment Gander (RPOD (GD)) with 5CRPG and some community members who indicated that the range (Location 1) was still used by local hunters and community members as a target practice area even though 'No Trespassing' and 'Range Closed' signs had been installed at the Range. Initial assessment work was completed at Location 1 in 2020 (Golder, 2021), along with additional assessment at Location 1 and initial assessment at Location 2 in 2021 (Golder, 2022). The final detailed assessment at Location 1 was conducted in 2022 (WSP, 2023). General findings indicated soil, groundwater, sediment and/or surface water impacts for various metals and/or Polycyclic Aromatic Hydrocarbons (PAHs) in comparison to applicable guidelines.

There is limited infrastructure on Site (a gravel access road to Location 1) and no engineered controls. A provincially protected water supply (for Long Pond – which supplies water for the town of Burgeo) intersects the Site. The location of the provincially protected water supply is shown on Figure 1. Two small ponds (Ponds 1 and 2) are located immediately adjacent to the firing backstops/bullet catches in the firing area, also shown on Figure 1.

### **2.1.1 Golder 2021 Report on Steps 1 to 4 of the FACS**

The Golder 2021 report entitled "Steps 1 to 4 of the Federal Approach to Contaminated Sites at the Former Burgeo Range, NL" provided an initial testing program for the Site. The Site was divided into three zones based on expected risk rating resulting from former/current activities at the Site – high (zone 1), medium (zone 2), and low (zone 3). The high-risk area (zone 1) included more sampling locations compared to the medium and low risk zones. Zone 3 is located approximately 1,150 m away from the zone 1 high-risk area and is considered to be representative of background conditions. Based on the findings of the analytical program, petroleum hydrocarbon (PHC) exceedances were identified in soil and sediment at the Site. However, additional analyses conducted by the laboratory indicated that these exceedances did not resemble any petroleum products and appeared to be of natural and organic origin. Several elevated concentrations of metals were identified in soil, sediment, and surface water were identified, but many were considered naturally occurring due to elevated background concentrations common to the Site and surrounding area. The concentrations of selenium and cadmium in the soil samples were fairly consistent across the Site, with some of the higher concentrations located in zone 3. The concentrations of aluminum and iron in surface water were also fairly consistent across the Site. Analytical data suggested that the elevated concentrations of these metals are common to the Site and suggested that zone 3 can be considered representative of background conditions. However, presence of lead, tin and zinc in soil, lead in sediment, and lead and copper in surface water at the Site, all in Zone 1, were attributed to bullets and casings from firing activities which included the former DND firing range and shooting practice by town residents. It is understood that the Site was used by community members as an informal firing range even prior to the 2000s, when it was leased by DND.

Soil, surface water and sediment exceedances on the Site that are not considered naturally occurring are located in the area of the former firing range. Lead and iron concentrations in surface water are present in the pond adjacent to the former firing range, which discharges to the south toward Long Pond (a drinking water source for the Town of Burgeo), located approximately 1.2 km hydraulically down-gradient of the Site. Elevated iron concentrations are noted in the source water database for Long Pond from the WRMD's Newfoundland and Labrador Water Resources Portal (collected from 1998 to 2018) suggesting iron is associated with background concentrations in the region. Lead concentrations in Long Pond source water data have been below the Guidelines for Canadian Drinking Water Quality.

Data gaps were identified with regards to site-specific background concentrations, potential leachate from soil to groundwater and delineation of localized metals contamination in soil, sediment, and surface water. As such, additional assessment was recommended to mitigate the identified impacts at the Site including collection of soil samples to laterally delineate the identified impacts and evaluate potential leaching into groundwater. In order to evaluate groundwater quality at the Site, installation of monitoring wells was recommended. Additional soil, sediment and surface water samples to establish Site-specific background concentrations were also recommended. A species at risk public registry search was recommended to be completed to confirm if species at risk are documented on or near the Site and to identify if the Site is considered critical habitat. It was noted that mitigation measures may involve risk assessment followed by remedial option evaluation.

### **2.1.2 Golder 2022 Report on Steps 5 to 7 of the FACS**

The Golder 2022 report entitled “Steps 5 to 7 of the Federal Approach to Contaminated Sites at the Former Burgeo Range, NL” provided an extended testing program for the Site in addition to previous testing. This testing program included additional assessment (at Location 1) and initial assessment (at Location 2), delineation of previously found contamination, and a re-classification of the Site.

Based on the findings of the analytical program, PHC and PAH concentrations in all soil samples analyzed were below the applicable guidelines. Several metal exceedances in soil were identified and many were attributed to the elevated background concentrations common to the Site and surrounding area. Exceedances of boron, cadmium, iron, and selenium were inferred to be due to naturally elevated background concentrations. However, the elevated presence of antimony, copper, lead, manganese, tin, vanadium and zinc in soil at Location 1 and Location 2 was identified and attributed to site activities. Exceedances near the firing locations and bullet catches were considered to have resulted from firing activities associated with the former DND firing range as well as use of the Site by local hunters and community members for target practice. The same metals exceedances found in samples collected outside of the immediate vicinity of the firing area may be due to firing activities at the Site, however, this was not confirmed. Given the distance from the firing area, it is possible that firing activity not related to the DND firing range, wind transport and deposition from the firing area, or other sources may be the reasons for impacts outside the immediate vicinity of the firing area.

Based on the findings of the analytical program, PHC exceedances were identified in sediment at the Site. However, additional analyses conducted by the laboratory indicated that these exceedances did not resemble any petroleum products and appeared to be of natural and organic origin. Exceedances of PAHs were identified and likely related to historical activities that occurred at the DND firing range. Sediment exceedances of arsenic, cadmium, lead, and mercury in samples collected from waterbodies in the vicinity of the firing area in Location 1 – Zone 1 and Location 2 were considered to have resulted from firing activities associated with the former DND firing range as well as use of the Site by local hunters and community members for target practice (or possible hunting). Sediment exceedances of chromium, iron, and selenium were considered elevated due to naturally occurring background concentrations that were not associated with historical activities at the Site. Full delineation was not achieved as there were delineation samples with results similar to what was found in previous sampling programs.

The PHCs and PAHs concentrations in all surface water samples analyzed were below the applicable guidelines and regulations. Exceedances of iron, copper, lead, and zinc were identified. The exceedances of lead and copper are considered to have likely resulted from the firing activities; exceedances of iron and zinc are considered background for the region.



The PHCs and PAHs concentrations in all groundwater samples analyzed were below the applicable guidelines and regulations. Exceedances of the applicable guidelines of cadmium, cobalt, copper, iron and zinc were found in groundwater samples collected on Site. It is possible that exceedances are related to firing activities; however, comparisons to background data have yet to be completed, and therefore the source of the exceedances cannot be confirmed as of the writing of this report.

Based on the findings of the assessment, a NCSCS score of 62.0 was calculated for the Burgeo Range, leading to a Site Letter Grade C Class 2 site with a medium priority for action. Elevated impacts in soil, sediment, and surface water in the firing area in Location 1 were recommended to be addressed through remedial measures, while scattered impacts in soil, sediment, and surface water in areas of the Site not in close proximity to the former DND firing range were recommended to be addressed through a risk management approach. Additional assessment was recommended to assess data gaps to support both the remediation strategy in the firing area as well as future risk management work for the farther out areas.

### **2.1.3 WSP 2023 Report on Steps 5 to 7 of the FACS**

The WSP 2023 report entitled “Steps 5 to 7 of the Federal Approach to Contaminated Sites at the Former Burgeo Range, NL” provided an extended testing program for the Site. The investigation program included delineation of previously found impacts and further characterization of the Site and background conditions.

Based on the findings of the analytical program, metals concentrations in soil (Location 1), sediment (Locations 1 and 2), surface water (Locations 1 and 2), and groundwater (Location 1), as well as PAH concentrations in sediment (Locations 1 and 2), have been found to exceed the applicable guidelines, and are attributed or likely attributed to bullets and casings from firing activities which includes the former DND firing range and shooting practice by town residents. It is understood that the Site was used by community members as an informal firing range even prior to the 2000s, when it was leased by DND.

Based on the findings of the investigation, the NCSCS score was calculated to be 74.4 for the former Burgeo Range. As such, the former Burgeo Range was re-classified as a Site Letter Grade C, Class 1 site with a high priority for action.

Horizontal and vertical delineation of impacts in soil was reasonably achieved. Given that the firing backstop material was found to contain hazardous concentrations of leachable lead, and that lead was elevated in the backstop locations, impacts were delineated around these two locations, and were recommended to be remediated through source removal. The remaining impacts in soil on-Site, were carried forward for Risk Assessment. A Site-Specific Human-Health Ecological Risk Assessment was prepared.

Concentrations of lead in surface water exceeding the Newfoundland and Labrador Drinking Water Quality Guidelines (NL DWQ) and Health Canada Drinking Water Quality Guidelines (HC GCDWQ) (applicable to the provincially protected water supply for the Town of Burgeo) were only found in BFR\_L1\_SW4, which was collected from Pond 2 (one of the two small ponds adjacent to the firing area). Lead concentrations in Pond 1 were only marginally below the NL DWQ and HC GCDWQ. Lead concentrations in sediment in Ponds 1 and 2 were found up to 770 mg/kg, over 5 times as high as anywhere else on-Site. As such, it was recommended that the surface water and sediment in Ponds 1 and 2 be remediated, to remove all media with the potential to impact the provincially protected water supply for the Town of Burgeo. The remaining impacts in sediment and surface water on-Site were carried forward for Risk Assessment.

### 2.1.4 Site Setting, Topography, Geology, and Hydrology

Most of the Site consists of vacant tundra-type landscape. The site is vegetated with grasses, shrubs, and small trees. Bedrock outcrops are present on Site and make up a significant portion of the Site area. Location 1 is accessed by a gravel road off of the highway. Location 2 does not have an access road. It was previously accessible directly off the highway, through a small parking lot; however, a ditch was constructed between the highway and the parking lot that has blocked off vehicle access to the Site. A water reservoir for the Town of Burgeo is located approximately 1.2 km south of the Site. The associated protected water supply area intersects Location 1 (see Figure 1).

Based on area mapping, the surficial geology in the vicinity of the Site is expected to consist predominantly of exposed bedrock with little or no soil or vegetation cover and with rare patches of till and other surficial soil types (Liverman and Taylor, 1994). The bedrock geology in the vicinity of the Site consists of weakly foliated to massive, coarse grained, variably K-feldspar porphyritic, biotite granite and adamellite (Gander Zone, Burgeo Granite) (O'Brien and Dickson, 1986).

Based on observations made during previous field programs, the surficial geology at the Site consisted of dark brown silt to sand, with significant covering of silty peat and bog. Soil depth varied highly from non-existent (bedrock outcrops) to 2.4 metres below ground surface (mbgs).

The topography of Location 1 is undulating hills with rocky outcrops and low-lying pond/wetland areas. In Location 2, a large rocky outcrop is found to the west of the firing point and acts as a natural backstop for rifle fire.

Non-potable groundwater conditions are applicable as no potable wells are in the vicinity of the Site; however, surface water bodies on the Site are hydraulically connected (through a series of creeks and ponds) to Long Pond, located approximately 1.2 km to the south (Figure 1). Long Pond is the water supply for the Town of Burgeo. Based on topography and Site observations, surface water is generally inferred to flow from north to south across the Site.

## 3.0 JULY 2023 HAZARDOUS VS. NON-HAZARDOUS DELINEATION OF IMPACTED SOIL

To potentially reduce costs associated with off-Site landfill disposal of impacted soil, additional delineation of leachable lead concentrations in soil (i.e., hazardous vs. non-hazardous waste) near the firing backstop area was recommended (WSP, 2023). Soil with leachable metals concentrations above General Schedule 4 Leachate Quality Criteria (R.R.O. 1990, Regulation 347) was determined to be hazardous, while impacted soil with leachable metal concentrations below these criteria were determined to be non-hazardous.

### 3.1 Methodology

On 13 July 2023, 18 shallow soil samples (including 2 field duplicates) were collected from native soil at 0.00 to 0.15 mbgs near the firing backstop areas, with eight parent samples collected in each backstop area (Figure 2). Soil samples were collected using a steel shovel/trowel, in accordance with WSP Standard Operating Procedures (SOPs) and industry accepted field methods and sampling protocols.

Samples were placed directly into laboratory supplied sample jars. Sample container lids were not removed from sample jars until immediately prior to sample collection and were resealed immediately following sample collection. Field personnel held the sample container lid in their gloved hand during sample collection. Following collection, samples were stored in a laboratory-supplied cooler with ice and submitted to the analytical laboratory under chain-of-custody for analysis of toxicity characteristic leaching procedure (TCLP) metals (i.e., leachable metals).

The easting and northing coordinates of each soil sampling location were measured using a handheld global positioning system (GPS) unit with sub-3 metre (<3 m) accuracy and recorded in the North American Datum of 1983 (NAD83), Universal Transverse Mercator (UTM) Zone 20 North datum.

Measures were taken to ensure data accuracy, precision, and representativeness. To ensure samples are representative of environmental conditions at the time of sampling, all sampling equipment was decontaminated using Alconox and deionized water rinses prior to sample collection and between sampling locations, in accordance with WSP SOPs. A new pair of nitrile gloves were donned prior to collecting each sample to prevent cross-contamination; gloves were replaced if field staff touched anything other than the sample or sample containers. Other measures taken to prevent cross-contamination are described above. To ensure data accuracy, a Canadian Association for Laboratory Accreditation (CALA)-approved laboratory was used for sample analysis. Sample analytical reports included the results of internal laboratory quality assurance/quality control procedures which were reviewed by WSP to ensure no data issues were present. To assess data precision, blind field duplicates were collected at a rate of 10% (i.e., one duplicate per ten samples) and compared to parent samples. Sample results are considered to be precise if the relative percent difference (RPD) between sample duplicates and parent samples is  $\leq 25\%$  for concentrations where the average of the parent and duplicate samples is greater than five times the reportable detection limit (RDL). RPD is calculated using the equation provided below, where  $x_1$  is the concentration of a given analyte in the parent sample, and  $x_2$  is the concentration of the same analyte in the duplicate sample. RPD is considered calculable if the concentration of either the parent or duplicate sample is above the RDL; if a concentration is detected in only one of the two, the RDL is used for the concentration below the RDL.

$$RPD = \frac{x_1 - x_2}{\frac{x_1 + x_2}{2}} \times 100$$

## 3.2 Results

Surface soil samples collected from the western impacted area consisted of grey and brown silt, sand, or silty sand with trace amounts of gravel with the exception of BF-TP23-5, which consisted of dark brown peat with organics. All surface soil samples collected from the eastern impacted area consisted of dark brown peat with organics, with trace amounts of light grey silt observed at BF-TP23-12.

Of the 16 surface soil samples collected, two samples had lead leachate concentrations exceeding General Schedule 4 Leachate Quality Criteria (R.R.O. 1990, Regulation 347), as shown in Table 1 below. The area of lead leachate exceedances is located south of Pond 2 (Figure 2). Concentrations of lead leachate ranged from 0.075 mg/L (BF-TP23-15) to 276 mg/L (BF-TP23-02); for detailed results, please refer to the data table presented in the appended Table 1. The laboratory certificate of analysis is included in Appendix B. As discussed in previous reports, the source of the leachable lead in the firing backstop areas is considered to be firing activities associated with the former DND firing range as well as use of the Site by local hunters and community members for target practice (or possibly hunting).

**Table 1: Soil Samples Exceeding Criteria.**

Sample Name	Sample Depth (mbgs)	Analyte	Criterion <sup>1</sup> (mg/L)	Concentration (mg/L)
BF-TP23-01	0.15	Lead leachate	5	11
BF-TP23-02	0.15	Lead leachate	5	276

Prepared by: LR

Reviewed by: AO

Based on the above results, the total area of hazardous material on site is 86 m<sup>2</sup>; the area of non-hazardous material is 1,840 m<sup>2</sup>. Based on the depth of observed impacts (Figures 3a and 3b), the estimated volume of hazardous soil is 30 m<sup>3</sup>, and volume of non-hazardous soil is 650 m<sup>3</sup>. The volume of hazardous material was calculated conservatively, in accordance with previous reports. No leachable metals samples were collected beyond 0.15 mbgs depth, but it is assumed that impacts extend to the depth of bedrock previously observed in this area. The exact volume of hazardous material should be confirmed in the field during the remediation program.

Based on the results of the QA/QC program, the results are considered representative, accurate, and precise. No deviations from WSP SOPs and industry accepted field methods and sampling protocols were made during sampling, no data quality issues were identified by the laboratory, and RPD results other than aluminum leachate at location BF-TP23-13 were within data quality objectives (i.e., RPD ≤25% for concentrations greater than five times the RDL). Observed RPDs ranged from 1% to 32% (Appendix 1, Table 2). The 32% RPD for aluminum leachate at location BF-TP23-13 is above maximum data quality objective for RPD (i.e., 25%); this may have been caused by the heterogenous nature of the soil. It is not expected to have impacted the reliability of the results, as all concentrations of aluminum leachate in both parent sample BF-TP23-13 and duplicate sample BF-TP23-DUP1 are within the ranges of aluminum leachate observed for other samples collected in this area of the Site.

## 4.0 REMEDIAL / RISK MANAGEMENT OBJECTIVE

The overall objective for the Site is to address contamination to support DND in receiving regulatory closure of the Site from the Government of Newfoundland and Labrador (NL) (provincial regulator). In addition, surficial debris on the Site require management because of concerns such as safety and aesthetic issues. This RRMS has been developed to outline the approach for remediation and risk management required to bring the Site to closure.

### 4.1 Approach to Site Closure

To achieve the overall objective, the following remedial options were considered for the Site:

- Remediation of impacted media (soil, sediment, and surface water) to meet applicable criteria, specifically:
  - **Soil Excavation and Off-Site Disposal:** impacted soil is excavated using heavy machinery where accessible, or smaller equipment on steep and difficult to access areas and loaded into trucks for transport and disposal at engineered landfills licensed to accept the hazardous contaminated soil present at the Site. Clean fill can be imported to the Site and used to backfill the excavated areas.

<sup>1</sup> General Schedule 4 Leachate Quality Criteria (R.R.O. 1990, Regulation 347)

- **Sediment Dredging and Off-Site Disposal:** the ponds containing impacted sediment are proposed to be pumped dry prior to excavation using heavy machinery where accessible **or** hydraulically dredging the remaining sediment using hydraulic vacuuming. The sediment would then be loaded into trucks for transport and disposal at engineered landfills licensed to accept the impacted material. The proposed water bodies (Ponds 1 and 2, see Figure 1) to be dredged are not considered fish habitat (WSP, 2023).
- **Treatment of Impacted Surface Water by Pumping for On-Site Treatment:** impacted surface water is pumped out of ponds/wetlands for on Site treatment and treated water is discharged to the adjacent water bodies.
- **Risk Management, specifically:**
  - Human-Health and Ecological Risk Assessment completed in accordance with federal guidance to identify risks associated with the impacts present on-Site. Based on the results of the risk assessment, risk management measures required to address unacceptable risks may be required.

To assess the feasibility and practicality of the site management approach, as described above, the following factors were taken into account:

- The extent of impacted media is widespread across zone 1 of Location 1, and the area of Location 2 closest to the firing point. In Location 1, identified impacts in soil and sediment were found up to 1.2 km from the firing point. It should be noted that practical delineation of the extent of impacts has been achieved.
- Given the widespread contamination in the area of Location 1, not in the immediate vicinity of the firing range, significant investigative effort would be required to delineate impacts. Soil investigation to date in zone 1 of Location 1 included one sample location for approximately every 8,000 m<sup>2</sup>. Sediment investigation to date generally included one or two shallow (0-0.15 m) samples in each of the many ponds/wetlands located on Site. While the previous sampling programs achieved their objective of characterizing the Site, extensive additional assessment would be required to properly delineate every impact in soil and sediment.
- Given that impacts were found in numerous locations in soil, sediment, and surface water in Location 1 and Location 2, a full-scale remediation of impacts to meet applicable generic criteria would be a large and unsustainable undertaking and cause ecosystem/habitat destruction.
- Metals and PAH exceedances found in impacted media, outside of the immediate vicinity of the firing area of Location 1, were marginally above the applicable criteria. In addition, given the exceedances found, it appears as though impacts in soil are localized and heterogenous, as opposed to being found in consistent concentrations across wider areas.
- Full-scale remediation using heavy equipment would be logistically challenging due to the boggy and rocky landscape. Use of heavy equipment would also likely result in habitat destruction to the areas that are to be traversed or excavated/dredged.

Based on the above factors, full-scale remediation is not practical or cost-effective. It was recommended to pursue a blended approach with remediation of the firing area of Location 1 (where the highest concentrations of contaminants are found) with risk assessment/management to address the areas of Location 1 outside of the immediate vicinity of the firing area, as well as Location 2 (where contaminant concentrations are found to be only marginally above the applicable criteria in select locations). The source impacts in the firing area have been delineated. Impacts in soil to be remediated were delineated to concentrations that could not be managed through

risk assessment/risk management (and contain hazardous levels of leachable lead (WSP, 2023)). The area can be generally described as the immediate vicinity around the firing backstops/bullet catches, in Location 1. The delineated areas of soil prescribed for source remediation are found on Figure 2. Cross sections of the areas can be found on Figures 3A and 3B. Surface water and sediment impacts to be remediated are in water bodies adjacent to the firing backstop/bullet catches with concentrations of lead in water greater than the NL DWQ. The remediation is targeted to address on-Site impacts that could potentially affect the downstream provincially protected water supply. Given that there were no nearby potable groundwater users, impacted groundwater was carried forward for risk assessment (WSP, 2023).

The report sections below detail the proposed approach for the following:

- Remediation of soil, sediment, and surface water in the firing area;
- Removal of debris from Site;
- Risk assessment and risk management;

## **5.0 REMEDIATION OF FIRING AREA**

The impacts found in the firing area, as described in Section 4.1, are proposed to be addressed through remediation of soil (areas shown on Figure 2), sediment (Ponds 1 and 2), and surface water (Ponds 1 and 2).

### **5.1 Material and Infrastructure to be Removed and/or Decommissioned**

The Golder 2022 and WSP 2023 Reports on Steps 5 to 7 of the FACS were completed to assess the impacts found on-Site and create an inventory of debris material to be removed.

As discussed in Section 4.1, the extent of impacts in the firing area have been delineated. The following impacted material exists on-Site, within the firing area:

- Metals (antimony, copper, lead, manganese, tin, vanadium) impacted soil.
- Metals (lead, mercury, arsenic, cadmium, selenium) impacted sediment in the two small ponds located adjacent to the north of the firing range bullet catch.
- Metals (copper, lead) impacted surface water in the two small ponds located adjacent to the north of the firing range bullet catch.

Debris to be removed from Location 1 and Location 2 primarily includes materials related to firing activities, consisting of wooden stakes, stands and targets, metal targets, spent rifle as well as shotgun ammunition and shells. Household waste such as a broken vacuum cleaner was also found on-Site.

### **5.2 Description of Remedial Work**

This section provides a summary of the scope of work and sequence of main operations for the remediation of impacted soil, sediment, and surface water in the firing area.

### 5.2.1 Health and Safety Plan

Given the leachable and hazardous concentrations of lead identified in the remedial area, there is potential risk of exposure to a remediation worker through direct soil contact (i.e., incidental ingestion, dermal contact, and inhalation of soil particulates). A remediation worker may also be exposed to COCs identified in groundwater through direct contact during remedial excavations (i.e., incidental ingestion, dermal contact).

As such, a project-specific HASP must be prepared and reviewed by a qualified health and safety professional and a Qualified Person when intrusive investigations or subsurface construction/repair work are to be undertaken at the Site. Preparation of a project-specific HASP is expected to be a standard component of any construction work and to include site-specific construction activities for issues unrelated to the COCs such as, but not limited to, working with heavy equipment. However, additional provisions must be included related to the potential hazards associated with the identified contamination. The HASP shall be prepared by a Qualified Person having knowledge of occupational health and safety practices pertaining to exposures to the COCs and the level of human health protection required to meet the objectives of the RA (WSP, 2023B). The construction HASP is intended to supplement the contractors' own health and safety program, which may not include appropriate controls for the chemical-specific hazards associated with soil and groundwater. The HASP will be used to communicate the potential concerns related to worker exposure to the COCs through the inhalation of trench air, incidental ingestion of soil, dermal contact with soil and inhalation of soil dust and incidental ingestion of groundwater and to provide recommendations for worker protection. A copy of the HASP shall be available at the Site for review by workers for the duration of all construction activities with the potential to encounter impacted trench air, soil and water.

At a minimum, the HASP shall include the following measures to address potential risks:

- Dewatering of excavations if standing water is present in the trench;
- Specifications for appropriate personal protective equipment;
- The use of appropriate decontamination protocols to remove COCs from equipment, tools and workers;

The HASP will be present on Site at all times during the work and will include the appropriate emergency contact numbers as well as the route to the nearest hospital.

### 5.2.2 Definition of Roles

For the purposes of this report, the following roles are defined:

- "Engineer": suitably qualified consultant or equivalent, responsible for remedial oversight and approval of work completed by the Contractor.
- "Contractor": remediation contractor responsible for execution of specifications.

### 5.2.3 Mobilization, Utility Locates and Site Preparation

Activities will include the completion of the layout of access as well as equipment lay-down and storage areas. There are no utilities expected to be within the remediation area based on current conditions. The Contractor is responsible for obtaining confirmatory locates.

### 5.2.4 Fencing

The Contractor may wish to enclose the laydown areas at the Site with fencing. Temporary construction fencing will be placed around active excavation areas to limit access to pedestrians and vehicles.

### 5.2.5 Protection of Utilities

There are no utilities expected to be within the remediation area requiring protection based on current conditions. The Contractor is responsible for obtaining confirmatory locates.

### 5.2.6 Groundwater Seepage or Stormwater Run-Off into Excavation

Excavation below the water table is not anticipated to be required at the Site. Groundwater depth on the Site was found to be between 2.3 and 6.7 mbgs, within the bedrock. However, the peat bog material present on-Site typically retains water and is anticipated to drain into the excavation. A hydraulic conductivity test was performed on a well installed directly into the peat bog and a horizontal hydraulic conductivity of  $9.2 \times 10^{-9}$  m/s was estimated.

It is important to keep all excavations dry and free of groundwater or storm water runoff. If groundwater is encountered within the excavation, it should be pumped and removed from the excavation. Contractors should also be prepared to treat excavation water prior to discharge to reduce contaminants to acceptable levels.

### 5.2.7 Decommissioning of Groundwater Monitoring Wells

Groundwater monitoring wells located within the limits of excavation may be decommissioned by a licenced well technician prior to removal. Decommissioning must adhere to provincial guidance.

### 5.2.8 Removal of Surficial Debris

Eighteen debris items were observed as part of the Golder 2022 Report on Steps 5 to 7 of the FACS. No changes to the debris inventory were noted during the WSP 2023 investigation. Debris at Location 1 amounts to approximately 5 m<sup>3</sup> of debris, including, but not limited to general refuse found at firing backstop, consisting of household waste, wooden stakes, cardboard and plastic targets, rusted material used as a target, spent shotgun shells, spent rifle cartridges, and spent ammunition. Debris at Location 2 amounts to approximately 13 m<sup>3</sup> of debris, including, but not limited to wooden stakes and gun stands, cardboard, plastic and wooden (plywood) targets, spent shotgun shells, spent rifle cartridges, and spent ammunition.

Remediation will include removal of the debris. Manual removal, by hand, will be required for the debris. Debris will need to be disposed of as waste to a licenced waste disposal site.

The locations of the debris items are shown in Figures 4 and 5. The debris inventory is provided in Table 2 below.

**Table 2: Debris Inventory**

Debris ID	Description	Approximate Quantity
L1_DEB_1	General refuse found at firing backstop. Includes household waste, targets, spent shotgun shells, spent rifle cartridges, and spent ammunition.	~1m <sup>3</sup>
L1_DEB_2	Plastic target behind backstop. Includes spent shotgun shells.	~1m <sup>3</sup>
L1_DEB_3	Wooden stakes and cardboard target	~1m <sup>3</sup>



Debris ID	Description	Approximate Quantity
L1_DEB_4	Rusted drum used as target. Includes spent ammunition, spent rifle cartridges, and spent ammunition.	~1m <sup>3</sup>
L1_DEB_5	Rusted sink used as target. Includes spent ammunition.	<1m <sup>3</sup>
L2_DEB_1	Wooden stake target and spent ammunition.	<1m <sup>3</sup>
L2_DEB_2	Wooden stakes and spent shotgun shells	<1m <sup>3</sup>
L2_DEB_3	Wooden stakes and cardboard target.	<1m <sup>3</sup>
L2_DEB_4	Wooden target, spent rifle cartridges and spent ammunition found on pathway towards firing backstop.	<1m <sup>3</sup>
L2_DEB_5	Wooden gun stand, plywood targets and spent rifle cartridges	~1m <sup>3</sup>
L2_DEB_6	Wooden plank target	<1m <sup>3</sup>
L2_DEB_7	Wooden gun stand, plywood targets and spent rifle cartridges	~1m <sup>3</sup>
L2_DEB_8	Wooden gun stand, composite target, spent rifle cartridges and spent ammunition	~1m <sup>3</sup>
L2_DEB_9	Wooden gun stand, plywood targets and spent rifle cartridges	~1m <sup>3</sup>
L2_DEB_10	Wooden stakes with plastic targets and spent ammunition	<1m <sup>3</sup>
L2_DEB_11	Wooden stakes and spent shotgun shells.	<1m <sup>3</sup>
L2_DEB_12	Wooden gun stand, plywood targets and spent rifle cartridges	~1m <sup>3</sup>
L2_DEB_13	Wooden stake and spent shot gun shells	~1m <sup>3</sup>

Created by: AB  
Checked by: JTD

### 5.2.9 Clearing of Vegetation

Clearing of alders around the backstop is required to remove impacted material. The total area of alders is approximately 850 m<sup>2</sup>, corresponding to an approximate volume of 5 m<sup>3</sup> shredded. Grubbing is not expected.

### 5.2.10 Access to Contaminated Soil

An access pathway extending approximately 50 m, will be required in order access the easternmost area of impacted soil. To avoid disturbing the unimpacted vegetated/peat bog areas, the contractor should use cribbing and mats as a temporary access measure.

### 5.2.11 Excavation of Contaminated Soil

Contaminated soil is to be removed from Site and will require the use of an excavator and/or backhoe. The soil will be excavated to the extent prescribed by the Engineer. Certain areas may be hard to access with large excavators due to naturally occurring obstacles or severe sloping of bedrock – in these cases, manual removal or use of smaller machinery may be required. Where bedrock is encountered, it is to be mechanically scraped of contaminated soil.

The horizontal extent of impacted soil to be removed can be found on Figure 2. Cross-sections (with estimated depth) of impacted soil to be removed can be found on Figures 3A and 3B. Approximately 680 m<sup>3</sup> of impacted soil is to be removed.

Contaminated soil excavated from the area shown in blue on Figures 2, 3A, and 3B must be treated as hazardous waste due to leachable lead, as discussed in Section 3.0. This soil should be disposed of at a licenced hazardous waste treatment facility. The estimated volume of hazardous soil is 30 m<sup>3</sup>.

Contaminated soil excavated from the areas shown in purple on Figures 2, 3A, and 3B is not considered to be hazardous waste due to acceptable concentrations of leachable lead and can be disposed of accordingly. The estimated volume of non-hazardous contaminated soil is 650 m<sup>3</sup>.

### 5.2.12 Cleaning of Heavy Machinery

Soil adhering to trucks and equipment will be removed before leaving Site. A designated decontamination area will be established to clean trucks through dry means. Wash water should only be used if dry means are not adequate. Heavy machinery used to excavate or transport of impacted material should not traverse otop impacted material. The excavation should move from west to east to avoid the wheels or tracks of heavy equipment coming into contact with impacted material.

### 5.2.13 Dredging of Contaminated Sediment

Contaminated sediment is to be removed by excavation/dredging using heavy equipment or by hydraulic dredging (using vacuum). In either case, the Ponds should be dewatered first, to provide visibility of the sediment. The contractor can then select the best method for sediment removal. Given that the only areas proposed to be dredged as part of the remediation (Pond 1 and 2) are approximately 9 m in width, it is not expected that a dredging barge will be required. It should be noted that the boggy shoreline may not be stable for heavy equipment. If mechanical excavation/dredging is selected, an excavator may need to be positioned away from the immediate shoreline. The treatment of dewatering water is discussed in Section 5.2.14. Upon removal, impacted sediment may be further dewatered on-Site to reduce the volume sent to landfill. Sediment dewatering should be done in a watertight contained cell (e.g. filter bag or tank) to eliminate the risk of cross-contamination. Dewatering water should be treated on-Site prior to recycling to a nearby on-Site water body.

The depth of the impacted sediment extends to approximately 0.6 meters below the bottom of the ponds. The approximate area of the impacted ponds (Ponds 1 and 2) is 300 m<sup>2</sup>. As such, sediment quantities have been estimated to be 180 m<sup>3</sup>.

The sediment on-Site is considered to be non-hazardous and should be disposed of at a licenced waste facility.

### **5.2.14 Pumping and Treatment/Recycle of Contaminated Surface Water**

Contaminated surface water from Ponds 1 and 2 is to be pumped and treated on-Site. The ponds have an approximate maximum depth of about 2 m, however this has not been confirmed due to the difficulty of measuring the pond bottom due to the presence of suspended sediment. An average depth of water of 1.5 m has been estimated. As such, water quantities have been estimated to 450 m<sup>3</sup> assuming no contribution from groundwater or precipitation. Removal of surface water may be conducted simultaneously with the removal of sediment (hydraulic dredging) or prior to its removal. Any water removed from impacted sediment during sediment dewatering should be considered impacted water and sent for on-Site treatment. It is expected that water treatment will require the passage of water through bag/mechanical filters and a secondary filter media.

The treated surface water must meet the NL DWQ and HC GCDWQ, prior to discharge back to an adjacent surface water body. Pond 3, located on Figure 1, would be an acceptable receiving water body. It is noted that only the chemical, health-based guidelines are required to be met for discharge. This includes a guideline of 0.005 mg/L of lead.

Ponds 1 and 2 were determined to not be active fish habitat (WSP, 2023), and therefore, no alternative habitat considerations are required.

### **5.2.15 Handling/Treatment of Dewatering Water, and Precipitation/Groundwater Seepage into Excavation and Ponds 1 and 2 (once Dewatered)**

The excavation will be conducted in a manner that minimizes the suspension of soils in water (groundwater or stormwater runoff) that has seeped into the excavation and minimizes the spread of suspended solids. The contractor should proceed with the soil excavation to limit the contact of impacted soil with precipitation, and facilitate any dewatering if needed.

Upon completion of an excavation area where water seepage has occurred (e.g. below water table or area draining stormwater), the excavation should promptly be backfilled to a level to inhibit seepage, following inspection by the Engineer.

### **5.2.16 Confirmatory Sampling of Excavated/Dredged Areas**

The total extent of impacted soil and sediment to be removed has been determined to be approximately 650 m<sup>3</sup> and 180 m<sup>3</sup> respectively. The final limits, both vertical and horizontal, will be determined in the field by the Engineer once the extents of delineated contamination have been reached. Soil and sediment samples will be collected to confirm that the impacted material has been removed. If the samples collected have concentrations exceeding the applicable criteria, further excavation/dredging will be required.

In absence of local requirements, sampling will be conducted in accordance with the sampling frequency outlined in the Nova Scotia Confirmation of Remediation Protocol (NSE, 2013). These sampling requirements are provided in Table 3 below.

**Table 3: Minimum Confirmation Sampling Requirements for Excavation**

Floor Area (m <sup>2</sup> )	Floor Samples	Sidewall Samples
<25	1	1
>25-50	1	2
>50-100	2	2
>100-250	2	4
>250-500	3	5
>500-750	3	6
>750-1000	4	7

Sidewall samples should not all be taken from the same wall and should represent worst-case. The final number of verification samples will depend on the final excavation size. The estimated area of hazardous impacted soil is 86 m<sup>2</sup>. The western area of non-hazardous impacted soil is approximately 850 m<sup>2</sup>, and the eastern area of impacted soil is approximately 990 m<sup>2</sup> (Figure 2). The Contractor will be required to facilitate and allow reasonable time in their project schedule to collect soil verification samples using excavation equipment at the direction of the Engineer and for analysis of the samples. If excavation is terminated on bedrock (expected in a majority of the excavated area), no sampling will be required as there will be no soil to sample. It is noted that confirmatory samples for hazardous impacted soil will need to be collected separately from non-hazardous impacted samples, as there are different disposal requirements for each.

### 5.2.17 Excavation Support

Excavation support will be required where the excavation depths are too great to maintain a safe excavation face. Excavations less than 1.2 metres may be able to be near vertical; however, excavations greater than 1.2 metres may remain unsupported if sloped at a slope of 1:1 (above the water table). Where excavation extends below the water table or water inflow is present (not expected), a three horizontal to one vertical slope may be required. Excavation support for deeper excavation is subject to Engineer's approval. Special considerations for dredging of Ponds 1 and 2 may need to be considered if mechanical dredging using an excavator is the selected method of removal.

### 5.2.18 Dust Control and Monitoring

In addition to the nuisance caused by dust, the presence of contamination in the overburden to be excavated will require strict control of dust. Use of water and/or environmentally compatible dust suppressants will be required. Any stockpiles of contaminated material (soil or sediment) will need to be lined beneath, and covered atop, to prevent leaching since the material is hazardous. If weather conditions require it, dust monitoring will be implemented at the discretion of the Engineer. The Contractor will be required to implement corrective actions to manage unacceptable dust generation.

### 5.2.19 Material Tracking

Waste and recyclables will be tracked with manifests from the disposal facilities. Overburden material and dewatered sediment will be measured by weight as measured at the disposal facility. Copies of tracking manifests from the disposal or treatment facility will be collected for each truck load to track the transport of the impacted material and prevent illegal dumping. Water treatment will be measured in volume using a calibrated flow meter. Quantities will be used for pricing by the Contractor.

### 5.2.20 Backfilling and Site Restoration

It is not expected that backfill will be required, as impacts are only expected to be found in shallow soil and sediment/surface water. Should it be determined that backfill is required, all imported material used within the remediation limits must comply with the applicable criteria for background Site conditions. Imported fill will be tested by the Engineer in accordance with the requirements. Testing of backfill will include, at a minimum, select metals, pH, PAHs and PHCs. The testing suite may be reduced based on the nature and source of fill. A Phase I ESA can be completed at the fill source to determine a more appropriate testing package at the discretion of the Engineer.

Material used for backfilling must be selected material from excavation or other sources, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse, recycled materials (such as reused asphalt) or other deleterious materials with minimal fines.

Backfill should be placed in 300 mm lifts and compacted to a minimum of 95% Standard Proctor Maximum Dry Density (SPMDD). The areas on Site that are currently graveled shall be reinstated with gravel following the remediation.

In the areas that are currently covered with shallow soil, the backfilled area will be covered with not less than a 15-centimetre thickness of topsoil and seeded with a mix of native grass and sedge species, as appropriate for the Site characteristics and local climate.

Results of the verification samples should be confirmed to meet the applicable criteria for the Site prior to an area being backfilled.

### 5.2.21 Confirmation of No Cross-Contamination

Upon completion of the remediation of the Site and removal of all materials and equipment from Site, areas used for access, laydown, storage, and other site activities maybe tested for soil quality upon completion of the works to confirm that no impacts have been caused during the remediation.

### 5.2.22 Landscaping

In the areas outside of the roadway/parking lot, the backfilled areas will be covered with not less than a 15-centimetre thickness of topsoil sourced from a licenced topsoil provider and seeded with a mix of native grass species, as appropriate for the Site characteristics and local climate.

### 5.2.23 Demobilization

Upon completion of the scope of work, all equipment and wastes will be removed from Site.

### 5.2.24 Reporting

Following completion of the remediation, the Engineer will prepare a remediation report documenting the final condition of the Site, including:

- A summary of Site activities;
- Photo documentation;
- Analytical results from confirmatory sampling;
- Quality control testing results; and,

- Dewatering discharge water sampling results, should they be required.

The Contractor will be responsible for all final submittals including:

- Final volumes of materials;
- Soil quality sampling results for any imported material; and,
- Records of proper disposal and treatment of impacted material.

## **6.0 ENVIRONMENTAL MONITORING**

The following activities will be monitored by the Engineer during remediation.

### **6.1 Soil and Sediment**

The Engineer will be present during all excavation works to monitor that Site activities are completed in accordance with the technical specifications. The Engineer will also collect confirmatory soil samples ensuring that all impacted soil prescribed for removal has been excavated in the remediation area.

### **6.2 Seepage Water in Excavation/Ponds 1 and 2 (After Initial Dewatering)**

The Engineer will ensure seepage water pumped out of the active excavation/Ponds 1 and 2 is sent for on-Site water treatment, prior to discharge to a receiving water body.

### **6.3 Sediment and Surface Water**

Sampling will be required to verify that impacted water, once treated, meets the NL DWQ and HC GCDWQ, prior to discharge to a receiving water body. The Contractor should allow for on-Site storage of treated water, to allow time for confirmatory sample results to be received (at least 72 hours of storage, based on estimated shipping time and rush turnaround of results).

### **6.4 Dust Monitoring**

If weather conditions require it, dust monitoring will be implemented at the discretion of the Engineer. The Engineer will ensure that the requirements for dust control listed in Section 5.2.18 are implemented correctly.

## **7.0 RISK ASSESSMENT AND RISK MANAGEMENT**

A human health and ecological risk assessment (HHERA) has been completed for the Site that incorporates the Site characterization (including characterization of priority contaminants of concerns (COCs)), habitat assessment (including species at risk) and toxicity testing (surface water and sediment) (WSP, 2023b). The risk assessment is completed in accordance with applicable federal guidelines (e.g., Federal Contaminated Sites Action Plan (FCSAP) and Canadian Council of Ministers of the Environment (CCME)). The HHERA includes a problem formulation which documents the contaminants of concern, human and ecological receptors and exposure pathways.

The HHERA evaluates potential risks to the local ecosystem and consider potential human exposure and risks associated with site visitors (trespassers, hunters, recreational users, etc.) for impacts that are proposed to be left on-Site (e.g. not remediated, as described in Sections 3.0 through 5.0).

Potential risk to Site-specific ecological receptors are evaluated using a weight of evidence (WOE) approach which is consistent with the recent FCSAP and CCME ecological risk assessment guidance. The WOE approach gathers and evaluates information from different lines of evidence to determine the possibility or degree of harm to receptors of concern. Specific lines of evidence include: comparison of measured chemical concentrations compared to literature-based toxicity values; results of the aquatic and terrestrial habitat assessment completed at the Site (described in Section 6.1).

The conclusions and recommendations of the HHERA with respect to human health were as follows:

- The HHERA evaluated potential risks to a Recreational User from direct contact with soil, sediment, and surface water, as well as the consumption of country foods.
- Based on screening against human health criteria, direct contact with soil was retained for further assessment of potential risks from soil COCs (aluminium, manganese, vanadium)
- Risks were negligible for a Recreational User; therefore, risk management measures (RMMs) are not required for these receptors.
- Potential off-Site health risks to the provincially protected watershed were also negligible as no COCs were identified in surface water above drinking water criteria.
- It is possible that a Subsurface Worker, who may be involved in future construction or other intrusive work, may also be exposed to COCs on the RA Property. However, no planned intrusive work is proposed outside of the remedial areas and there are no development plans that may require intrusive work. As any potential exposures are short-term and are mitigated through an industry standard HASP, this receptor was not evaluated in the HHERA.

The conclusions and recommendations of the HHERA with respect to ecological health were as follows:

- Primary producers (terrestrial plants), soil invertebrates, mammals, birds, and amphibians were identified as receptor groups for the terrestrial ecosystem. No terrestrial species at risk (SAR) were identified as a receptor of concern (ROC).
- Primary producers (aquatic plants, algae), pelagic invertebrates, benthic invertebrates, fish, and amphibians were identified as receptor groups for the aquatic ecosystem (collectively referred to as aquatic life). Fish SAR were identified as ROCs (American eel and banded killfish).
- Based on screening against ecological criteria, terrestrial plants and soil invertebrates were retained for further assessment of potential risks from soil COCs (tin), and aquatic life were retained for further assessment of potential risks from sediment and surface water COCs (lead).
- Protection goals included maintenance of communities of ecological receptors that are similar to reference areas and protection of individual SAR.
- Several lines of evidence (LOEs) were used to characterize risks to terrestrial and aquatic ecosystems. These LOEs included hazard quotients (HQs; where COC concentrations are compared to literature-based toxicity information), Site-specific toxicity studies, and Site-specific biological studies.
- Risks to terrestrial plants and soil invertebrates from soil COCs were found to be negligible based on a vegetation health and community study.

- Risks to aquatic life from sediment COCs were found to be negligible based on HQs that considered average concentrations and site-specific toxicity testing.
- Risks to aquatic life from surface water COCs were found to be negligible based on site-specific toxicity testing.
- Based on these results, no further work or RMMs are recommended for ecological receptors.

The HHERA can be found under separate cover (WSP, 2023b).

## 8.0 APPROXIMATE SCHEDULE FOR IMPLEMENTATION OF NEXT STEPS

The following is an approximate timeline for implementation of next steps of the RRMS and remediation:

- Summer 2022-23: Remediation tendering process
- Fall 2023: Remediation

## 9.0 CONCLUSIONS

A Remedial and Risk Management Strategy has been developed. This report includes the extents of impacts in the firing area, and quantities of impacted material to be remediated. Results of the risk assessment are covered under separate cover. A Class A cost estimate is provided under separate cover.

## 10.0 LIMITATIONS

This report was prepared for the exclusive use of DCC and DND for the express purpose of providing advice with respect to the environmental condition of the Site. In evaluating the Site, WSP Canada Inc. has relied in good faith on information provided by others as noted in the Report. We have assumed that the information provided is factual and accurate. We accept no responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or fraudulent acts of persons interviewed or contacted.

Any use which a third party makes of this Report, or any reliance on or decisions to be made based on it, are the sole responsibility of the third parties. If a third party require reliance on this Report, written authorization from WSP is required. Failing such authorization, WSP disclaims responsibility to third parties of consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

The scope and the period of WSP's assessment are described in this Report, and are subject to the restrictions, assumptions and limitations described herein. Except as noted herein, the work was conducted in accordance with the scope of work and terms and conditions within WSP's proposal. WSP did not perform a complete assessment of all possible conditions or circumstances that may exist at the Site referenced in the Report. Conditions may therefore exist which were not detected given the limited nature of the assessment WSP was retained to undertake with respect to the Site and additional environmental studies and actions may be required. In addition, it is recognized that the passage of time affects the information provided in the Report. WSP's opinions are based upon information that existed at the time of the writing of the Report. It is understood that the services provided for in the scope of work allowed WSP to form no more than an opinion of the actual conditions at the Site at the time the Site was visited, and cannot be used to assess the effect of any subsequent changes in any laws, regulations, the environmental quality of the Site or its surroundings. If a service is not expressly indicated, do not assume it has been provided.

The results of an assessment of this nature should in no way be construed as a warranty that the Site is free from any and all contamination from past or current practices.



## 11.0 REFERENCES

- Golder, 2021. Steps 1 to 4 of the Federal Approach to Contaminated Sites at the Former Burgeo Range, NL. Golder Project Number 20439355. March 5, 2021.
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- O'Brien, S.J. and Dickson, W.L. (compilers), 1986. Geology, Burgeo, Newfoundland. Map 86-32. Scale: 1:250,000. Government of Newfoundland and Labrador, Department of Mines and Energy, Mineral Development Division. GS# 011P/0119.
- WSP, 2023. Steps 5 to 7 of the Federal Approach to Contaminated Sites, Former Burgeo Rifle Range, Burgeo, NL. WSP Project Number 22532464. March 2023.
- WSP, 2023b. Human Health and Ecological Risk Assessment, Former Burgeo Rifle Range, Burgeo, NL. WSP Project Number 22532464. March 2023.

## Signature Page

**WSP Canada Inc.**



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PC/JD/SM/LR/AO/ha

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**Table 1: Analytical Results - Metals in Surficial Soil TCLP Leachate  
Burgeon Firing Range, 9 Wing Gander, NL**

Location	R.R.O. 1990, REGULATION 347	Units	BF-TP23-01	BF-TP23-02	BF-TP23-03	BF-TP23-04	
	GENERAL SCHEDULE 4 LEACHATE QUALITY CRITERIA (mg/L)		BF-TP23-01	BF-TP23-02	BF-TP23-03	BF-TP23-04	BF-TP23-DUP2
Sample ID			0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Sample Depth (mbgs)			Composite	Composite	Composite	Composite	Composite
Sample Type			2023-07-13	2023-07-13	2023-07-13	2023-07-13	2023-07-13
Date Collected							
Aluminum Leachate	-	mg/L	0.552	0.662	1.32	0.911	0.94
Antimony Leachate	-	mg/L	0.034	1.56	0.047	0.016	<0.010
Arsenic Leachate	2.5	mg/L	<0.010	0.048	<0.010	<0.010	<0.010
Barium Leachate	100	mg/L	0.057	0.137	0.053	0.043	0.052
Beryllium Leachate	-	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth Leachate	-	mg/L	<0.008	<0.008	<0.008	<0.008	<0.008
Boron Leachate	500	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Cadmium Leachate	0.5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium Leachate	5	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Cobalt Leachate	-	mg/L	0.001	0.004	<0.001	<0.001	<0.001
Copper Leachate	-	mg/L	0.4	5.53	<0.080	<0.080	<0.080
Iron Leachate	-	mg/L	<0.200	<0.200	0.331	0.204	<0.200
Lead Leachate	5	mg/L	<b>11</b>	<b>276</b>	4.87	0.771	0.486
Mercury Leachate	0.1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese Leachate	-	mg/L	0.111	0.253	0.04	<0.020	<0.020
Molybdenum Leachate	-	mg/L	<0.002	0.002	<0.002	<0.002	<0.002
Nickel Leachate	-	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Selenium Leachate	1	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020
Silver Leachate	5	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Strontium Leachate	-	mg/L	0.019	0.028	0.017	0.008	0.013
Thallium Leachate	-	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium Leachate	-	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Vanadium Leachate	10	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020
Zinc Leachate	-	mg/L	0.084	0.39	<0.050	0.052	<0.050

**Notes:**

NA = Not Applicable

- = No Guideline Available

mbgs = metres below ground surface

&lt; = concentration is below Reportable Detection Limit (RDL)

**Exceedance Identification:****Bold and shaded = exceedance of leachate quality criteria**

Reference: Government of Ontario. Revised Regulations of Ontario (R.R.O.), General – Waste Management, Regulation 347, 1990.

**Table 1: Analytical Results - Metals in Surficial Soil TCLP Leachate  
Burgeon Firing Range, 9 Wing Gander, NL**

Location	R.R.O. 1990, REGULATION 347	Units	BF-TP23-05	BF-TP23-06	BF-TP23-07	BF-TP23-08	BF-TP23-09
	GENERAL SCHEDULE 4 LEACHATE QUALITY CRITERIA (mg/L)		BF-TP23-05	BF-TP23-06	BF-TP23-07	BF-TP23-08	BF-TP23-09
Sample ID			0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Sample Depth (mbgs)			Composite	Composite	Composite	Composite	Composite
Sample Type			2023-07-13	2023-07-13	2023-07-13	2023-07-13	2023-07-13
Date Collected							
Aluminum Leachate	-	mg/L	0.278	0.912	1.36	0.684	0.160
Antimony Leachate	-	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic Leachate	2.5	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Barium Leachate	100	mg/L	0.023	0.04	0.073	0.037	<0.020
Beryllium Leachate	-	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth Leachate	-	mg/L	<0.008	<0.008	<0.008	<0.008	<0.008
Boron Leachate	500	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Cadmium Leachate	0.5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium Leachate	5	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Cobalt Leachate	-	mg/L	<0.001	0.001	0.002	0.002	<0.001
Copper Leachate	-	mg/L	0.082	<0.080	0.106	<0.080	<0.080
Iron Leachate	-	mg/L	<0.200	<0.200	0.476	<0.200	<0.200
Lead Leachate	5	mg/L	0.332	1.27	0.425	0.315	0.098
Mercury Leachate	0.1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese Leachate	-	mg/L	<0.020	0.048	0.083	0.081	<0.020
Molybdenum Leachate	-	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel Leachate	-	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Selenium Leachate	1	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020
Silver Leachate	5	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Strontium Leachate	-	mg/L	0.021	0.009	0.031	0.01	0.026
Thallium Leachate	-	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium Leachate	-	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Vanadium Leachate	10	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020
Zinc Leachate	-	mg/L	<0.050	<0.050	<0.050	0.087	<0.050

**Notes:**

NA = Not Applicable

- = No Guideline Available

mbgs = metres below ground surface

&lt; = concentration is below Reportable Detection Limit (RDL)

**Exceedance Identification:****Bold and shaded = exceedance of leachate quality criteria**

Reference: Government of Ontario. Revised Regulations of Ontario (R.R.O.), General – Waste Management, Regulation 347, 1990.

**Table 1: Analytical Results - Metals in Surficial Soil TCLP Leachate  
Burgeon Firing Range, 9 Wing Gander, NL**

Location	R.R.O. 1990, REGULATION 347	Units	BF-TP23-10	BF-TP23-11	BF-TP23-12	BF-TP23-13	
	GENERAL SCHEDULE 4 LEACHATE QUALITY CRITERIA (mg/L)		BF-TP23-10	BF-TP23-11	BF-TP23-12	BF-TP23-13	BF-TP23-DUP1
Sample ID			0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15	0 - 0.15
Sample Depth (mbgs)			Composite	Composite	Composite	Composite	Composite
Sample Type			2023-07-13	2023-07-13	2023-07-13	2023-07-13	2023-07-13
Date Collected							
Aluminum Leachate	-	mg/L	0.194	0.100	0.877	0.514	0.114
Antimony Leachate	-	mg/L	<0.010	<0.010	<0.010	0.011	0.028
Arsenic Leachate	2.5	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Barium Leachate	100	mg/L	<0.020	0.022	0.111	0.044	0.035
Beryllium Leachate	-	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Bismuth Leachate	-	mg/L	<0.008	<0.008	<0.008	<0.008	<0.008
Boron Leachate	500	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Cadmium Leachate	0.5	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium Leachate	5	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Cobalt Leachate	-	mg/L	<0.001	<0.001	0.009	<0.001	<0.001
Copper Leachate	-	mg/L	0.086	0.087	0.084	0.116	0.091
Iron Leachate	-	mg/L	<0.200	<0.200	0.309	0.707	<0.200
Lead Leachate	5	mg/L	0.226	0.177	0.199	1.94	1.75
Mercury Leachate	0.1	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Manganese Leachate	-	mg/L	<0.020	<0.020	0.453	0.082	0.093
Molybdenum Leachate	-	mg/L	<0.002	<0.002	<0.002	0.002	<0.002
Nickel Leachate	-	mg/L	<0.010	<0.010	<0.010	0.016	<0.010
Selenium Leachate	1	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020
Silver Leachate	5	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Strontium Leachate	-	mg/L	0.036	0.037	0.133	0.065	0.058
Thallium Leachate	-	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium Leachate	-	mg/L	<0.050	<0.050	<0.050	<0.050	<0.050
Vanadium Leachate	10	mg/L	<0.020	<0.020	<0.020	<0.020	<0.020
Zinc Leachate	-	mg/L	<0.050	<0.050	0.563	0.191	0.098

**Notes:**

NA = Not Applicable

- = No Guideline Available

mbgs = metres below ground surface

&lt; = concentration is below Reportable Detection Limit (RDL)

**Exceedance Identification:****Bold and shaded = exceedance of leachate quality criteria**

Reference: Government of Ontario. Revised Regulations of Ontario (R.R.O.), General – Waste Management, Regulation 347, 1990.

**Table 1: Analytical Results - Metals in Surficial Soil TCLP Leachate  
Burgeo Firing Range, 9 Wing Gander, NL**

Location	R.R.O. 1990, REGULATION 347	Units	BF-TP23-14	BF-TP23-15	BF-TP23-16
	GENERAL SCHEDULE 4 LEACHATE QUALITY CRITERIA (mg/L)		BF-TP23-14	BF-TP23-15	BF-TP23-16
Sample ID		0 - 0.15	0 - 0.15	0 - 0.15	
Sample Depth (mbgs)		Composite	Composite	Composite	
Sample Type		2023-07-13	2023-07-13	2023-07-13	
Date Collected					
Aluminum Leachate	-	mg/L	0.126	0.139	0.073
Antimony Leachate	-	mg/L	<0.010	<0.010	0.056
Arsenic Leachate	2.5	mg/L	<0.010	<0.010	<0.010
Barium Leachate	100	mg/L	0.031	<0.020	0.041
Beryllium Leachate	-	mg/L	<0.010	<0.010	<0.010
Bismuth Leachate	-	mg/L	<0.008	<0.008	<0.008
Boron Leachate	500	mg/L	<0.050	<0.050	<0.050
Cadmium Leachate	0.5	mg/L	<0.01	<0.01	<0.01
Chromium Leachate	5	mg/L	<0.050	<0.050	<0.050
Cobalt Leachate	-	mg/L	<0.001	<0.001	<0.001
Copper Leachate	-	mg/L	<0.080	<0.080	0.089
Iron Leachate	-	mg/L	<0.200	<0.200	<0.200
Lead Leachate	5	mg/L	0.09	0.075	1.27
Mercury Leachate	0.1	mg/L	<0.01	<0.01	<0.01
Manganese Leachate	-	mg/L	<0.020	0.062	0.071
Molybdenum Leachate	-	mg/L	<0.002	<0.002	<0.002
Nickel Leachate	-	mg/L	<0.010	<0.010	<0.010
Selenium Leachate	1	mg/L	<0.020	0.021	<0.020
Silver Leachate	5	mg/L	<0.010	<0.010	<0.010
Strontium Leachate	-	mg/L	0.074	0.034	0.058
Thallium Leachate	-	mg/L	<0.010	<0.010	<0.010
Uranium Leachate	-	mg/L	<0.050	<0.050	<0.050
Vanadium Leachate	10	mg/L	<0.020	<0.020	<0.020
Zinc Leachate	-	mg/L	<0.050	<0.050	0.064

**Notes:**

NA = Not Applicable

- = No Guideline Available

mbgs = metres below ground surface

&lt; = concentration is below Reportable Detection Limit (RDL)

**Exceedance Identification:****Bold and shaded = exceedance of leachate quality criteria**

Reference: Government of Ontario. Revised Regulations of Ontario (R.R.O.), General – Waste Management, Regulation 347, 1990.

**Table 2: Relative Percent Difference Calculations**  
**Burgeo Firing Range, 9 Wing Gander, NL**

Location	RDL	Units	BF-TP23-04		RPD (%)	BF-TP23-13		RPD (%)
			BF-TP23-04	BF-TP23-DUP2		BF-TP23-13	BF-TP23-DUP1	
Sample ID			0 - 0.15	0 - 0.15		0 - 0.15	0 - 0.15	
Sample Depth (mbgs)			Composite	Composite		Composite	Composite	
Sample Type			2023-07-13	2023-07-13		2023-07-13	2023-07-13	
Aluminum Leachate	0.050	mg/L	0.911	0.94	1%	0.514	0.114	32%
Antimony Leachate	0.010	mg/L	0.016	<0.010	-	0.011	0.028	-
Arsenic Leachate	0.010	mg/L	<0.010	<0.010	-	<0.010	<0.010	-
Barium Leachate	0.020	mg/L	0.043	0.052	5%	0.044	0.035	-
Beryllium Leachate	0.010	mg/L	<0.010	<0.010	-	<0.010	<0.010	-
Bismuth Leachate	0.008	mg/L	<0.008	<0.008	-	<0.008	<0.008	-
Boron Leachate	0.050	mg/L	<0.050	<0.050	-	<0.050	<0.050	-
Cadmium Leachate	0.01	mg/L	<0.01	<0.01	-	<0.01	<0.01	-
Chromium Leachate	0.050	mg/L	<0.050	<0.050	-	<0.050	<0.050	-
Cobalt Leachate	0.001	mg/L	<0.001	<0.001	-	<0.001	<0.001	-
Copper Leachate	0.080	mg/L	<0.080	<0.080	-	0.116	0.091	-
Iron Leachate	0.200	mg/L	0.204	<0.200	-	0.707	<0.200	-
Lead Leachate	0.010	mg/L	0.771	0.486	11%	1.94	1.75	3%
Mercury Leachate	0.01	mg/L	<0.01	<0.01	-	<0.01	<0.01	-
Manganese Leachate	0.002	mg/L	<0.020	<0.020	-	0.082	0.093	3%
Molybdenum Leachate	0.002	mg/L	<0.002	<0.002	-	0.002	<0.002	-
Nickel Leachate	0.010	mg/L	<0.010	<0.010	-	0.016	<0.010	-
Selenium Leachate	0.020	mg/L	<0.020	<0.020	-	<0.020	<0.020	-
Silver Leachate	0.010	mg/L	<0.010	<0.010	-	<0.010	<0.010	-
Strontium Leachate	0.003	mg/L	0.008	0.013	12%	0.065	0.058	3%
Thallium Leachate	0.010	mg/L	<0.010	<0.010	-	<0.010	<0.010	-
Uranium Leachate	0.050	mg/L	<0.050	<0.050	-	<0.050	<0.050	-
Vanadium Leachate	0.020	mg/L	<0.020	<0.020	-	<0.020	<0.020	-
Zinc Leachate	0.050	mg/L	0.052	<0.050	-	0.191	0.098	-

**Notes:**

NA = Not Applicable

NGA = No Guideline Available

mbgs = metres below ground surface

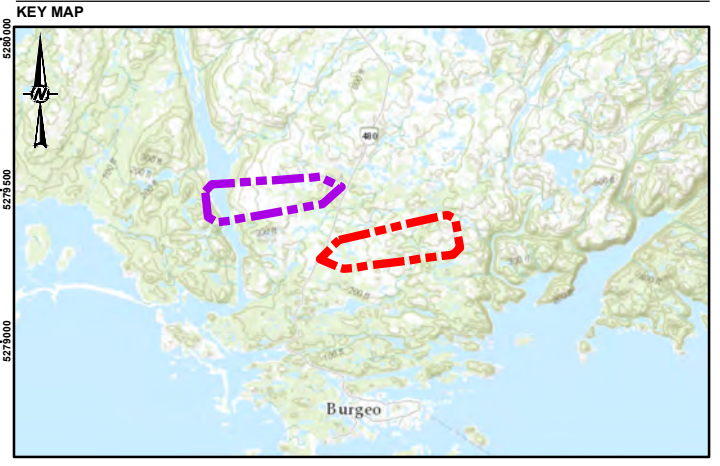
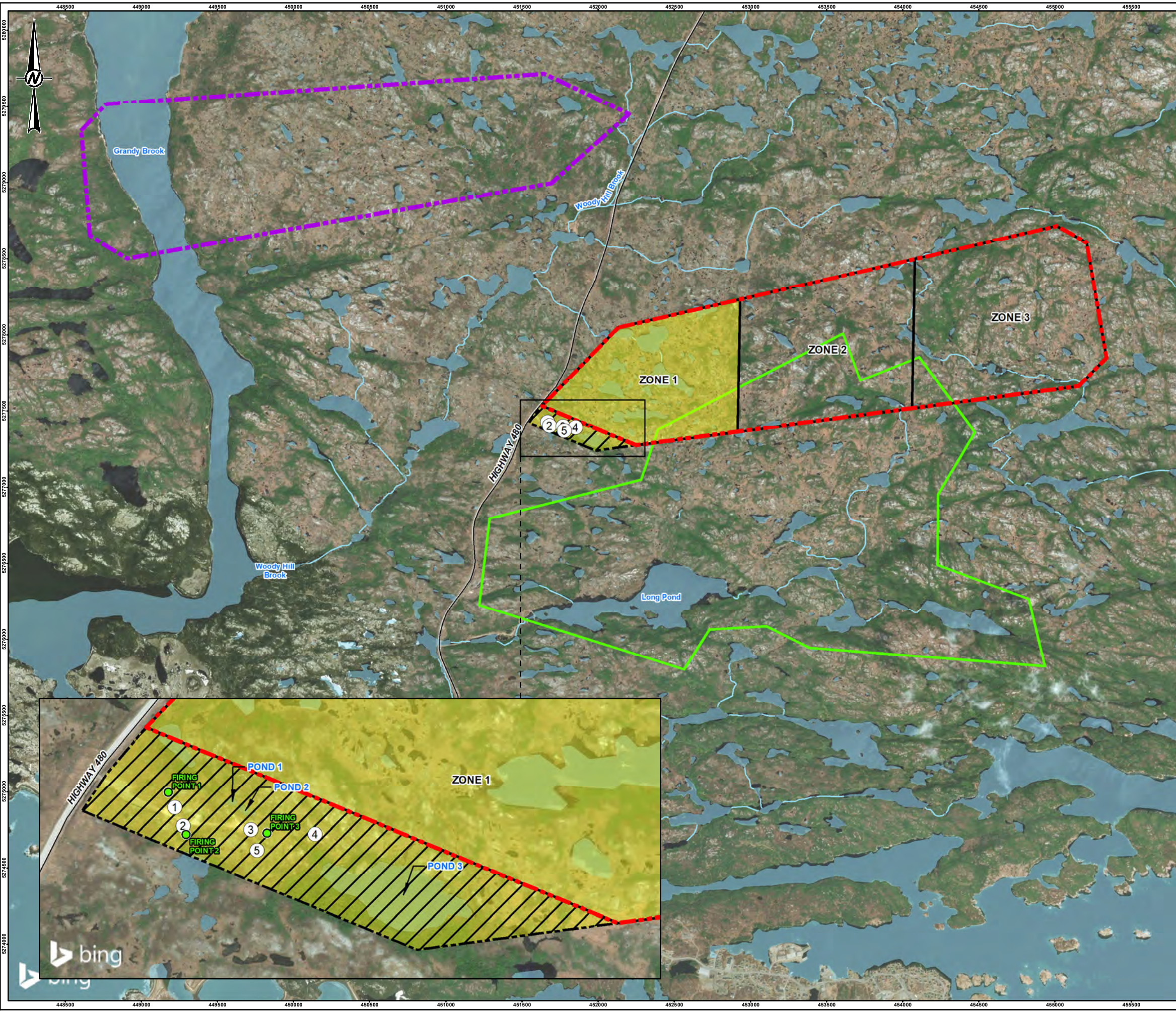
&lt; = concentration is below Reportable Detection Limit (RDL)

RPD = relative percent difference, as calculated using the equation provided below, where x1 is the concentration of a given analyte in the parent sample, and x2 is the concentration of the same analyte in the duplicate sample. RPD is considered calculable if the concentration of either the parent or duplicate sample is above the RDL; if a concentration is detected in only one of the two, the RDL is used for the concentration below the RDL.

$$RPD = \frac{x_1 - x_2}{\frac{x_1 + x_2}{2}} \times 100$$

**Exceedance Identification:**

**Bold and shaded = exceedance of data quality objectives**



- LEGEND**
- ① APPROXIMATE RANGERS TARGET PRACTICE SHOOTING LOCATION
  - ② APPROXIMATE LOCATION OF LOCAL RESIDENTS' CLAY TARGET SHOOTING AREA
  - ③ APPROXIMATE LOCATION OF BACKSTOP (BULLET CATCH)
  - ④ APPROXIMATE FORMER LOCATION OF WOODEN TARGETS USED BY LOCAL RESIDENTS
  - ⑤ APPROXIMATE LOCATION WHERE LOCAL RESIDENTS SETUP TO SHOOT ACROSS WATERBODY
  - ROADWAY
  - WATERCOURSE
  - WATERBODY
  - PROTECTED PUBLIC WATER SUPPLY
  - ADDITIONAL PROPOSED LEASED LANDS/FIRING AREA
  - ZONE BOUNDARY
  - RISK ASSESSMENT AREA
  - LOCATION 1
  - LOCATION 2

**NOTE(S)**  
 1. ALL LOCATIONS ARE APPROXIMATE

**REFERENCE(S)**  
 1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES  
 2. KEY MAP: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY  
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 3. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.  
 4. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

0 275 550 1,100  
 1:25,000 METRES

CLIENT  
 DEFENCE CONSTRUCTION CANADA (DCC)

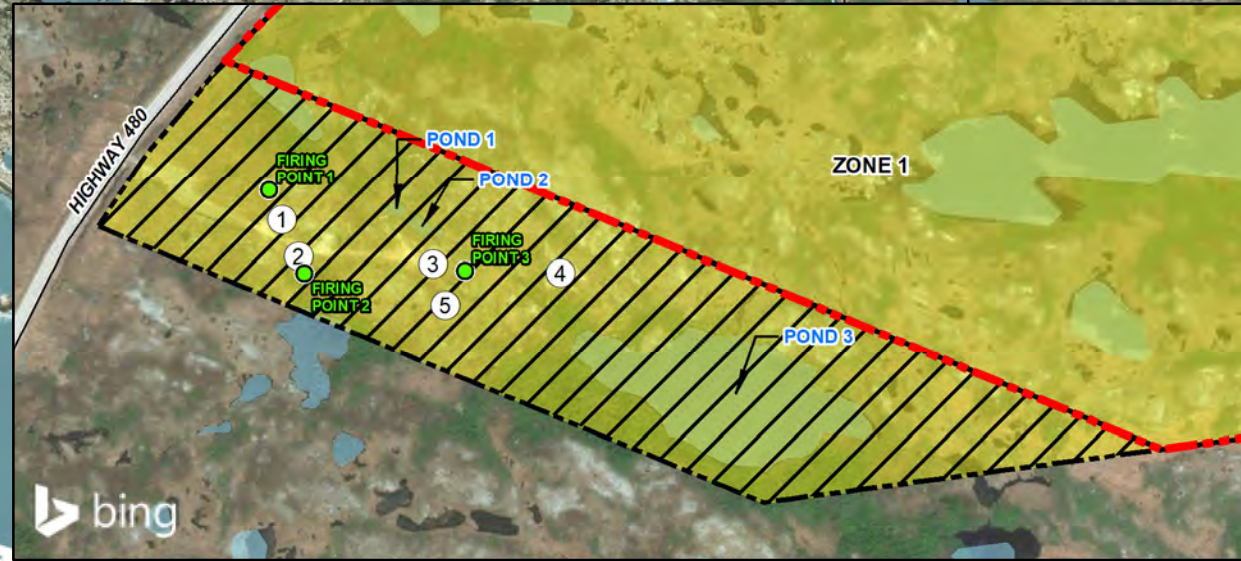
PROJECT  
 BURGEO FIRING RANGE  
 9 WING GANDER, NL

TITLE  
 SITE PLAN

CONSULTANT	YYYY-MM-DD	2023-03-03
DESIGNED	---	
PREPARED	JEM	
REVIEWED	JD	
APPROVED	SM	

PROJECT NO. 22532464 CONTROL 0004 REV. 0

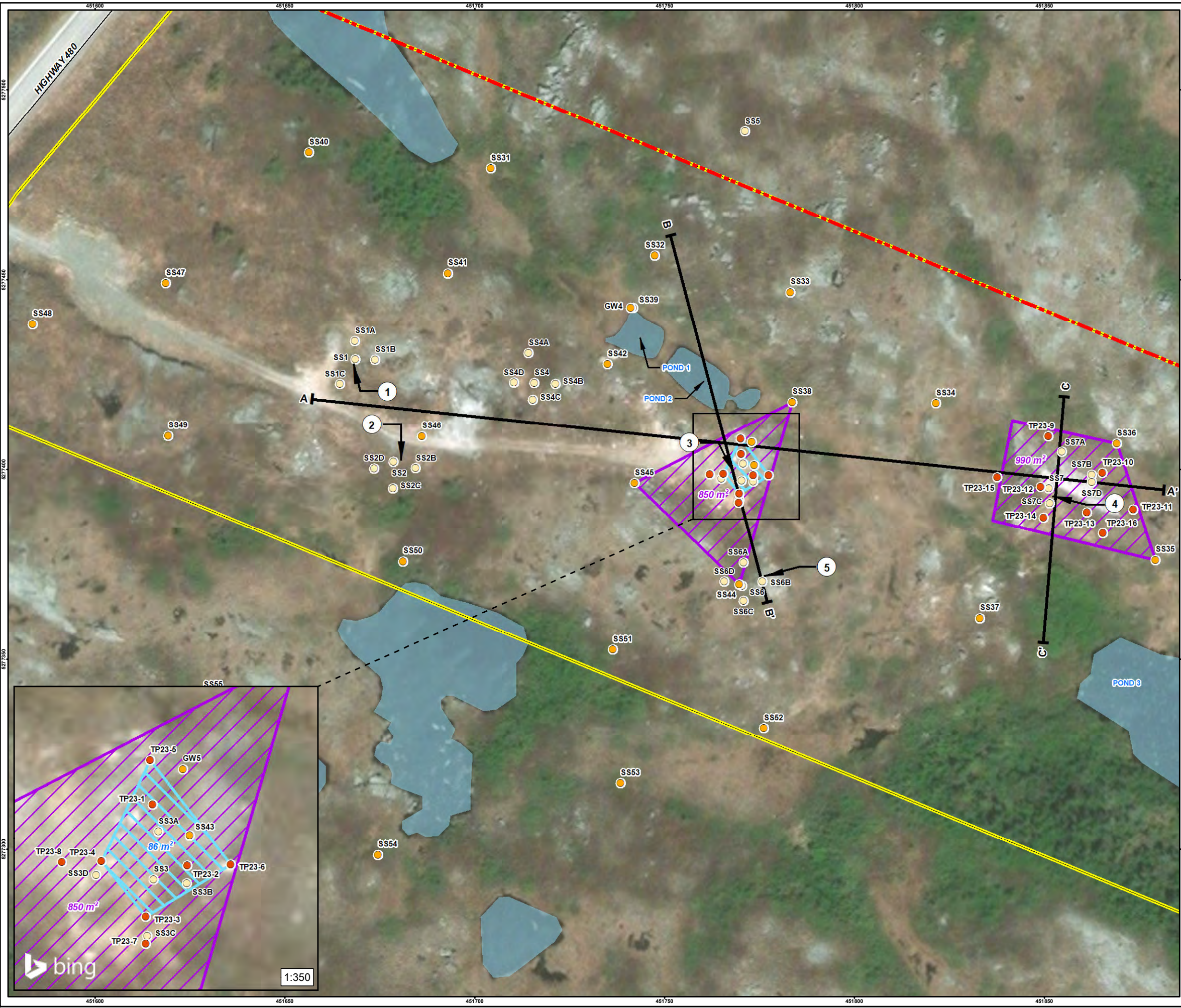
FIGURE 1



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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 28mm





**LEGEND**

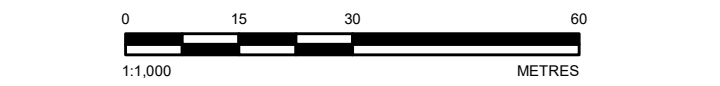
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- APPROXIMATE SOIL SAMPLE LOCATION (2022)
- APPROXIMATE SOIL SAMPLE LOCATION (2020/21)
- ROADWAY
- CROSS-SECTION LOCATION
- WATERBODY
- ▨ DELINEATED AREA OF HAZARDOUS WASTE
- ▨ DELINEATED AREA OF NON-HAZARDOUS WASTE
- ▭ PROPOSED ADDITIONAL LEASE AREA
- ▭ ZONE BOUNDARY
- ▭ SITE

**NOTE(S)**

1. ALL LOCATIONS ARE APPROXIMATE
2. APPROXIMATE 2023 SOIL SAMPLE LOCATION NAMES ABBREVIATED (I.E., EXCLUDING "BF-" PREFIX)

**REFERENCE(S)**

1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28



CLIENT  
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT  
BURGEO FIRING RANGE  
9 WING GANDER, NL

TITLE  
**LOCATION 1 - ZONE 1 - FIRING AREA - DELINEATION OF CONTAMINATED SOIL**

CONSULTANT	YYYY-MM-DD	2023-07-26
DESIGNED	---	
PREPARED	JEM/MG	
REVIEWED	JD	
APPROVED	SM	

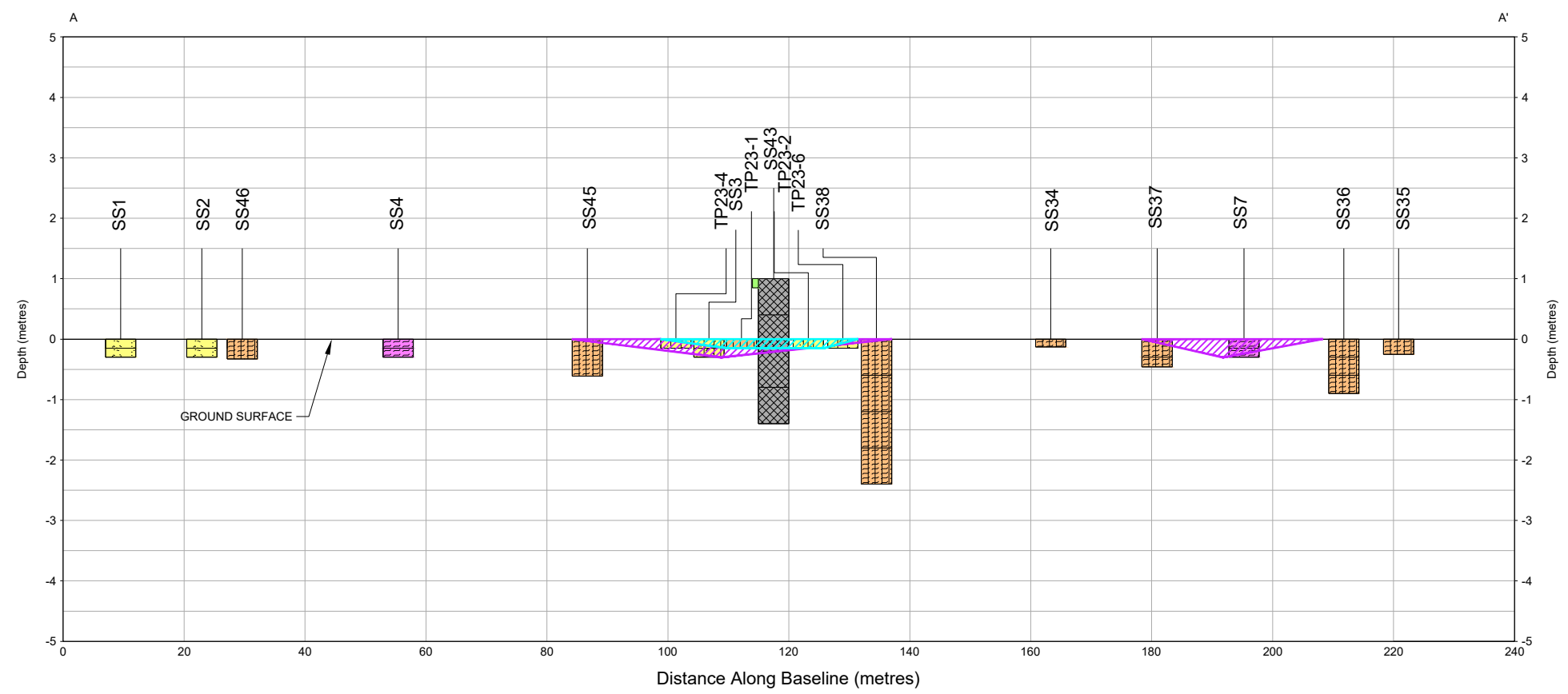
PROJECT NO. 22532464 CONTROL 0004 REV. 0

FIGURE 2

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 29mm

Path: \\gpc\proj\22532464\004\HS\004.dwg | Last Edited By: mkeenan Date: 2023-07-28 Time: 9:09:14 AM | Printed By: Mkeenan Date: 2023-07-28 Time: 10:53:39 AM



**LEGEND**

BOREHOLE/MONITORING IDENTIFIER → SS1

GROUNDWATER LEVEL →

STRATIGRAPHY →

WELL SCREEN →

SAND

SILTY SAND

ORGANIC SILT

TOPSOIL

FILL

EXTENT OF NON-HAZARDOUS SOIL IMPACTS

EXTENT OF HAZARDOUS SOIL IMPACTS

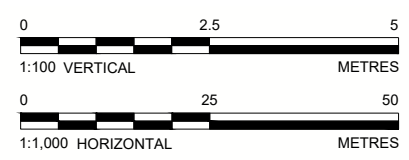
- NOTE(S)**
1. ALL LOCATIONS ARE APPROXIMATE
  2. FOR DETAILED STRATIGRAPHY SEE RECORD OF BOREHOLE LOGS
  3. FOR CROSS-SECTION LOCATION SEE FIGURE 10B
  4. ALL SOIL, SEDIMENT, AND SURFACE WATER LOCATIONS ARE APPROXIMATE, MONITORING WELLS HAVE BEEN SURVEYED
  5. APPROXIMATE 2023 SOIL SAMPLE LOCATION NAMES ABBREVIATED (I.E., EXCLUDING "BF-" PREFIX)

CLIENT  
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT  
BURGEO FIRING RANGE  
9 WING GANDER, NL

TITLE  
**CROSS-SECTION A-A'**

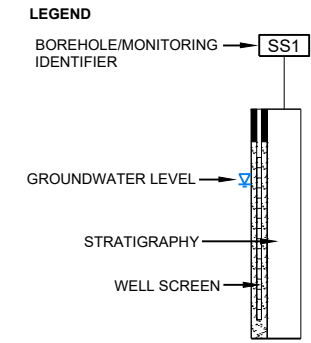
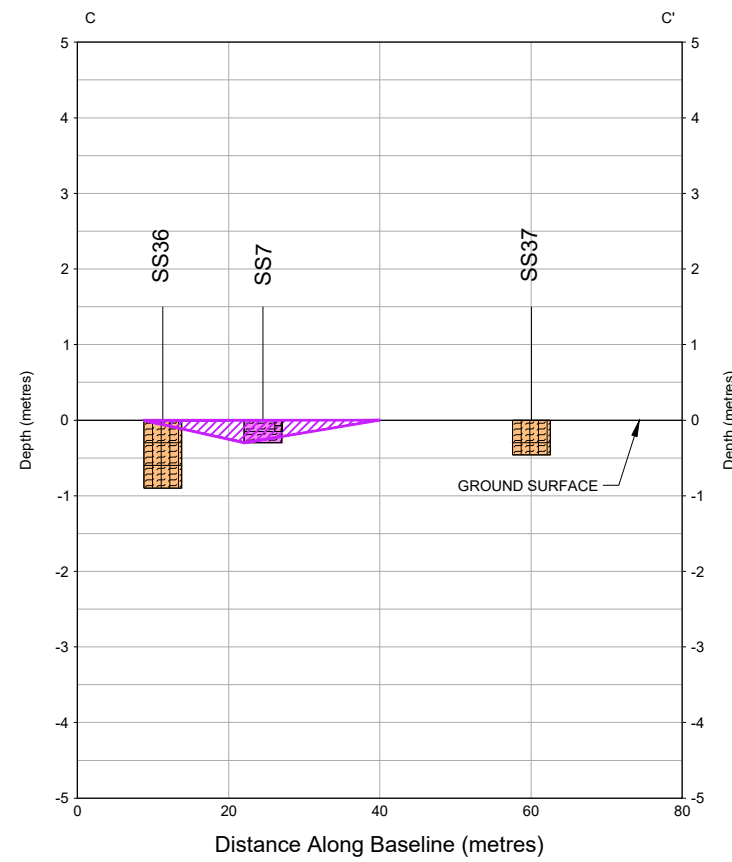
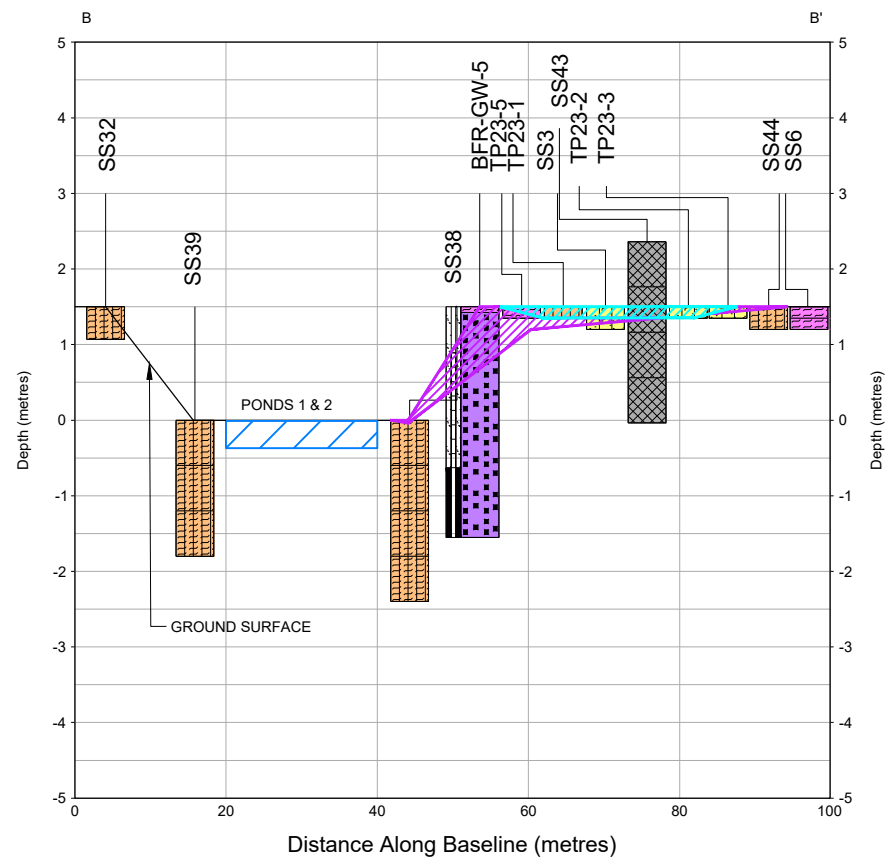
CONSULTANT	WSP	YYYY-MM-DD	2023-03-03
DESIGNED			
PREPARED		DM/SA	
REVIEWED		JD	
APPROVED		SM	



PROJECT NO. 22532464 CONTROL 0004 REV. 0 FIGURE 3A

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANS/B 25 mm

Path: \\gpc\p\proj\22532464\004\SS\1009\_PROD\22532464\_DCC\_Emilia\0\_PROD\004\_Borehole\_Assessment\_1\_Fig\_Name\_22532464-0004-SS-03B.dwg | Last Edited By: mkeenan | Date: 2023-07-28 | Time: 10:52:17 AM | Printed By: MKeenan | Date: 2023-07-28 | Time: 10:52:50 AM



- LEGEND**
- DIORITE
  - SAND
  - SILTY SAND
  - ORGANIC SILT
  - TOPSOIL
  - FILL
  - EXTENT OF NON-HAZARDOUS SOIL IMPACTS
  - EXTENT OF HAZARDOUS SOIL IMPACTS

- NOTE(S)**
1. ALL LOCATIONS ARE APPROXIMATE
  2. FOR DETAILED STRATIGRAPHY SEE RECORD OF BOREHOLE LOGS
  3. FOR CROSS-SECTION LOCATION SEE FIGURE 10B
  4. ALL SOIL, SEDIMENT, AND SURFACE WATER LOCATIONS ARE APPROXIMATE, MONITORING WELLS HAVE BEEN SURVEYED
  5. APPROXIMATE 2023 SOIL SAMPLE LOCATION NAMES ABBREVIATED (I.E., EXCLUDING "BF-" PREFIX)

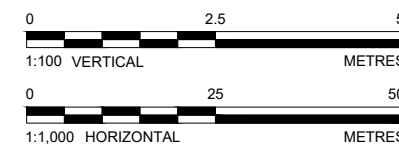
CLIENT  
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT  
BURGEO FIRING RANGE  
9 WING GANDER, NL

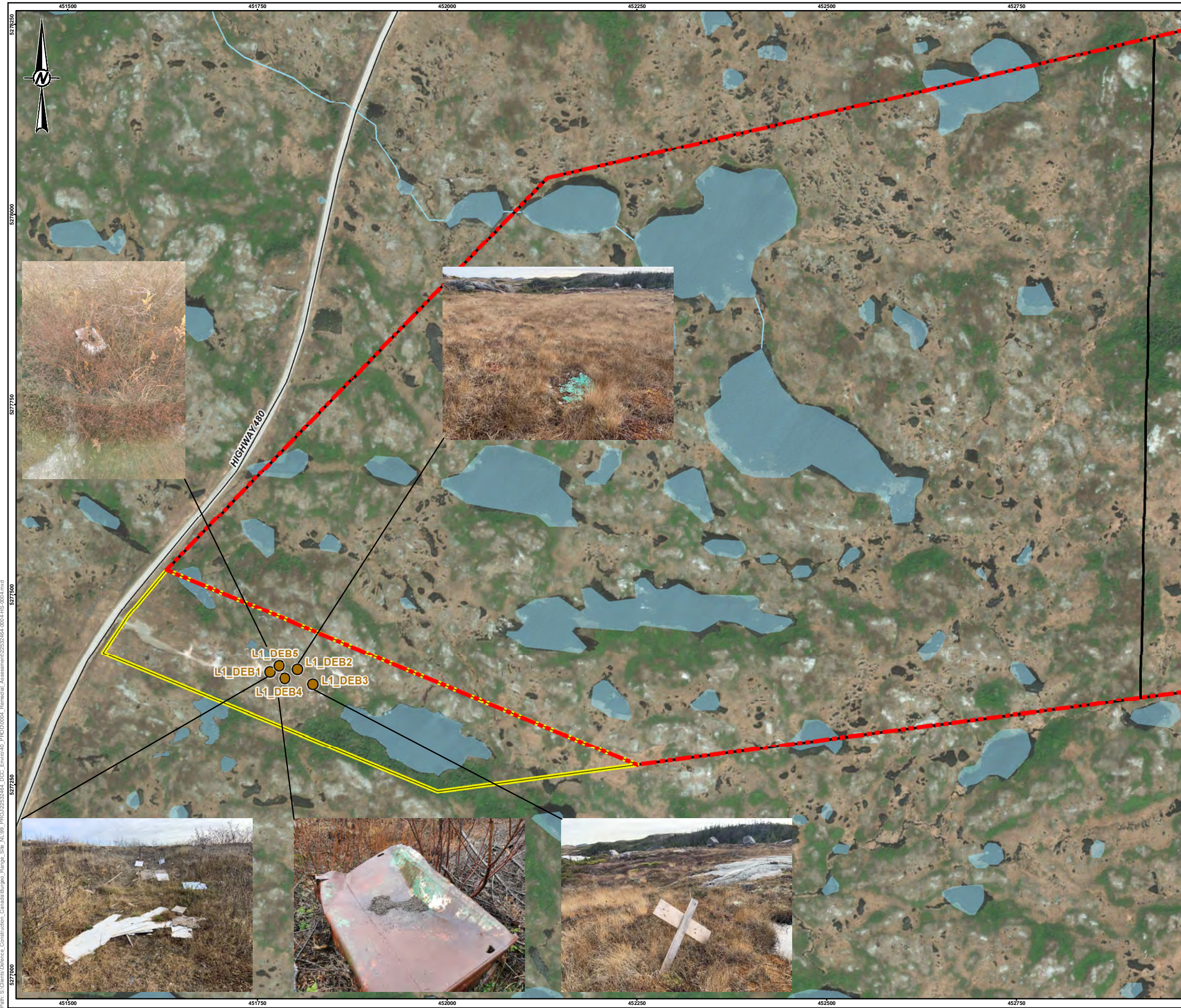
TITLE  
CROSS-SECTION'S B-B' AND C-C'

CONSULTANT	YYYY-MM-DD	2023-03-03
	DESIGNED	---
	PREPARED	DM/SA
	REVIEWED	JD
	APPROVED	SM

PROJECT NO. 22532464 CONTROL 0004 REV. 0 FIGURE 3B



IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A3/B



**LEGEND**

- APPROXIMATE DEBRIS LOCATION
- ROADWAY
- WATERCOURSE
- WATERBODY
- ▭ PROPOSED ADDITIONAL LEASE AREA
- ▭ ZONE BOUNDARY
- ▭ SITE

Debris ID	Description	Approximate Quantity
L1_DEB_1	General refuse found at firing backstop. Includes household waste, targets, spent shotgun shells, spent rifle cartridges, and spent ammunition.	~1m <sup>3</sup>
L1_DEB_2	Plastic target behind backstop. Includes spent shotgun shells.	~1m <sup>3</sup>
L1_DEB_3	Wooden stakes and cardboard target.	~1m <sup>3</sup>
L1_DEB_4	Rusted tank used as target. Includes spent ammunition, spent rifle cartridges and spent ammunition.	~1m <sup>3</sup>
L1_DEB_5	Rusted Kitchen sink used as target. Includes spent ammunition.	<1m <sup>3</sup>

**NOTE(S)**  
1. ALL LOCATIONS ARE APPROXIMATE

**REFERENCE(S)**  
1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES  
2. BING IMAGERY SUPPLIED BY ESRI AND MICROSOFT © 2020 MICROSOFT CORPORATION AND ITS DATA SUPPLIERS.  
3. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28

CLIENT  
DEFENCE CONSTRUCTION CANADA (DCC)

PROJECT  
BURGEO FIRING RANGE  
9 WING GANDER, NL

TITLE  
**LOCATION 1 - DEBRIS LOCATIONS**

CONSULTANT

YYYY-MM-DD 2023-03-03

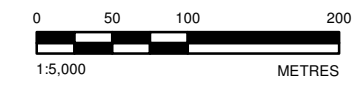
DESIGNED ----

PREPARED JEM/MG

REVIEWED JD

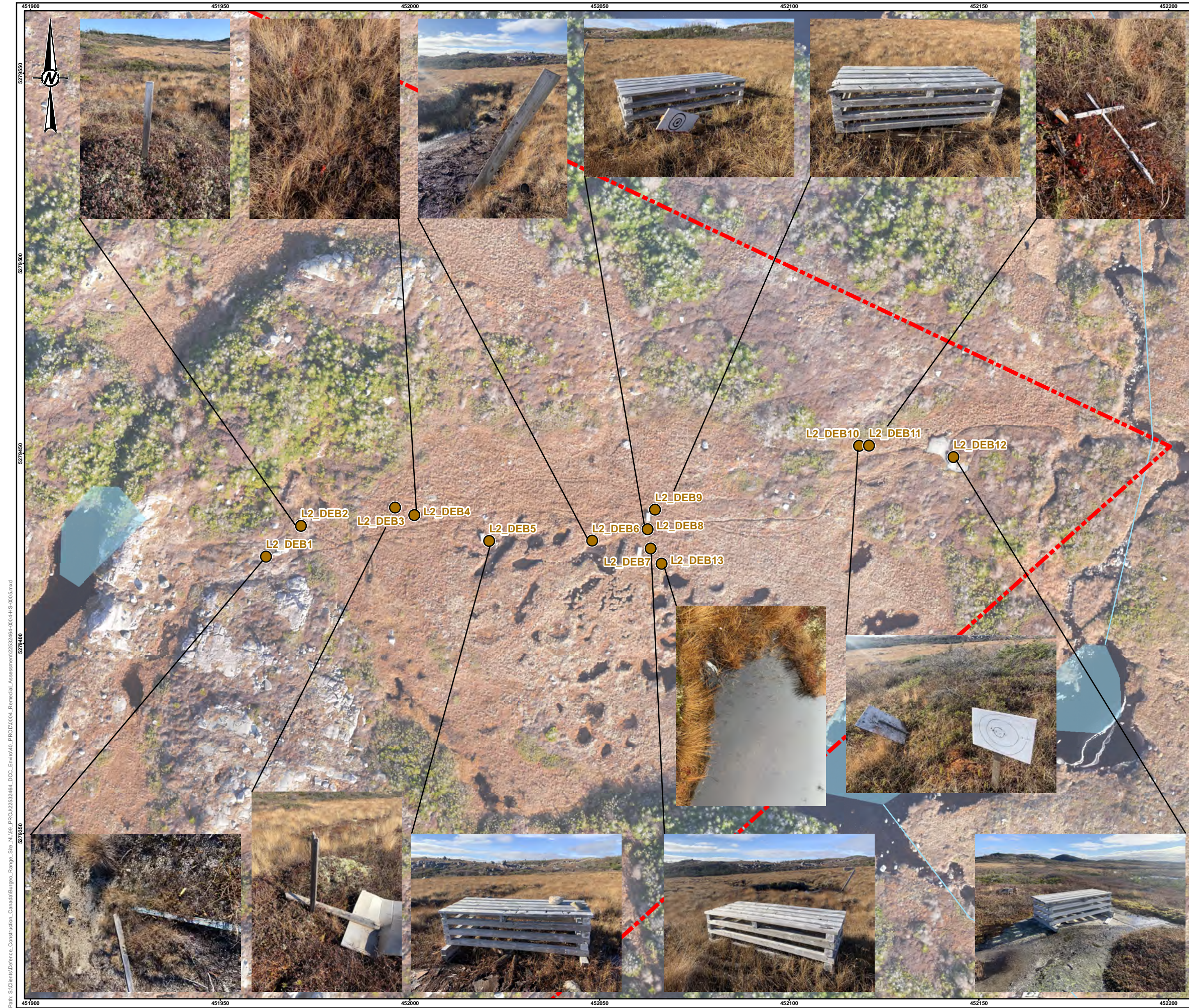
APPROVED SM

PROJECT NO. 22532464 CONTROL 0004 REV. 0 FIGURE 4



Path: S:\Client\Defence Construction Canada\Burgoe\_Range\_Site\_NL\99\_PROJ\22532464\_DCC\_Enviro\04\_PROJ\03004\_Remedial\_Assessment\22532464\_0004\_HS\_0004.mxd

25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:



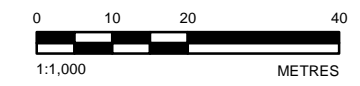
**LEGEND**

- APPROXIMATE DEBRIS LOCATION
- WATERCOURSE
- WATERBODY
- SITE

Debris ID	Description	Approximate Quantity
L2_DEB_1	Wooden stake target and spent ammunition.	<1m <sup>3</sup>
L2_DEB_2	Wooden stakes and spent shotgun shells.	<1m <sup>3</sup>
L2_DEB_3	Wooden stakes and cardboard target.	<1m <sup>3</sup>
L2_DEB_4	Wooden target, spent rifle cartridges and spent ammunition found on pathway towards firing backstop.	<1m <sup>3</sup>
L2_DEB_5	Wooden gun stand, plywood targets and spent rifle cartridges	~1m <sup>3</sup>
L2_DEB_6	Wooden plank target	<1m <sup>3</sup>
L2_DEB_7	Wooden gun stand, plywood targets and spent rifle cartridges	~1m <sup>3</sup>
L2_DEB_8	Wooden gun stand, composite target, spent rifle cartridges and spent ammunition	~1m <sup>3</sup>
L2_DEB_9	Wooden gun stand, plywood targets and spent rifle cartridges	~1m <sup>3</sup>
L2_DEB_10	Wooden stakes with plastic targets and spent ammunition	<1m <sup>3</sup>
L2_DEB_11	Wooden stakes and spent shotgun shells.	<1m <sup>3</sup>
L2_DEB_12	Wooden gun stand, plywood targets and spent rifle cartridges	~1m <sup>3</sup>
L2_DEB_13	Wooden stake and spent shot gun shells	~1m <sup>3</sup>

**NOTE(S)**  
1. ALL LOCATIONS ARE APPROXIMATE

**REFERENCE(S)**  
1. BASE DATA - CANVEC PROVIDED BY HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT OF NATURAL RESOURCES  
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 21, VERTICAL DATUM: CGVD28



CLIENT  
DEFENCE CONSTRUCTION CANADA (DCC)

---

PROJECT  
BURGEO FIRING RANGE  
9 WING GANDER, NL

TITLE  
**LOCATION 2 - DEBRIS LOCATIONS**

---

CONSULTANT	YYYY-MM-DD	2023-03-03
	DESIGNED	----
	PREPARED	JEM/MG
	REVIEWED	JD
	APPROVED	SM

---

PROJECT NO. 22532464	CONTROL 0004	REV. 0	FIGURE <b>5</b>
-------------------------	-----------------	-----------	--------------------

Path: S:\Clients\Defence Construction Canada\Burgoe\_Range\_Site\_NL\99\_PRC\12532464\_DCC\_Enviro\04\_PRC\03004\_Remedial\_Assessment\2532464\_004\_4HS\_0005.mxd

25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

**APPENDIX A**

# Remediation Cost Estimate

**APPENDIX B**

**Laboratory Certificates of Analysis**

**CLIENT NAME: WSP CANADA INC.**  
**1931 ROBERTSON ROAD**  
**OTTAWA, ON K2H5B7**  
**(613) 592-9600**

**ATTENTION TO: JAMES DOYLE**

**PROJECT: 22532464**

**AGAT WORK ORDER: 23K047635**

**SOIL ANALYSIS REVIEWED BY: Sukhwinder Randhawa, Lab Team Leader**

**DATE REPORTED: Jul 20, 2023**

**PAGES (INCLUDING COVER): 8**

**VERSION\*: 1**

Should you require any information regarding this analysis please contact your client services representative at (709)747-8573

\*Notes

**Disclaimer:**

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.
- For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.



# Certificate of Analysis

AGAT WORK ORDER: 23K047635

PROJECT: 22532464

57 Old Pennywell Road, Unit I  
 St. John's, NL  
 CANADA A1E 6A8  
 TEL (709)747-8573  
 FAX (709) 747-2139  
<http://www.agatlabs.com>

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: JAMES DOYLE

SAMPLING SITE:

SAMPLED BY:

## Full Scan TCLP EPA 1311

DATE RECEIVED: 2023-07-17

DATE REPORTED: 2023-07-20

Parameter	Unit	SAMPLE DESCRIPTION: BF-TP23-01		BF-TP23-02		BF-TP23-04		BF-TP23-05		BF-TP23-06		BF-TP23-07	
		SAMPLE TYPE: Soil		Soil		Soil		Soil		Soil		Soil	
		DATE SAMPLED: 2023-07-13		2023-07-13		2023-07-13		2023-07-13		2023-07-13		2023-07-13	
		G / S	RDL	5145691	RDL	5145694	RDL	5145695	5145696	5145697	5145698	5145698	5145698
Aluminum Leachate	mg/L	0.050	0.552	0.050	0.662	0.050	0.911	0.278	0.912	1.36			
Antimony Leachate	mg/L	0.010	0.034	0.010	1.56	0.010	0.016	<0.010	<0.010	<0.010			
Arsenic Leachate	mg/L	0.010	<0.010	0.010	0.048	0.010	<0.010	<0.010	<0.010	<0.010			
Barium Leachate	mg/L	0.020	0.057	0.020	0.137	0.020	0.043	0.023	0.040	0.073			
Beryllium Leachate	mg/L	0.010	<0.010	0.010	<0.010	0.010	<0.010	<0.010	<0.010	<0.010			
Bismuth Leachate	mg/L	0.008	<0.008	0.008	<0.008	0.008	<0.008	<0.008	<0.008	<0.008			
Boron Leachate	mg/L	0.050	<0.050	0.050	<0.050	0.050	<0.050	<0.050	<0.050	<0.050			
Cadmium Leachate	mg/L	0.01	<0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01			
Chromium Leachate	mg/L	0.050	<0.050	0.050	<0.050	0.050	<0.050	<0.050	<0.050	<0.050			
Cobalt Leachate	mg/L	0.001	0.001	0.001	0.004	0.001	<0.001	<0.001	0.001	0.002			
Copper Leachate	mg/L	0.080	0.400	0.080	5.53	0.080	<0.080	0.082	<0.080	0.106			
Iron Leachate	mg/L	0.200	<0.200	0.200	<0.200	0.200	0.204	<0.200	<0.200	0.476			
Lead Leachate	mg/L	0.010	11.0	0.50	276	0.010	0.771	0.332	1.27	0.425			
Manganese Leachate	mg/L	0.020	0.111	0.020	0.253	0.020	<0.020	<0.020	0.048	0.083			
Mercury Leachate	mg/L	0.01	<0.01	0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01			
Molybdenum Leachate	mg/L	0.002	<0.002	0.002	0.002	0.002	<0.002	<0.002	<0.002	<0.002			
Nickel Leachate	mg/L	0.010	<0.010	0.010	<0.010	0.010	<0.010	<0.010	<0.010	<0.010			
Selenium Leachate	mg/L	0.020	<0.020	0.020	<0.020	0.020	<0.020	<0.020	<0.020	<0.020			
Silver Leachate	mg/L	0.010	<0.010	0.010	<0.010	0.010	<0.010	<0.010	<0.010	<0.010			
Strontium Leachate	mg/L	0.003	0.019	0.003	0.028	0.003	0.008	0.021	0.009	0.031			
Thallium Leachate	mg/L	0.010	<0.010	0.010	<0.010	0.010	<0.010	<0.010	<0.010	<0.010			
Titanium Leachate	mg/L	0.050	<0.050	0.050	<0.050	0.050	<0.050	<0.050	<0.050	<0.050			
Uranium Leachate	mg/L	0.050	<0.050	0.050	<0.050	0.050	<0.050	<0.050	<0.050	<0.050			
Vanadium Leachate	mg/L	0.020	<0.020	0.020	<0.020	0.020	<0.020	<0.020	<0.020	<0.020			
Zinc Leachate	mg/L	0.050	0.084	0.050	0.390	0.050	0.052	<0.050	<0.050	<0.050			

Certified By: \_\_\_\_\_



# Certificate of Analysis

AGAT WORK ORDER: 23K047635

PROJECT: 22532464

57 Old Pennywell Road, Unit I  
 St. John's, NL  
 CANADA A1E 6A8  
 TEL (709)747-8573  
 FAX (709) 747-2139  
<http://www.agatlabs.com>

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: JAMES DOYLE

SAMPLING SITE:

SAMPLED BY:

## Full Scan TCLP EPA 1311

DATE RECEIVED: 2023-07-17

DATE REPORTED: 2023-07-20

Parameter	Unit	SAMPLE DESCRIPTION:		BF-TP23-08	BF-TP23-09	BF-TP23-10	BF-TP23-11	BF-TP23-12	BF-TP23-13	BF-TP23-14	BF-TP23-15
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		G / S	RDL	2023-07-13	2023-07-13	2023-07-13	2023-07-13	2023-07-13	2023-07-13	2023-07-13	2023-07-13
Aluminum Leachate	mg/L	0.050	0.684	0.160	0.194	0.100	0.877	0.514	0.126	0.139	
Antimony Leachate	mg/L	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Arsenic Leachate	mg/L	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Barium Leachate	mg/L	0.020	0.037	<0.020	<0.020	0.022	0.111	0.044	0.031	<0.020	
Beryllium Leachate	mg/L	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Bismuth Leachate	mg/L	0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	
Boron Leachate	mg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	
Cadmium Leachate	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Chromium Leachate	mg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	
Cobalt Leachate	mg/L	0.001	0.002	<0.001	<0.001	<0.001	0.009	<0.001	<0.001	<0.001	
Copper Leachate	mg/L	0.080	<0.080	<0.080	0.086	0.087	0.084	0.116	<0.080	<0.080	
Iron Leachate	mg/L	0.200	<0.200	<0.200	<0.200	<0.200	0.309	0.707	<0.200	<0.200	
Lead Leachate	mg/L	0.010	0.315	0.098	0.226	0.177	0.199	1.94	0.090	0.075	
Manganese Leachate	mg/L	0.020	0.081	<0.020	<0.020	<0.020	0.453	0.082	<0.020	0.062	
Mercury Leachate	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Molybdenum Leachate	mg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002	
Nickel Leachate	mg/L	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.016	<0.010	<0.010	
Selenium Leachate	mg/L	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.021	
Silver Leachate	mg/L	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Strontium Leachate	mg/L	0.003	0.010	0.026	0.036	0.037	0.133	0.065	0.074	0.034	
Thallium Leachate	mg/L	0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Titanium Leachate	mg/L	0.050	<0.050	<0.050	<0.050	<0.050	0.141	<0.050	<0.050	<0.050	
Uranium Leachate	mg/L	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	
Vanadium Leachate	mg/L	0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	
Zinc Leachate	mg/L	0.050	0.087	<0.050	<0.050	<0.050	0.563	0.191	<0.050	<0.050	

Certified By:



# Certificate of Analysis

AGAT WORK ORDER: 23K047635

PROJECT: 22532464

57 Old Pennywell Road, Unit I  
 St. John's, NL  
 CANADA A1E 6A8  
 TEL (709)747-8573  
 FAX (709) 747-2139  
<http://www.agatlabs.com>

CLIENT NAME: WSP CANADA INC.

ATTENTION TO: JAMES DOYLE

SAMPLING SITE:

SAMPLED BY:

## Full Scan TCLP EPA 1311

DATE RECEIVED: 2023-07-17

DATE REPORTED: 2023-07-20

Parameter	Unit	SAMPLE DESCRIPTION:		BF-TP23-16	BF-TP23-DUP1	BF-TP23-DUP2	BF-TP23-03
		SAMPLE TYPE:		Soil	Soil	Soil	Soil
		DATE SAMPLED:		2023-07-13	2023-07-13	2023-07-13	2023-07-13
		G / S	RDL	5145707	5145708	5145709	5145736
Aluminum Leachate	mg/L	0.050	0.073	0.114	0.940	1.32	
Antimony Leachate	mg/L	0.010	0.056	0.028	<0.010	0.047	
Arsenic Leachate	mg/L	0.010	<0.010	<0.010	<0.010	<0.010	
Barium Leachate	mg/L	0.020	0.041	0.035	0.052	0.053	
Beryllium Leachate	mg/L	0.010	<0.010	<0.010	<0.010	<0.010	
Bismuth Leachate	mg/L	0.008	<0.008	<0.008	<0.008	<0.008	
Boron Leachate	mg/L	0.050	<0.050	<0.050	<0.050	<0.050	
Cadmium Leachate	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	
Chromium Leachate	mg/L	0.050	<0.050	<0.050	<0.050	<0.050	
Cobalt Leachate	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	
Copper Leachate	mg/L	0.080	0.089	0.091	<0.080	<0.080	
Iron Leachate	mg/L	0.200	<0.200	<0.200	<0.200	0.331	
Lead Leachate	mg/L	0.010	1.27	1.75	0.486	4.87	
Manganese Leachate	mg/L	0.020	0.071	0.093	<0.020	0.040	
Mercury Leachate	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	
Molybdenum Leachate	mg/L	0.002	<0.002	<0.002	<0.002	<0.002	
Nickel Leachate	mg/L	0.010	<0.010	<0.010	<0.010	<0.010	
Selenium Leachate	mg/L	0.020	<0.020	<0.020	<0.020	<0.020	
Silver Leachate	mg/L	0.010	<0.010	<0.010	<0.010	<0.010	
Strontium Leachate	mg/L	0.003	0.058	0.058	0.013	0.017	
Thallium Leachate	mg/L	0.010	<0.010	<0.010	<0.010	<0.010	
Titanium Leachate	mg/L	0.050	<0.050	<0.050	<0.050	<0.050	
Uranium Leachate	mg/L	0.050	<0.050	<0.050	<0.050	<0.050	
Vanadium Leachate	mg/L	0.020	<0.020	<0.020	<0.020	<0.020	
Zinc Leachate	mg/L	0.050	0.064	0.098	<0.050	<0.050	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

5145694 Dilution required, RDL has been increased accordingly.

Analysis performed at AGAT Toronto (unless marked by \*)

Certified By:



## Quality Assurance

CLIENT NAME: WSP CANADA INC.

AGAT WORK ORDER: 23K047635

PROJECT: 22532464

ATTENTION TO: JAMES DOYLE

SAMPLING SITE:

SAMPLED BY:

Soil Analysis															
RPT Date: Jul 20, 2023			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

**Full Scan TCLP EPA 1311**

Aluminum Leachate	5145691	5145691	0.552	0.509	8.1%	< 0.050	102%	70%	130%	109%	80%	120%	111%	70%	130%
Antimony Leachate	5145691	5145691	0.034	0.032	NA	< 0.010	97%	70%	130%	98%	80%	120%	89%	70%	130%
Arsenic Leachate	5145691	5145691	<0.010	<0.010	NA	< 0.010	99%	70%	130%	110%	80%	120%	106%	70%	130%
Barium Leachate	5145691	5145691	0.057	0.054	NA	< 0.020	96%	70%	130%	100%	80%	120%	93%	70%	130%
Beryllium Leachate	5145691	5145691	<0.010	<0.010	NA	< 0.010	98%	70%	130%	105%	80%	120%	103%	70%	130%
Bismuth Leachate	5145691	5145691	<0.008	<0.008	NA	< 0.008	98%	70%	130%	82%	80%	120%	78%	70%	130%
Boron Leachate	5145691	5145691	<0.050	<0.050	NA	< 0.050	98%	70%	130%	103%	80%	120%	85%	70%	130%
Cadmium Leachate	5145691	5145691	<0.01	<0.01	NA	< 0.01	98%	70%	130%	101%	80%	120%	94%	70%	130%
Chromium Leachate	5145691	5145691	<0.050	<0.050	NA	< 0.050	101%	70%	130%	101%	80%	120%	88%	70%	130%
Cobalt Leachate	5145691	5145691	0.001	0.001	NA	< 0.001	98%	70%	130%	96%	80%	120%	86%	70%	130%
Copper Leachate	5145691	5145691	0.400	0.378	NA	< 0.080	97%	70%	130%	95%	80%	120%	94%	70%	130%
Iron Leachate	5145691	5145691	<0.200	<0.200	NA	< 0.200	96%	70%	130%	109%	80%	120%	100%	70%	130%
Lead Leachate	5145691	5145691	11.0	10.2	7.5%	< 0.010	93%	70%	130%	89%	80%	120%	91%	70%	130%
Manganese Leachate	5145691	5145691	0.111	0.104	6.5%	< 0.020	97%	70%	130%	101%	80%	120%	97%	70%	130%
Mercury Leachate	5145691	5145691	<0.01	<0.01	NA	< 0.01	96%	70%	130%	90%	80%	120%	74%	70%	130%
Molybdenum Leachate	5145691	5145691	<0.002	<0.002	NA	< 0.002	100%	70%	130%	103%	80%	120%	113%	70%	130%
Nickel Leachate	5145691	5145691	<0.010	<0.010	NA	< 0.010	98%	70%	130%	102%	80%	120%	95%	70%	130%
Selenium Leachate	5145691	5145691	<0.020	<0.020	NA	< 0.020	100%	70%	130%	100%	80%	120%	105%	70%	130%
Silver Leachate	5145691	5145691	<0.010	<0.010	NA	< 0.010	100%	70%	130%	102%	80%	120%	93%	70%	130%
Strontium Leachate	5145691	5145691	0.019	0.018	5.4%	< 0.003	84%	70%	130%	95%	80%	120%	91%	70%	130%
Thallium Leachate	5145691	5145691	<0.010	<0.010	NA	< 0.010	109%	70%	130%	104%	80%	120%	101%	70%	130%
Titanium Leachate	5145691	5145691	<0.050	<0.050	NA	< 0.050	98%	70%	130%	110%	80%	120%	106%	70%	130%
Uranium Leachate	5145691	5145691	<0.050	<0.050	NA	< 0.050	107%	70%	130%	100%	80%	120%	98%	70%	130%
Vanadium Leachate	5145691	5145691	<0.020	<0.020	NA	< 0.020	102%	70%	130%	109%	80%	120%	91%	70%	130%
Zinc Leachate	5145691	5145691	0.084	0.087	NA	< 0.050	100%	70%	130%	100%	80%	120%	108%	70%	130%

Comments: NA Signifies Not Applicable  
 Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By: \_\_\_\_\_



## Method Summary

**CLIENT NAME: WSP CANADA INC.**
**AGAT WORK ORDER: 23K047635**
**PROJECT: 22532464**
**ATTENTION TO: JAMES DOYLE**
**SAMPLING SITE:**
**SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
<b>Soil Analysis</b>			
Aluminum Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Antimony Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Arsenic Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Barium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Beryllium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Bismuth Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Boron Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Cadmium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Chromium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Cobalt Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Copper Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Iron Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Lead Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Manganese Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Mercury Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Molybdenum Leachate	MET -93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Nickel Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Selenium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Silver Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Strontium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Thallium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Titanium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Uranium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Vanadium Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	
Zinc Leachate	MET-93-6103	EPA 1311 & modified from EPA 6020B ICP-MS	

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**Laboratory Use Only**

Arrival Condition:  Good  Poor (see notes)  
Arrival Temperature: 4.9, 8.2, 7.2  
Hold Time: \_\_\_\_\_  
AGAT Job Number: 23k047635

Notes: \_\_\_\_\_

**Chain of Custody Record**

**Report Information**  
Company: WSP E&I  
Contact: 36 Pippy Alex  
Address: 1931 Robertson Rd  
Ottawa, Ontario K2H 5B7  
Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
Client Project #: TE22532464.1000  
AGAT Quotation: WSP confirm with James  
Pr. of to in K.C. City  
Please Note: If quotation number is not provided client will be billed full price for analysis.

**Report Information (Please print):**  
1. Name: James Doyle  
Email: James.doyle@wsp.com  
2. Name: Samantha Zareski  
Email: Samantha.Zareski@wsp.com

**Report Format**  
 Single Sample per page  
 Multiple Samples per page  
 Excel Format Included  
 Export

**Turnaround Time Required (TAT)**  
Regular TAT  5 to 7 working days  
Rush TAT  Same day  1 day  
 2 days  3 days  
Date Required: \_\_\_\_\_

**Invoice To** Same Yes  / No   
Company: \_\_\_\_\_  
Contact: \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
PO/Credit Card#: \_\_\_\_\_

**Regulatory Requirements (Check):**  
 List Guidelines on Report  Do not list Guidelines on Report  
 PIRI  
 Tier 1  Res  Pot  Coarse  
 Tier 2  Com  N/Pot  Fine  
 Gas  Fuel  Lube

CCME  CDWQ  
 Industrial  NSEQS-Cont Sites  
 Commercial  HRM 101  
 Res/Park  Storm Water  
 Agricultural  Waste Water  
 FWAL  
 Sediment  Other \_\_\_\_\_

Drinking Water Sample:  Yes  No Salt Water Sample:  Yes  No  
Reg. No.: \_\_\_\_\_

Sample Identification	Date/Time Sampled	Sample Matrix	# Containers	Comments - Site/Sample Info. Sample Containment	Field Filtered/Preserved	Standard Water Analysis	Metals: <input type="checkbox"/> Total <input type="checkbox"/> Diss <input type="checkbox"/> Available	Mercury	<input type="checkbox"/> BOD <input type="checkbox"/> CBOD	pH	<input type="checkbox"/> TSS <input type="checkbox"/> TDS <input type="checkbox"/> VSS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (PIR) <input type="checkbox"/> low level	Tier 2: TPH/BTEX Fractionation	CCME-CWS TPH/BTEX	VOC	THM	HAA	PAH	PCB	TC + EC <input type="checkbox"/> P/A <input type="checkbox"/> MPN <input type="checkbox"/> MF	<input type="checkbox"/> HPC <input type="checkbox"/> Pseudomonas	Fecal Coliform <input type="checkbox"/> MPN <input type="checkbox"/> MF	Other: <u>TCLP Metals</u>	Other:	Hazardous (Y/N)
BF-TP23-01	7/13/23	SOIL	1																									
BF-TP23-02																										X		
BF-TP23-03																										X		
BF-TP23-04																										X		
BF-TP23-05																										X		
BF-TP23-06																										X		
BF-TP23-07																										X		
BF-TP23-08																										X		
BF-TP23-09																										X		
BF-TP23-10																										X		
BF-TP23-11																										X		
BF-TP23-12																										X		

Samples Relinquished By (Print Name): Dylan Smith Date/Time: 07/17/23  
 Samples Relinquished By (Sign): [Signature] Date/Time: 10:05  
 Samples Received By (Print Name): Emily Collins Date/Time: July 17, 2023  
 Samples Received By (Sign): [Signature] Date/Time: 10:05

Blank Copy - Client  
Yellow Copy - AGAT  
White Copy - AGAT

Page 1 of 2  
No: \_\_\_\_\_

Chain of Custody Record

P: 709.747.8573 • F: 709.747.2139

Report to: \_\_\_\_\_  
Company: \_\_\_\_\_ Same as COC#: \_\_\_\_\_

LINE NO.	SAMPLE IDENTIFICATION	DATE/TIME SAMPLED	SAMPLE MATRIX	COMMENTS	# OF CONTAINERS			Field Filtered/Preserved	Standard Water Analysis	Metals: <input type="checkbox"/> Total <input type="checkbox"/> Diss <input type="checkbox"/> Available	Mercury	<input type="checkbox"/> BOD <input type="checkbox"/> CBOD	pH	<input type="checkbox"/> TSS <input type="checkbox"/> TDS <input type="checkbox"/> VSS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (PIRI) <input type="checkbox"/> low level	Tier 2: TPH/BTEX Fractionation	CCME-CWS TPH/BTEX	VOC	THM	HAA	PAH	PCB	TC + EC <input type="checkbox"/> P/A <input type="checkbox"/> MPN <input type="checkbox"/> MF	<input type="checkbox"/> HPC <input type="checkbox"/> Pseudomonas	Fecal Coliform <input type="checkbox"/> MPN <input type="checkbox"/> MF	Other: <i>TLP Metals</i>	Other:	Hazardous (Y/N)				
					VIALS / JARS	BAGS	BOTTLES																												
1	BF-TP23-13	7/13/23	SOIL																																
2	BF-TP23-14																																		
3	BF-TP23-15																																		
4	BF-TP23-16																																		
5	BF-TP23-DWP1																																		
6	BF-TP23-DWP2																																		
7																																			
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*RUSH!*

Samples Relinquished By (Print Name and Sign): <i>Dylan Smith</i>	Date/Time: <i>07/17/23</i>	Samples Received By (Print Name and Sign): <i>Emily Collins</i>	Date/Time: <i>July 17 2023</i>	Pink Copy - Client Yellow Copy - AGAT White Copy - AGAT	Page <i>2</i> of <i>2</i> No:
Samples Relinquished By (Print Name and Sign): <i>Dylan Smith</i>	Date/Time: <i>10:05</i>	Samples Received By (Print Name and Sign): <i>Emily Collins</i>	Date/Time: <i>10:05</i>		
Samples Relinquished By (Print Name and Sign):	Date/Time:	Samples Received By (Print Name and Sign):	Date/Time:		

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