



**Contaminated Sites and
Excavated Materials Technical
Data Report**

October 30, 2019

Prepared for:

Broadway Subway Project
Ministry of Transportation and
Infrastructure

Prepared by:

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Executive Summary

The BC Ministry of Transportation and Infrastructure (MOTI) is advancing the Broadway Subway Project (the Project) in order to address key gaps in the existing rapid transit network, support economic development with the Region, increase sustainable transportation options, and increase rapid transit mode-share. The scope of the Project includes a 5.7 km tunnelled alignment, with six stations, running between the existing VCC-Clark Station and the western terminus at Arbutus and Broadway.

Development of a tunnel and underground stations for the Project is anticipated to result in the generation of excavated materials and demolition waste, some of which is anticipated to contain contaminated or hazardous materials.

In order to support Project planning and procurement, the Project team has undertaken studies to estimate the volume and type of excavated materials, the risk of encountering contaminated and hazardous materials, and identify options for the appropriate management and disposal of such materials. This Technical Data Report (TDR) presents information including:

- Regulatory requirements pertaining to the management of contaminated materials
- Known and potentially contaminated sites along the alignment
- Types and estimated volumes of anticipated excavated materials
- Sources of contaminated and hazardous materials potentially present in existing structures
- Material management options that may be used during construction
- Best practices for characterizing, and managing, excavated materials in compliance with the Contaminated Site Regulation (CSR) and Hazardous Waste Regulation (HWR)

Contaminated materials that are encountered will require management in accordance with the British Columbia (BC) *Environmental Management Act* (EMA), the CSR, and the BC HWR.

A review of available information has identified a number of known or suspected contaminated sites that may be intersected by construction of the Project. These include potential laydown areas, station houses, ventilation shafts and portal locations. Four sites were rated as high-risk (i.e., where there is a high likelihood of encountering contamination during construction). Nine sites were rated as moderate-risk (i.e., moderate risk of encountering contamination during construction), and five sites were rated as low-risk (i.e., low risk of encountering contamination during construction).

A variety of materials are anticipated to be generated through tunneling and excavation including overburden (i.e., material above the bedrock), miscellaneous fill materials, and spoil from tunnel construction (i.e., both excavated rock and muck from the tunnel boring machine [TBM]). It has been estimated that approximately 173,000 m³ of uncontaminated overburden and 14,000 m³ of contaminated overburden will be excavated. Tunnel spoil has been estimated at 324,000 m³. Station house excavation material volume has been estimated at 543,000 m³.



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Materials generated through tunneling and excavation are expected to be managed in a variety of ways, depending on the volume, characteristics of the material, and presence of contaminants. Options for excavated material management include: beneficial re-use, disposal at local or out-of-region commercial remediation and landfill facilities, as well as Disposal at Sea (DAS).

The review has also identified the potential for hazardous building materials (e.g., asbestos, PCBs, mercury containing equipment etc.) to be present in existing structures required to be demolished to support Project construction. Hazardous materials that may be encountered will require appropriate management in accordance with the BC *Workers Compensation Act*, the Occupational Health and Safety Regulation, the HWR, and the federal *Transportation of Dangerous Goods Act*.

The review also outlines the material characterization protocols as defined by the BC CSR and guidance that will be required to ensure appropriate management of contaminated materials. These protocols will define the characteristics of the excavated material, the level of contamination present, and the methodology for reporting the findings of the classification to the Project owner, the treatment or disposal facilities, and the applicable regulatory agencies.



Abbreviations

AWF	Aquatic Life water use standards to protect freshwater life
AWM	Aquatic Life water use standards to protect marine life
BC	British Columbia
CEMP	Construction Environmental Management Plan
CL	Commercial Land use standards
CofC	Certificate of Compliance
CSR	Contaminated Sites Regulation
DAS	Disposal at Sea
DW	CSR Drinking Water standards
ECCC	Environment and Climate Change Canada
EMA	<i>BC Environmental Management Act</i>
EPB	Earth Pressure Balance
ESR	Environmental and Socio-Economic Review
HWR	Hazardous Waste Regulation
IL	CSR Industrial Land use standards
masl	metres above sea level



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MOECCS	BC Ministry of Environment and Climate Change Strategy
PCBs	polychlorinated biphenyls
PCOCs	Potential Contaminants of Concern
RE	Review Element
RL	CSR Residential Land use standards
TBM	tunnel boring machine
TDR	Technical Data Report
TSS	total suspended solids



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Introduction
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1.0 INTRODUCTION

The BC Ministry of Transportation and Infrastructure (MOTI) is advancing the Broadway Subway Project (the Project) in order to address key gaps in the existing rapid transit network, support economic development with the Region, increase sustainable transportation options, and increase rapid transit mode-share. The scope of the Project includes a 5.7 km tunnelled alignment, with six stations, running between the existing VCC-Clark Station and the western terminus at Arbutus and Broadway.

This TDR provides information on contaminated sites and excavated materials management, including:

- Regulatory requirements governing the management of contaminated sites, and materials removed from these sites, and the management of hazardous building materials
- Known and potentially contaminated sites that may be encountered by the Project
- Types of construction excavation spoil and hazardous building materials that are anticipated during construction
- Options for the management of excavated construction materials
- Overview of classification protocols that will be required for excavated materials to provide direction on management and disposal in accordance with the British Columbia (BC) Contaminated Sites Regulation (CSR).

As part of developing Project-focused guidance on the management of contaminated sites and excavated materials, this document has been provided to the BC Ministry of Environment and Climate Change Strategy (MOECCS) for review and comment in relation to the characterization protocols for excavated material management.

2.0 REVIEW AREA

2.1 PROJECT SETTING

The east end of the Project Alignment (the Alignment) runs through an area of Vancouver, BC known as the False Creek Flats. This area was historically a marine estuary and tidal flat. To accommodate development for industrial properties and rail terminals, this area was infilled between 1915 and 1917, and was completed using materials including spoils from development projects, scrap lumber and bricks from surrounding mills, and general industrial waste.

The majority of the Alignment, starting at the eastern tunnel portal adjacent to Great Northern Way, will be underground between the Mount Pleasant and Arbutus stations. This stretch of the Alignment runs below an area of Vancouver that has long been used for light industrial and commercial activities and is currently one of the major commercial corridors.



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Review Area
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In addition to historical land use considerations, the Project setting includes a variety of physical features that can influence the nature of materials likely to be encountered. As such, the following sections provide information to help set the context for examining contaminated sites and materials management considerations associated with the Project.

2.1.1 Physical Setting

Physical factors, such as surficial geology, topography, and groundwater elevation can have a substantial influence on the migration and fate of subsurface contamination. Stantec assessed the relevant physical factors in the region of the Project right-of-way.

2.1.1.1 Surficial Geology

Native surficial soils across the False Creek Flats area predominantly consist of marine sediments and organic deposits over glacial till-like deposits, underlain by bedrock.

West of the False Creek Flats, surficial geology is predominantly glacial, fluvial, and deltaic deposits over the bedrock. Bedrock across the alignment is reported to include sandstone, siltstone, claystone, and conglomerate, with occasional carbonaceous or coal layers. A detailed characterization of soil and bedrock is provided in a separate geotechnical study that was completed for the Alignment (Golder 2017).

2.1.1.2 Topography

The topography of the alignment through the False Creek Flats area (from VCC-Clark Station to the beginning of the tunnel section at 555 Great Northern Way) is relatively flat, with elevations ranging between approximately 5 to 6 metres above sea level (masl).

The surface topography above the Alignment from the beginning of the tunnel section, as it runs southwest to Broadway, slopes up substantially until it reaches an elevation of approximately 40 masl. From there the surface topography has gentle rolling hills as it runs westward along the Broadway corridor, with elevations ranging from approximately 25 masl around Yukon Street to approximately 50 masl around Alder Street.



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2.1.1.3 Groundwater Elevation

In the False Creek Flats area, groundwater is typically within a few metres below grade. Along the rest of the Alignment the perched groundwater table is typically at least a few metres below grade. Groundwater elevations generally tend to mirror surface topography. More detailed data regarding groundwater elevations is provided in the geotechnical study report (Golder 2017). As indicated in that report, the groundwater elevations at each planned station location are as follows:

- Great Northern Way Station—approximately 3 masl
- Mount Pleasant Station—approximately 37 masl
- Broadway-VGH Station—approximately 21 masl
- Fairview-VGH Station—approximately 36 masl
- South Granville Station—approximately 39 masl
- Arbutus Station—approximately 33 masl

3.0 REGULATORY REQUIREMENTS

3.1 MANAGEMENT OF CONTAMINATED MATERIALS

Contaminated sites in BC are regulated under the BC *Environmental Management Act* (EMA) which is administered by the BC MOECCS. In BC, a contaminated site is defined as an area of land in which the soil or underlying groundwater, soil vapour or sediment contains either a hazardous waste or a substance in an amount or concentration that exceeds provincial environmental quality standards or criteria. Specific provisions are set out in the BC CSR (BC Reg. 375/96 including 11 stages of amendments up to BC Reg. 196/2017), which is the enabling regulation of the BC EMA with respect to contaminated sites; and the Hazardous Waste Regulation (HWR, BC Reg. 63/88, including amendments up to BC Reg. 179/2016; formerly the Special Waste Regulation). The BC CSR includes specific legal standards for identification, assessment and remediation of contaminated sites.

The CSR and applicable standards can be found at the BC MOECCS website:

http://www.bclaws.ca/Recon/document/ID/freeside/375_96_00.

BC MOECCS has a comprehensive library of guidance on required practices for assessment and remediation of contaminated sites. These can be found at:

<https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/guidance-resources>.

3.1.1 Soil Standards

Matrix numerical standards for soil (Schedule 3.1 Part 1 of the BC CSR) are applied according to land use and site-specific factors, which include: intake of contaminated soil, toxicity to soil invertebrates and plants, groundwater used for drinking water, and groundwater flow to surface water used by aquatic life (freshwater and marine). The standards are concentration-based.



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Generic numerical standards for soil (Schedule 3.1 Parts 2 and 3 of the BC CSR) are intended to protect human health and ecological receptors at any site without consideration of site-specific factors other than land use. These standards are also concentration-based.

Applicable land use standards for the Project are the Commercial and Industrial Land Use (CL/IL) standards. For station sites that may be developed in future, with residential units above the ground floor, the CL/IL still applies to the remediation standard for the site.

Contaminated soils can be disposed of at approved facilities, in some cases may be relocated to other properties where the soil is not considered contaminated (based upon applicable land use standards) or may be relocated to another property where a contaminated soil relocation agreement has been submitted and approved by the BC MOECCS.

3.1.2 Groundwater Standards

Groundwater may be encountered during excavation and would need to be managed in compliance with regulatory requirements. In such cases, groundwater should be sampled and submitted for lab analysis of appropriate potential contaminants of concern for comparison to the appropriate criteria, which, depending on the intended disposal method, include those detailed in the following:

- Greater Vancouver Sewerage and Drainage District (GVSD) Sewer Use Bylaw
- City of Vancouver Sewer and Watercourse By-Law No. 8093
- BC CSR Schedule 3.2—Generic Numerical Water Standards
- BC Water Quality Guidelines

Depending on the presence and concentration of identified contaminants of concern, water may require disposal at an approved facility, or may be of suitable quality for discharge to storm or sanitary sewers provided that proper arrangements or permits are obtained from GVSD, the City of Vancouver, or the BC MOECCS. Water quality parameters to be considered, where discharge to the storm or sanitary sewer is being considered, include (but are not limited to) total oil and grease (TOG), metals, pH, and total suspended solids (TSS).

3.2 PROJECT REGULATORY REQUIREMENTS

This section discusses the application of provincial legislation and guidelines and municipal by-laws as they relate specifically to soil and groundwater displaced by the Project. These regulatory requirements apply to the classification, management, and disposal of contaminated material encountered during construction, and the responsibility for remediation of these materials.



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3.2.1 Soil Management Requirements

Discussions with BC MOECCS confirmed the following investigation and remediation requirements that will apply during construction:

- As in all cases on provincially-regulated properties, contamination encountered during construction of the Project will need to be characterized and managed appropriately, including at licensed facilities where necessary, and in accordance with the requirements of the BC CSR.

Responsibility for assessment and remediation of contaminated sites rests with the 'responsible person', as detailed in the CSR and MOECCS policies. Additional information on the definition of responsible person can be found in BC MOECCS Fact Sheet 16, Remediation Liability Overview (<https://www2.gov.bc.ca/assets/gov/environment/air-land-water/site-remediation/docs/fact-sheets/fs16.pdf>). In summary, BC utilizes a polluter-pay principle, and since MOTI has not caused or contributed to contamination of the Alignment, MOTI is not considered a responsible person. As such, the Project is not responsible for historic remediation that may be encountered. The CSR also contains remediation responsibility exemption requirements, including those for owners of easements and rights-of-way. Therefore, the cost of assessment and remediation of contamination originating from a site adjacent to the Alignment will remain the responsible person's obligation under the BC CSR.

- In contrast to most development projects (such as those on fee-simple properties) in BC, the BC MOECCS confirmed that the Project will not be obligated to determine the geographic bounds of contamination encountered during construction. Only the material necessarily encountered for the purpose of construction needs to be managed in accordance with the CSR. Any material remaining in situ, at the extent of excavation, may remain in place and no additional investigation or characterization outside the zone of construction is required.
- Recovering the cost of remediation from the responsible person is permitted by law and may be considered by the Project. However, the scope of work to confirm the source of contamination and identification of the responsible person has not been included in this review. It has been assumed (based on similar projects in BC) that a Certificate of Compliance will not be required by the Project, for contaminated sites encountered during construction.
- Following from the second bullet above, contamination present at the limits of excavation does not require remediation. Confirmatory sampling at the limits of excavation, where contamination is identified, may be prudent; for in the event of gross contamination that may affect subsurface utilities, it may be necessary to consider the installation of protective measures, such as conduit or membranes to protect these utilities from recontamination after construction. Determining the concentration of contaminants at the limit of excavation may assist with this design.



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- As indicated in the first bullet above, contaminated soil and groundwater encountered during excavation and construction of the Project must be managed in accordance with the BC EMA and CSR. This includes: characterization of contaminated materials leaving the construction sites to direct appropriate disposal; proper documentation and transportation of these materials to treatment or disposal facilities; and the completion of applicable reporting documentation to BC MOECCS (such as submission of the Notice of Independent Remediation where contaminated materials are excavated). Section 6.0 of this TDR provides an outline of these characterization and reporting requirements.

3.2.2 Excavation Water Management

Construction of the Project is expected to produce water that will seep into the underground portion of the Alignment. This water will originate from two different hydrogeologic sources:

- Groundwater contained within the overburden (above bedrock) may potentially be in contact with soil contamination. During construction, excavation that may be required at station locations may penetrate into, and potentially through, surface aquifers resulting in seepage entering the excavation.
- Geotechnical investigations have revealed the presence of groundwater contained within the sedimentary bedrock layers underlying the overburden. Early investigations indicate this bedrock groundwater is pressurized and, at the bedrock and overburden interface, will tend to flow out of the rock (upward gradient). Because of this characteristic, it is unlikely that the groundwater in bedrock will be contaminated from surface activities.

As with any urban construction project, excavation water will need to be collected to maintain integrity of the excavation and this water may require treatment and permitting prior to discharge as per the applicable and appropriate municipal, provincial, and/or federal requirements.

4.0 BASELINE CONTAMINATED SITES SUMMARY

4.1 METHODS

Existing conditions were evaluated by reviewing publicly available information on known contaminated sites and reviewing historical land use for suspected or potentially contaminated sites for properties for which there is no publicly available record of a contaminated sites investigation. The information reviewed includes, where available, intrusive site investigation reports prepared for the responsible parties and obtained from BC MOECCS.

The methodology used to support the evaluation presented in this TDR is consistent with the initial screening-level assessments defined by the CSR in BC and by the CSA standard Z-768-01. Intrusive site investigations, including sampling of soil, groundwater or vapour, were not conducted as part of this work.



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The scope of work included a site reconnaissance of current operations and occupants of properties adjacent to the planned stations and laydown areas. In addition, the following documents and databases were consulted:

- BC MOECCS Site Registry—A database of registered sites which have been investigated for environmental concerns
- BC MOECCS publicly available environmental reports
- Golder Associates Transmittal, Reference No. 1419105-045-TR-Rev0-700A-7020, October 19, 2017. (Draft borehole records at locations with possible contamination observations and summary table)
- VanMap, the City of Vancouver's online mapping application.
http://vanmapp.vancouver.ca/pubvanmap_net/default.aspx
- Google Map and Google Street View
- Available historical aerial photographs

Data collected through the above-mentioned methods were reviewed for the following information:

- Current or historical operations at properties adjacent to the Alignment
 - Type of potential contaminants of concern (PCOCs) associated with identified operation
 - Duration that identified operation has been or was present (typically a longer duration will result in a greater potential for leaks and spills.
- Location of known contamination
 - Presence of identified contamination on the Alignment, including contaminants that may have migrated into the Project footprint from adjacent sites
 - Known soil stratigraphy and groundwater elevations to determine potential of migration of contaminants to the Project footprint
 - Known areas and depths of contamination to determine potential for encountering contamination during construction (based on the assumption that overburden excavation will consist of the entire footprint of station access structures and ventilation shafts to bedrock for those stations within bedrock, or the entire footprint of the station and access and ventilation shafts from surface to station invert elevation for those stations within the overburden)

The contaminated sites evaluation included a review of land assumed to be required to support project-related infrastructure, including laydown areas, for evidence of actual or potential contamination within approximately 100 m. Most contamination sources greater than 100 m away are considered to have a low likelihood of affecting the alignment. The risk of encountering contamination as part of construction was then evaluated based on the following factors:

- Publicly available information on private properties
 - Reported contamination
 - Reported contamination migration
 - Reported depths of contamination
- Expected excavation locations during construction
- Expected property acquisitions needed



CONTAMINATED SITES AND EXCAVATED MATERIALS TECHNICAL DATA REPORT

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Based on the methodology noted above, a risk ranking was assigned to each station location and laydown site as described below.

Lists of all reports obtained and reviewed, along with a summary of relevant information from each, are provided in the evaluation summary reports for each of the stations and station houses and laydown sites. These evaluation summary reports are included in Appendix A of this TDR. Appendix A also includes Table A-1, which summarizes the pertinent details for each station and laydown site, including key findings, site risk classification, and potential risks to the Project.

4.1.1 Low-Risk Locations

Low-risk locations are areas where there is a low likelihood of encountering contamination during construction or demolition of existing structures. These are locations where there is no known contamination, or sites where activities indicate a low likelihood of contamination being present. These locations may not have been assessed by intrusive site investigation to confirm the absence of contamination.

4.1.2 Moderate-Risk Locations

Moderate-risk locations are areas where there is a moderate likelihood of encountering contamination during construction or demolition of existing structures. These are locations where there is uncertainty with respect to the presence or absence of contamination, where adjacent known or anticipated contamination is not expected to be encountered by construction (i.e., contamination is expected to be outside of the planned excavation area), or sites where activities indicate a moderate likelihood of contamination may be present but have yet to be assessed by site investigation.

4.1.3 High-Risk Locations

High-risk locations are areas where there is a high likelihood of encountering contamination during construction or demolition of existing structures. This is based on knowledge of confirmed or anticipated contamination being present in planned excavation areas, based on historic or current operations adjacent to the alignment (or on the station house or laydown property) and information in reviewed publicly-available environmental investigation reports. In these areas, subsurface investigations would provide further information as to the presence or absence of contamination and assist with scheduling and costing of meeting contaminated sites requirements, during construction, in such locations.



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4.2 SUMMARY OF FINDINGS

The detailed results of the contaminated sites review are provided in Appendix A. Table A-1 provides key findings, risk ranking and recommended management strategy for each site. Appendix A also includes a brief description of the current ownership and land use of specific sites, existing site assessment reports that are publicly available, and the potential project-related use of such properties. Figures showing the Alignment combined with areas of known or suspected environmental concern are also provided in Appendix B.

Key elements from the summary table are presented in Table 1 below.



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Table 1 Summary of Key Contaminated Site Findings

Site Identification	Known or Assumed Contaminants Present	Risk Ranking	Comments or Suggested Actions
Great Northern Way East Laydown Yard	Hydrocarbons, VOCs, metals assumed to be present in soil	Moderate	Possible laydown site so limited excavation expected. Conduct baseline assessment of surface soil conditions
Great Northern Way Laydown Yard, Station, Station House, Emergency Exit and Ventilation Shafts, and Tunnel Construction Excavation	Hydrocarbons, VOCs, metals known to be present in lot in proximity to anticipated excavation	High	A qualified environmental consultant is to be on site during excavation to characterize suspect contaminated media and recommend contamination management.
Main Street East Laydown Main Street West Laydown	Hydrocarbons, VOCs, metals known or suspected on laydown sites	Moderate	Possible laydown site so limited excavation expected. Conduct baseline assessment of surface soil conditions at laydown sites.
Mount Pleasant Station House Mount Pleasant Station Emergency Exits and Ventilation Shafts	Hydrocarbons, VOCs, metals known or suspected on station house and laydown sites	Moderate	A qualified environmental consultant is to be on site during excavation to characterize suspect contaminated media and recommend contamination management.
Cambie Street Laydown Broadway-City Hall Station House	Hydrocarbons, VOCs, metals possible on station house and laydown sites from nearby higher risk sites	Low	Conduct baseline assessment of surface soil conditions at laydown site. A qualified environmental consultant is to be on site during excavation to characterize suspect contaminated media and recommend contamination management.
Oak Street North Laydown Oak Street South Laydown Fairview-VGH Station	Hydrocarbons, VOCs, metals possible on station house and laydown sites from nearby higher risk sites.	Low	Conduct baseline assessment of surface soil conditions at laydown sites. A qualified environmental consultant is to be on site during excavation to characterize suspect contaminated media and recommend contamination management.
Granville Street Laydown South Granville Station House South Granville Station Emergency Exits and Ventilation Shafts	Hydrocarbons, VOCs, metals possible on station house and laydown sites from nearby higher risk sites.	Moderate	Conduct baseline assessment of surface soil conditions at laydown sites. A qualified environmental consultant is to be on site during excavation to characterize suspect contaminated media and recommend contamination management.



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Table 1 **Summary of Key Contaminated Site Findings**

Site Identification	Known or Assumed Contaminants Present	Risk Ranking	Comments or Suggested Actions
Arbutus Station House (and associated required property) Arbutus Station Emergency Exits and Ventilation Shafts	Known contaminants include hydrocarbons and lead. Potential contaminants include VOCs including chlorinated solvent (dry cleaning solution), and metals	High	Conduct baseline assessment of surface soil conditions at laydown sites. A qualified environmental consultant is to be on site during excavation to characterize suspect contaminated media and recommend contamination management.
Arbutus Station and cross-over Tunnel	Known contaminants include hydrocarbons and lead. Potential contaminants include VOCs including chlorinated solvent (dry cleaning solution), and metals	High	Encountering contamination should be expected during construction. A qualified environmental consultant is to be on site during excavation to characterize suspect contaminated media and recommend contamination management.
Arbutus Laydown Yards and required property	No known contamination identified by review, but hydrocarbons, VOCs, metals may be encountered during construction	Moderate	Conduct baseline assessment of surface soil conditions at laydown site. A qualified environmental consultant is to be on site during excavation to characterize suspect contaminated media and recommend contamination management.



CONTAMINATED SITES AND EXCAVATED MATERIALS TECHNICAL DATA REPORT

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Based on the desktop review of investigation and remediation reports provided by the BC MOECCS, two locations where known contamination will be encountered within the expected excavation area during construction include the Arbutus and Great Northern Way areas.

5.0 MATERIAL MANAGEMENT

This section provides an overview of the materials that may be generated by the construction of the Project, and require appropriate management, including:

- Excavated materials including overburden, rock, and tunnel spoil
- Excavation water generated during construction
- Demolition material including Hazardous Building Materials and salvageable and recyclable materials that may be encountered during construction.

The section also discusses potential options for the management of contaminated and uncontaminated materials generated during construction.

5.1 MATERIAL TYPES AND VOLUMES

5.1.1 Background

Excavated construction material will consist of a variety of geologic materials of varying environmental quality. The general categories of material defined by this review include:

- **Overburden:** This is expected to consist of consolidated and unconsolidated materials on top of the underlying bedrock, and expected to include:
 - Clean, native soil and glacial till, including boulders (glacial erratic), encountered during excavation
 - Historical fill materials, such as backfill and structural fill (but not containing waste materials or debris or characterized as contaminated)
 - Contaminated fill and soil from historical or current activities at surface
- **Rock:** This is expected to consist of:
 - Tunnel boring spoil
 - Excavated bedrock from station locations

These excavated material types and their anticipated volumes are described in Section 5.1.2 and 5.1.3 below. A bulking factor of 1.3 has been applied to account for the increase in volume that soil and rock material displaces once excavated as compared to the volume it occupies in situ.



CONTAMINATED SITES AND EXCAVATED MATERIALS TECHNICAL DATA REPORT

Material Management
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Hazardous building materials are commonly found in older structures constructed when use of these materials was permitted. Some commonly encountered hazardous building materials include asbestos (in a variety of forms and matrices), mercury (in thermostats and switches), polychlorinated biphenyls (PCBs; in electrical equipment), and ozone-depleting substances (in refrigerants and fire suppression systems). Demolition and hazardous materials management options are described in Section 5.1.5 below.

5.1.2 Overburden

5.1.2.1 Clean Native Soil, Fill and Glacial Till

Soil layers (horizons) that lie above the bedrock surface are defined as overburden. These horizons vary across the Alignment as a result of natural conditions and man-made disturbances. It is estimated that approximately 173,000 m³ of uncontaminated overburden material will be excavated, including organic topsoil, clay, silt, sand, gravels and till, and possibly peat. In addition, early geotechnical investigations (Golder 2017) for the Project have indicated the potential for encountering boulders in the horizon close to the bedrock surface. Fill materials consisting of structural and non-structural sands and gravels, placed historically for construction, may also be encountered.

Uncontaminated overburden materials are not regulated by the BC EMA or the CSR. However, relocation of these materials to deposition sites will still require conformance with municipal requirements for placement of fill materials. These requirements are jurisdiction-dependent and will need to be determined prior to relocation of these materials.

Uncontaminated overburden material may be found immediately beside contaminated materials. As it is not possible to fully characterize all soils that will be encountered in advance of excavation, excavated materials will need to be characterized prior to, or immediately after, excavation in order that the material is to be managed appropriately.

5.1.2.2 Contaminated Soil and Fill

Excavation in overburden has the potential to encounter contaminated soil and fill materials. Contaminants may include petroleum hydrocarbons from gas stations, automotive repair sites or railway operations; chlorinated solvents from drycleaners; and trace metals from a variety of sources. Borehole records from Project geotechnical investigations indicate that some shallow fill materials are contaminated with construction and demolition debris, such as steel, timber, wood waste, and concrete.

Overburden containing construction and demolition debris are considered contaminated and will require management in accordance with the BC EMA and the CSR. These overburden materials will require disposal at authorized facilities (as discussed below) in-region or out-of-region, and potentially require treatment prior to disposal.

The volume of contaminated overburden material that may be excavated for the Project has been estimated at approximately 14,000 m³. These locations include some station sites and laydown sites and portions of the Great Northern Way portal and Arbutus Street alignment and terminus sites.



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It is also possible that contaminated overburden materials will be encountered at locations not previously identified. In all cases, these excavation spoil materials will need to be characterized prior to, or immediately after, excavation in order for the material to be managed appropriately.

There is some risk that hazardous waste-contaminated overburden materials may be encountered during excavation. Hazardous wastes include asbestos (including asbestos-cement pipe, paneling and other materials), PCBs, mercury or elevated concentrations of other metals, or elevated concentrations of petroleum hydrocarbons. Should hazardous wastes be encountered at concentrations regulated by the BC HWR, the Project will need to identify, characterize and manage these overburden materials in accordance with the CSR and HWR.

5.1.3 Bedrock

This section provides information on the characteristics of the excavated material generated from the construction in bedrock.

5.1.3.1 Tunnel Boring Machine Spoil

The reference design of the Project assumes twin 6 m diameter bored tunnels from Great Northern Way Station (the portal) to the east end of the Project at Arbutus Street. Construction of the reference design assumes a tunnel boring machine (TBM) will be delivered, assembled and launched from the portal at the eastern terminus. During construction, the TBM cuttings (spoil) will likely be transported by conveyor or 'muck cars' for management and disposal. The volume of solids generated by the TBM has been estimated to be approximately 324,000 m³.

Bedrock through which the Project tunnel(s) will be bored is not expected to contain contamination from surface activities. Man-made contamination has been assumed to be contained within the overburden and because of hydrostatic pressures within the bedrock, contamination will not have penetrated bedrock.

The physical characteristics of the TBM spoil depends on a variety of factors. There are several TBM equipment options available and the selection of the appropriate TBM will be made by the Contractor based on their evaluation of bedrock conditions from geotechnical investigations.

The construction of the reference concept assumes that an Earth Pressure Balance (EPB) TBM machine is likely to be selected by the Contractor for the soft sedimentary bedrock being encountered on the alignment. Other TBMs include Main Beam (Gripper or Thrust TBMs), typically used for hard rock applications; slurry TBMs, used primarily in sands and gravels; or pressurized slurry TBMs that utilize slurry at the cutting face to establish and balance pressure. Physical characteristics associated with the use of an EPB-type of TBM is discussed below.

An EPB TBM can be operated in 'open' or 'closed' mode. In open mode, the cutting face is not pressurized, and higher production rates can be achieved. Spoil from the TBM operating in open mode is likely to have a gradation of 6" minus (most material less than 6 inches diameter). In closed mode, used for softer materials, a pressurized cutting face is generated which applies support pressure through highly viscous, conditioned spoil which is formed from mixing the excavated material with conditioners.



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This mixture is commonly referred to as “muck”. For optimum performance, EPB machines require the muck to have good plastic deformation characteristics, low internal friction and low permeability. These characteristics are produced through the selection of the conditioners and additives.

Muck is mixed with conditioners to reduce wear of the cutting tools and create a homogeneous material inside the excavation chamber which helps to maintain a pressurized excavation face. Typically, the conditioners include a polymer to maintain the consistency of the mixture through a variety of material conditions. The conditioner and polymers are often proprietary to the TBM operators making it difficult to determine the potential environmental impacts associated with disposal of the muck. As such, where conditioners are used, regulatory agencies may consider the muck to be contaminated, which will influence the management options available to the Contractor.

The muck generated by a TBM operated in “closed” mode will most likely be a high moisture content, sloppy paste, which is unlikely to be suitable for re-use as a construction material. In a high moisture state, muck may be difficult to transport, and require a dewatering process to separate the water from the solids. The characteristics of the dewatering system will depend on the TBM selection, methodology, and moisture content of the muck. The most basic treatment consists of settling ponds, sized to allow sufficient time for the solids to separate from the water.

Construction of the reference design for the Project assumes a muck dewatering system will be necessary. Both the dewatered muck and the water produced by tunneling will require appropriate management and disposal.

5.1.3.2 Excavated Bedrock from Station Locations

Construction of the reference concept assumes that, in addition to tunnel boring, the development of stations will require some degree of excavation using techniques similar to those used during the construction of underground parking lots at high-rise structures. This section focuses on the bedrock excavated at the station locations.

As the bedrock along the Alignment is relatively soft, it is assumed that typical hoe excavators will be used to hammer or rip the bedrock. As such, the spoil will consist of larger sized material than the TBM spoil, potentially in the 20” minus range (rock chunks up to 20 inches in diameter). The size will be limited more by the excavation technique and the method of handling and disposal of the spoil.

It has been estimated that approximately 40,000 m³ of material will be removed from each of the station sites at the Mount Pleasant, Fairview-VGH, and South Granville stations. As the Broadway-City Hall Street station will require connectivity to the Canada Line, the station excavation is expected to be larger, at 55,000 m³. Bedrock removal at Great Northern Way has been estimated at 26,000 m³. Bedrock removal at Arbutus Station has been estimated at 18,000 m³.

The total estimated volume of bedrock to be removed for the Project by TBM and by excavation is approximately 543,000 m³.



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5.1.4 Excavation Water Management

The volume of water that will be encountered as seepage in the excavations is expected to be consistent with other similar construction projects being completed in this part of Vancouver, within these soil horizons.

Typically, treatment of excavation water is necessary to remove suspended solids, reduce turbidity, potentially remove contaminants of concern (such as petroleum hydrocarbons) adjust water chemistry, and control the rate of discharge. This is normally accomplished through the use of physical and chemical treatment systems specifically sized to manage steady-state and rainfall-induced flow and quality. These systems are generally readily available from specialty contractors and are used on most construction sites.

5.1.5 Demolition and Hazardous Building Materials

While an inventory of the presence of Hazardous Building Materials that may be contained within existing buildings is not within the scope of this study, it is anticipated that existing structures that will need to be demolished to support Project construction will contain some Hazardous Building Materials. In order to ensure that the management of such materials complies with regulatory requirements (including, but not limited to, the federal *Transportation of Dangerous Goods Act*, the *BC Workers Compensation Act*, the Occupational Health and Safety Regulation, and HWR), a Hazardous Building Materials assessment will be undertaken prior to demolition of surface structures for the Project. The scope of the assessment will include the following materials:

- Asbestos—Asbestos is considered a hazardous waste in BC. The City of Vancouver Landfill in Delta, BC is permitted to accept asbestos containing materials (as asbestos waste in accordance with the BC HWR and the Vancouver Landfill Permit). Typical materials that may be encountered on the Project include asbestos-cement sewer and drainage pipe, or asbestos-containing building materials like insulation, floor tile or building cladding.
- Gypsum wall board—Gypsum wall board (i.e., drywall) may also be a hazardous material because, historically, wall board and joint compounds may have contained asbestos. This makes historical gypsum wall board (drywall) suspect in terms of quality and requires assessment prior to demolition. In addition, regional landfill facilities will not accept drywall into the landfill and it must be managed separately through a recycling facility.
- Other—Other potentially hazardous building materials that may be encountered as part of building demolition for station redevelopment include:
 - Fluorescent lamp ballasts, which may contain PCBs, mercury switches and thermostats
 - Paints, fittings, fixtures, solders, etc., which may contain lead
 - Oil-filled transformers (which may also contain PCBs)
 - Air conditioning units and fire suppression systems containing ozone-depleting substances

Each of these items will require appropriate management in accordance with the applicable Acts and Regulations.



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In addition to Hazardous Building Materials, the demolition of structures will likely produce a wide variety of salvageable and recyclable materials, including wood, glass, metal, and concrete. Consistent with best practice, such materials may be managed and recycled or reused to reduce waste as much as practically possible.

5.2 MATERIAL MANAGEMENT OPTIONS

Construction of the Project will produce a variety of excavated soil and rock materials, at various stages of construction, of varying quality and consistency. As the Project will likely have limited space for on-site management of excavated materials, the main options available are off-site reuse or off-site disposal. Construction of the reference concept assumes that a mix of disposal options is likely to be employed in order to provide for the most efficient means of managing excavated soil and rock materials. An overview of the anticipated material management options is provided in the following section.

5.2.1 Beneficial Use of Non-Contaminated Excavated Materials

Soil relocation is the term used for the movement of soil from a development location to another location where fill material is required. Soil relocation is managed under the BC CSR. In general terms, the quality of the material to be relocated must meet the quality requirements listed in the BC CSR, for the destination location, based on the destination location land use (i.e., residential, commercial, or industrial land use). Uncontaminated material is typically easier to relocate as it has the greatest potential to meet the soil relocation requirements of the BC CSR.

During construction, it is anticipated that beneficial reuse of excavated materials may be possible and could assist in reducing costs otherwise associated with disposal. Potential options for beneficial re-use (on-site or off-site) of non-contaminated materials include the following:

- Organic soils (top soil) may be collected and re-used as suitable growing media. It may also be relocated to a soil conditioning facility or elsewhere in the region where this class of fill may be useful. The requirements for meeting requirements of the CSR, discussed above, also apply to the relocation of organic soils.
- Suitably graded soil and rock may be used as bulk or structural fill for infrastructure development projects around the Lower Mainland. The potential for beneficial reuse of Project materials will be determined by the project-specific requirements of other regional developments including: destination land use and CSR requirements; engineering specifications for required fill timing (i.e., when is it available relative to project need?) and costs of obtaining and transporting materials.

Some other options for disposal of excavation spoil include intermediate cover or final cover at a permitted landfill site, or infill and reclamation of gravel pit, quarry and mine sites. Several of these options exist within or near Metro Vancouver. As noted above, the beneficial reuse of Project materials for such applications will be determined by project-specific requirements associated with potential destination locations.



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5.2.2 Regional Management Facilities

Excavated materials that are not suitable for beneficial reuse, or for relocation as bulk fill, will require deposition in a permitted landfill facility. Costs for deposition will include those for transportation of the material from the Project site to the disposal location and will likely include a tipping fee if materials are being deposited at a commercial landfill. As described above, materials unsuitable for disposal in a permitted landfill facility include soil containing constituents of concern, such as hydrocarbon or metals contamination, the presence of demolition materials like concrete, steel, timber and woodwaste, or soil and rock with elevated moisture content (such as EPB TBM spoil).

The Project will not be required to obtain a permit for disposal of material at a commercial landfill, as it is a requirement of the commercial landfill operator to hold the permit authorizing the deposition of qualifying materials at the landfill. Some examples of regional facilities where unusable materials may be deposited are provided below.

5.2.2.1 Demolition Waste Facilities

Some regional landfills accept building demolition materials, after recyclable materials, source contaminants and hazardous materials (e.g., asbestos-containing materials, lead-containing paint) have been removed. Not all demolition waste will be accepted at these facilities, so it is typical for demolition contractors to deconstruct buildings and salvage and sort building materials prior to demolition of a structure.

5.2.2.2 Treatment and Disposal Facilities

Some regional facilities will accept some forms of contaminated excavated materials (non-hazardous waste) for treatment and disposal. These include hydrocarbon contaminated soils, such as gas station and heating oil tank contamination, or for low-concentration metals contamination. These permitted facilities receive soils in accordance with the BC CSR standards and under their specific permits with the BC MOECCS.

5.2.2.3 Access and Transportation

Regional facilities are generally accessible by truck, though some options for barge transportation (for a portion of the haul) may exist. Once on a barge, materials can be transported in larger quantities at lower cost than trucking and rail options.

Barge loading facilities exist in the Port of Vancouver (foot of Clark Street on Burrard Inlet). Other barge loading facilities exist along the North Arm and Main Arm of the Fraser River. Some of the nearby potential disposal facilities have barge unloading facilities or are in relatively close proximity to barge unloading facilities.



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Traffic related considerations, associated with truck hauling of excavated material associated with the Project, will be addressed as one element of a project-wide Traffic Management Plan that will be developed and implemented by the Contractor. Development and implementation of the Traffic Management Plan will require the Contractor to work with City of Vancouver, and other relevant agencies, responsible for management and oversight of the local and regional road network.

5.2.3 Disposal at Sea

Disposal at Sea involves disposal at a designated ocean disposal location. Disposal at Sea is regulated by ECCC under the *Canadian Environmental Protection Act* and would require the Contractor to obtain a Permit from ECCC for the material being deposited. Of those materials potentially generated by the Project, ECCC generally permits only inert inorganic geological matter to be disposed at sea.

5.2.4 Out-of-Region Management Options

Similar facilities to those in the Lower Mainland, described above, exist out-of-region. These facilities may be commercially advantageous for the Project when both transportation and tipping fees are included.

Similar to regional facilities, it is not anticipated that the Contractor will be required to obtain permits or authorizations for the deposition of excavated soil material as the available facilities will be operating under authorization of local regulators. Typically, these facilities assume ownership of the material at the transfer point to the final transportation method.

Potentially more cost-effective disposal options exist with out-of-region disposal. Tipping fees for excavated materials (contaminated or uncontaminated) at out-of-region or province facilities may be found to be less than local options.

Excavated material containing elevated concentrations of contaminants (at Hazardous Waste levels) may require out-of-province disposal as suitable facilities may not exist in BC. Handling and transportation of these materials must be in accordance with the BC HWR, the Canadian Transportation of Dangerous Goods Regulation and regulations and requirements in place at the disposal location.

5.3 SUMMARY OF MATERIAL TYPES AND OPTIONS

There are a wide variety of management options available, depending on the material classification. It is assumed that beneficial reuse of materials will be undertaken by the Contractor where the reuse of materials supports achieving broader project-related cost and schedule related considerations.



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6.0 CONTRACTOR PROTOCOLS

This section discusses the sampling and monitoring requirements that will be implemented to characterize Project-generated excavation materials. This section has been included to support the review of this report by BC MOECCS for concordance with applicable regulations, policy and guidance on the management of contaminated materials encountered during construction.

Prior to construction, the Contractor will be required to prepare a Construction Environmental Management Plan (CEMP). The CEMP will include a Contaminated Sites and Excavated Materials Management Plan, a Construction and Demolition Waste Management Plan, and a Hazardous Materials Management Plan. These plans will meet the requirements of the CSR and HWR, and will be implemented to characterize and manage excavated material, excavation water, and hazardous building materials.

Section 4.2 and associated appendices define the current understanding of where contamination may be encountered. An overview of best practices for these characterization protocols that the Contractor may use in order to maintain compliance with applicable regulatory requirements is provided in the sections below.

6.1 CHARACTERIZATION PRIOR TO EXCAVATION

During construction of the Project, a variety of materials will be excavated and will require off-site management. Regardless of the extent to which known contaminated materials are identified *in situ* by current information, the Contractor will retain the obligation to adequately characterize these excavated materials and to verify that these materials are disposed of in accordance with regulatory requirements.

Characterization of materials prior to excavation is the preferred approach as it supports:

- Improved opportunity to delineate *in situ* areas of contamination
- Planning of disposal and relocation options, and making the appropriate arrangements
- Better planning of excavation and segregation of contaminated soils (if any), which allows for effective construction scheduling, and generally results in lower management, handling and disposal or relocation costs.

In situ characterization is usually completed by a drilling or test pitting program, with higher sampling frequencies targeted at high-risk areas, and general low-resolution grid sampling across lower-risk areas. Drilling techniques are typically used for obtaining samples from depths greater than 2 metres below ground surface and where groundwater monitoring is also desired, whereas test pits are effective methods of sampling shallow soils.

Characterization prior to excavation is recommended for overburden excavations for the Project. Decoupling the general characterization of excavated materials from the actual excavation activity provides the Contractor with the best opportunity to anticipate the quality of material that will be encountered and make appropriate management arrangements without schedule impacts.



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As discussed in Section 3.0, the BC MOECCS has a wide range of technical guidance documents available to help define the methodology and requirements for undertaking a compliant site investigation. These methods and protocols will guide the Contractor's approach to managing excavated materials. Excavation of areas where contaminated soils have been identified must be completed under the guidance of an appropriately experienced and qualified environmental consultant on the Contractor's team.

6.2 ON-SITE CHARACTERIZATION OF EXCAVATED SOILS

Characterization of soils after they have been excavated may be the best, or in some cases only, option for characterization. Examples of such circumstances include the following:

- Where access to the area has been limited or restricted prior to the time of excavation (e.g., covered by structures)
- Where an unexpected area of contamination is encountered (i.e., a "chance find")

Where on-site characterization (during construction) is required, excavated soils are typically placed in stockpiles within the boundaries of the Project site, where they can then be assessed and characterized. The BC MOECCS Technical Guidance Document 1 (TG1; MOECCS 2009) provides detailed guidance on stockpile sampling that will likely be followed by the Contractor's environmental team, and defined within the Contractor's CEMP. The size of the stockpiles and the number of samples required to characterize the stockpile are defined in the guidance. These methods have been in place in BC for many years and are accepted as suitable methodology by the regulatory agencies and disposal facilities as being adequate to characterize a stockpile.

Soils not suspected of contamination must still be characterized to confirm final disposal and relocation options. Demonstrating that excavated materials are free from contamination is critical where beneficial reuse or deposition at uncontaminated locations is being undertaken by the Contractor.

This characterization will be completed and documented before the soil is removed from the site.

6.3 OFF-SITE CHARACTERIZATION

Characterization of soils after removal from the Site is the least-preferred approach and may be considered by the Contractor where prior access has been restricted and site conditions are such that there will be no available area on the Site to stockpile soil for characterization sampling prior to transporting off-site. This approach is not typically utilized for contaminated materials but may be negotiated with the disposal facility on a case-by-case basis. This approach must have pre-approval by the disposal facility and by the Project team. Where off-site characterization is necessary, these areas are to be identified by the Contractor as early as possible to allow for acceptance and approval.

Similar to the on-Site characterization approach, during excavation, any soil exhibiting visual or olfactory signs of potential contamination must be segregated from other soils and stockpiled separately. Excavation of those areas suspected to have a moderate- or high-risk of being contaminated must be completed under the observation of an appropriately experienced and qualified environmental consultant.



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As indicated above, soils not suspected of contamination must still be characterized to determine final disposal and relocation options.

6.4 REPORTING REQUIREMENTS

During construction, it will be the responsibility of the Contractor to document contaminated material excavated and report this information to the Owner. The exact nature of this reporting will be documented in the Contractor's CEMP.

Excavation of contaminated materials (as defined by the CSR) is considered remediation in BC and has a corresponding reporting requirement to the BC MOECCS. A Notice of Independent Remediation must be generated in the prescribed format and submitted to the BC MOECCS for the site registry.

In the unlikely circumstance that commercial- or industrial-class excavated material is to be relocated to another class of site (e.g. Residential, Parkland, Agricultural, etc.), a Contaminated Soil Relocation Agreement may be required. This is an agreement that includes the source and recipient site owners and is reported to the BC MOECCS for approval.

While the Project will not require a Certificate of Compliance (CofC) demonstrating that remediation has been completed along the Alignment or station sites, it is possible that at some point in the future the lots containing the stations may be redeveloped above ground for residential or commercial use. If contaminated, it is possible that a CofC may be necessary for these sites under the requirements of the CSR. In such cases, it will be necessary for the owner or developer of the property to confirm that remediation has been completed in accordance with the CSR, and to follow the protocols for obtaining a CofC for the site.



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APPENDIX A

Evaluation Summary Table and Summary Reports

Table A-1: Summary of Contaminated Sites Desktop Study Findings
Broadway Subway Project

Site	Current Site Owner	Current Zoning / Land Use	Summary of Evaluation Findings	Contaminants	Risk Ranking	Discussions and Recommendations
Great Northern Way East Laydown Yard (901 and 906 Great Northern Way)	901 Great Northern Way Investments Ltd.	Commercial	<ul style="list-style-type: none">•Currently occupied by RR Donnelley: Digital Prints, Warehousing and Sales•A railway is present adjacent to the north of the property•Property to the east of the Site is listed in the BC Online Site Registry (Site ID: 13190) and is listed as "Active - Remediation Complete." There are conditions to the risk-based COC, which include vapour management if the property is redeveloped. Currently a MEC office building•Due to historical industrial use in the area and the application of wide area fill, it is possible that contaminated soil and/or groundwater is present at the Site	PCOCs (assumed): <ul style="list-style-type: none">• Hydrocarbons• VOCs• Metals	Moderate	As no previous environmental investigations were conducted on this property, soil and groundwater investigation of areas of potential environmental concern identified on this property is recommended for baseline due diligence purposes prior to obtaining this property. As this property is to be used as a laydown area, excavation of material may not be required.
Great Northern Way Laydown Yard, Station, Station House, Emergency Exit/Ventilation Shafts, and Tunnel Construction Excavation (525-555 Great Northern Way)	University of BC/BC Institute of Technology City of Vancouver	Commercial, Institutional	<ul style="list-style-type: none">• In-filled in the early 1900s by Great Northern Railway Company. Purchased in 1960 by Finning for heavy equipment sales and services until 2001• Extensive investigation and remedial excavations conducted at this property between 1994 and 2013• Numerical Certificate of Compliance (CofC) for commercial land use was obtained for this property in 2000• DSI was conducted in 2013 to support application for a CofC to residential standards; 5 AECs identified. Soil contamination was identified in the northeast section of the proposed station location• AIP for the Site dated April 2014 - remediation plan to residential has been approved. Remediation must be completed with 5 years• Golder (2015) collected samples during geotechnical investigation - results showed a shallow soil concentration of VPH exceeding CSR CL standards and CSR soil relocation standards, and one shallow soil concentration of LEPH exceeding CSR soil relocation standards• Several APECs are located along the excavation section from the station extents along the alignment to approximately Foley Street. These include: multiple USTs for waste oil, fuel, and other petroleum products, unidentified fill (primarily metals contamination), a previous chemical storage building, and the railway north adjacent of the alignment• Due to long standing industrial use for this property, possibility of contamination is present even though the property has been subject to numerous environmental investigations	PCOCs: <ul style="list-style-type: none">• Hydrocarbons• VOCs• Metals	High	<p>This property has been the subject of numerous site investigation and remedial excavations. It is currently under an AIP and an application for a CofC to residential standards (risk based) is either currently being prepared or will be prepared in the near future. Some small pockets of contamination are still present on the property; however they were adequately delineated and identified to be distant relative to the location of the proposed SkyTrain station.</p> <p>In November and December 2015, Golder Associates collected soil samples during a geotechnical investigation for the Project. They submitted six samples for laboratory analysis of hydrocarbons, VOCs, and metals. Analytical results indicated some hydrocarbon impacts in shallow soils within the planned alignment. There was additional subsurface investigation conducted in 2016.</p> <p>Further assessment could be completed within the areas of planned excavation, in an effort to better define the contamination in these areas, to allow for more informed planning for work in these areas. A qualified environmental consultant should be present on site during excavation to characterize suspect contaminated media and provide recommendations for contamination management and/or off-site disposal, as necessary.</p>
Main Street East Laydown Yard (Quebec Street North half of 2500 Block) Main Street West Laydown Yard (Part of 2501 and 2509 Main Street)	2501 Main Street Holdings Ltd. Broadway Main Investments Ltd. City of Vancouver	Commercial	<ul style="list-style-type: none">•142-150 East Broadway (adjacent west of East Laydown Yard): Portion of the property is listed in the BC Site Registry (Site ID: 1404), as "Active - Under Remediation"; suspected land use: waste oil, reprocessing, recycling or bulk storage. No documents were available for the site.• 2509 Main Street (East Laydown Yard and Station House): Portion of the property is listed in the BC Site Registry (Site ID: 12939), as "Not Assigned"; site risk classified as non-high risk.• A dry cleaner was identified adjacent west of the East Laydown Yard property between 1930 and 1940• Historical auto repairs and service stations were identified within 50 m of the laydown/station areas (1915-1990)• Historical auto repairs, service stations, cleaners at a distance of 50-100 m from the laydown/station areas (1915-2001)	PCOCs: <ul style="list-style-type: none">• Hydrocarbons• VOCs• Metals	Moderate	As limited previous environmental investigations were conducted on these properties, a portion of the property to be used for laydown is listed on the Site Registry as "Active - Under Remediation", and a historical drycleaner was present on one of the laydown areas. Further investigation of areas of potential environmental concern identified on these properties is recommended for baseline due diligence purposes prior to obtaining the property.
Mount Pleasant Station House (Part of 2501 and 2509 Main Street) Mount Pleasant Station Emergency Exits/Ventilation Shafts (Part of Quebec Street and East Broadway Avenue)	2501 Main Street Holdings Ltd. Broadway Main Investments Ltd.	Commercial	<ul style="list-style-type: none">• Historical auto repairs, service stations, cleaners at a distance of 50-100 m from the station area (1915-2001)•285 East 10th Avenue (formerly 196 Kingsway Avenue) within 100 m of the station and is listed in the BC Site Registry (Site ID: 4313) as "Not Assigned"; certificate of compliance issued using numerical standards for the site. Soil metals contamination still present on western edge of the site due to wide-area fill, which may impact the east section of the station house extents.• 2509 Main Street (East Laydown Yard and Station House): Portion of the property is listed in the BC Site Registry (Site ID: 12939), as "Not Assigned"; site risk classified as non-high risk.	PCOCs: <ul style="list-style-type: none">• Hydrocarbons• VOCs• Metals	Moderate	As limited previous environmental investigations were conducted on the properties overlying the station and station house extents, potential contamination issues are not fully defined. However, a portion of the property to be used for laydown beside the station, is listed on the Site Registry as "Active - Under Remediation." Additionally, a historical drycleaner was present on one of the laydown areas and there is known metals contamination from wide-area fill material to the east of the station. Further investigation of areas of potential environmental concern identified on these properties is recommended for baseline due diligence purposes prior to obtaining the property.
Broadway-City Hall Emergency Exit 505-525 W Broadway	487438 BC Ltd	Commercial	<ul style="list-style-type: none">• A numerical COC to residential standards for this property was obtained in 2008• It is currently all built up as office building / commercial activities	Site remediated to residential standards; no contaminants expected to be encountered or to impact the station	Low	No impact to the proposed SkyTrain station site are anticipated from this property

Table A-1: Summary of Contaminated Sites Desktop Study Findings
Broadway Subway Project

Site	Current Site Owner	Current Zoning / Land Use	Summary of Evaluation Findings	Contaminants	Risk Ranking	Discussions and Recommendations
Cambie Street Laydown (456/450/438/400 West Broadway and 455 West 10th Avenue) Broadway-City Hall Station House (496 and part of 456 West Broadway, 455 West 10th Avenue)	City of Vancouver	Commercial	<ul style="list-style-type: none">• No current areas of potential environmental concern were identified within the property extents• Historical contamination at 505 West Broadway Avenue is listed in the BC Site Registry (Site ID: 9113) as "Inactive-Remediation Complete"; certificate of compliance issued using numerical standards• Historical service station located 10 m west of station house between 1960 and 1975; however it appears this area was excavated during construction of the Canada Line construction and is assumed to not have impacts	PCOCs (assumed): <ul style="list-style-type: none">• Hydrocarbons• Lead	Low	No current areas of potential environmental concern were identified on this property. A historical gas station was located 10 m west from the property between 1960 and 1975; however it is expected that this area was excavated during construction of the Canada Line. If soil, groundwater or soil vapour contamination is suspected during construction, a qualified environmental consultant should be present on site during excavation to characterize suspect contaminated media and provide recommendations for contamination management and/or off-site disposal, if necessary.
Oak Street North Laydown (Laurel Street North of Broadway) Oak Street South Laydown (South of Laurel Street, 925-935 West 10th Avenue) Fairview-VGH Station (916 West Broadway, 2539 Laurel Street, and 984/988 West Broadway)	Hometop Enterprises Ltd. City of Vancouver City of Vancouver Doris H Hsu 984 Developments Inc.	Commercial	<ul style="list-style-type: none">• No current areas of potential environmental concern were identified within the property limits• A current drycleaner was identified to be present at 943 West Broadway Avenue since 1985• A former drycleaner was identified to be present at 999 West Broadway Avenue from approximately the early 1950s to early 1970s• A former service station/car rental/car service property at 988 West Broadway Avenue is listed in the BC Site Registry (Site ID: 12131) as "Not Assigned"; a final determination of contaminated site was issued and the site was determined not contaminated	PCOCs (assumed): <ul style="list-style-type: none">• Hydrocarbons• VOCs• Metals	Low	No current areas of potential environmental concern were identified within the property limits. A drycleaner was identified to be present at 943 West Broadway Avenue since 1985. Additionally, there was a former drycleaner at 999 West Broadway Avenue northwest of the station extents, but is not listed in the BC Site Registry. These are both located downgradient of the station, and no overburden excavation adjacent to these locations is anticipated. The former gas station at 984/988 West Broadway Avenue was determined not to be contaminated but could pose a moderate risk as the emergency exit is within the property extents. Soil and groundwater investigation should be conducted for due diligence purposes prior to construction.
Granville Street Laydown (1409-1451 West Broadway, Part of 1465 West Broadway Avenue (Required Property)) South Granville Station House (1453-1481 West Broadway Avenue) South Granville Station Emergency Exits/Ventilation Shafts (Part of 1409 West Broadway Avenue, Part of 1465 West Broadway Avenue)	South Coast British Columbia Transportation Auth. City of Vancouver Shompond Pongsaratana City of Vancouver South Coast British Columbia Transportation Auth. Gaerber Ventures Ltd.	Commercial	<ul style="list-style-type: none">• Historical car repair shops/auto wrecker were identified at 1421 W Broadway (laydown area) between 1935 and 1950• Historical sheet metal work at 1445 W Broadway (laydown area) between 1930 and 1990• Historical service station at 1424 West Broadway Avenue south of station extents is listed in the BC Site Registry (Site ID: 9183) as "Inactive-Remediation Complete"; certificate of compliance issued using numerical standards• Historical gas stations/garages/cleaners (1920-1990) were identified at 1412/1408 West Broadway Avenue and 2521 Hemlock Street within 50 m of these properties• Historical garage and current service station at 1398 West Broadway Avenue (approximately 50 m southeast of the Site) is listed in the BC Site Registry (Site ID: 293) as "Not Assigned"; notification received about likely or actual substance migration to neighbouring site (West Broadway Avenue and Hemlock Street)• Historical service station located at 2500 Granville Street was identified south of the site• Historical drycleaners located at 2456 Granville street was identified northwest of the site• Historical heating oil sales business located at 1467 West Broadway Avenue was identified within station house extents• A current vehicle dealership and garage were identified at 1395 West Broadway Avenue, east of the Site	PCOCs (assumed): <ul style="list-style-type: none">• Hydrocarbons• VOCs• Metals	Moderate	Former areas of potential environmental concern were identified within the property limits. The former auto wrecker, sheet metal work and heating oil business are potential sources of contamination. In addition, the current service station at 1398 West Broadway Avenue has recent known offsite migration of hydrocarbon contaminants westward towards the station extents. Further investigation of areas of potential environmental concern identified on the laydown properties requiring acquisition is recommended for baseline due diligence purposes prior to obtaining these properties. If soil, groundwater or soil vapour contamination is suspected during construction, a qualified environmental consultant should be present on site during excavation to characterize suspect contaminated media and provide recommendations for contamination management and/or off-site disposal, if necessary.
Arbutus Station House (and associated required property) (2097 West Broadway Avenue and 2096 West 8th Avenue) Arbutus Station Emergency Exits/Ventilation Shafts (2084 West Broadway Avenue and sidewalks on West Broadway Avenue)	City of Vancouver Private Strata City of Vancouver	Commercial	<ul style="list-style-type: none">• Historical roofing company at 2097 West Broadway Avenue (station house) is listed in the BC Site Registry (Site ID: 43) as "Active - Under Remediation"; concentration criteria approach used. A gasoline underground storage tank (900-gallon) and smaller fuel oil tank were excavated from this property in 1989 during site upgrades (new/updated building on site dated 1989). There was active remediation conducted on-site using a bio-remediation facility, with impacts remaining that exceed current CSR standards• Contamination appears to extend off the property towards Arbutus to the west but no investigation was conducted outside of the property limits• No groundwater investigation was conducted but groundwater is likely impacted by hydrocarbons• No indication of completion / confirmation of remediation on file	Confirmed contaminants : <ul style="list-style-type: none">• Hydrocarbons• Lead PCOCs <ul style="list-style-type: none">• Chlorinated solvents (dry-cleaning)• Metals• VOCs	High	Historical contamination has been identified to be present on this property and is suspected to be migrating to the adjacent Arbutus street. If soil, groundwater or soil vapour contamination is suspected during construction, a qualified environmental consultant should be present on site during excavation to characterize suspect contaminated media and provide recommendations for contamination management and/or off-site disposal, if necessary.

Table A-1: Summary of Contaminated Sites Desktop Study Findings
Broadway Subway Project

Site	Current Site Owner	Current Zoning / Land Use	Summary of Evaluation Findings	Contaminants	Risk Ranking	Discussions and Recommendations
Arbutus Station and cross-over Tunnel Excavation (West Broadway from approximately 2145 West Broadway to Cypress Street)	City of Vancouver	Industrial	<ul style="list-style-type: none">•The roadway (project alignment) between approximately Arbutus Street and Cypress Street has three BC Site Registries along or near the alignment: impacted property at 2150 West Broadway Avenue (Site ID: 18381), City Management Area north of West Broadway Avenue on Arbutus Street (Site ID: 18380), and the corner of Maple Street and West Broadway Avenue (Site ID: 15919).•Investigation along the roadway has been limited•High likelihood of encountering confirmed contaminants and PCOCs to the west of Arbutus Street on West Broadway Avenue and to the north of Maple Street along West Broadway Avenue.•Historical service station at 1996 West Broadway Avenue/2528 Maple Street south of alignment is listed in the BC Site Registry (Site ID: 6274) as "Not Assigned"; certificate of compliance was issued using numerical standardsHowever, the historical service station has impacted Maple Street to the west (Site ID: 15919) and 2002-2084 West Broadway Avenue (Site ID 11559). Site ID 15919 does not have any indication of completion/confirmation of remediation on file. Site ID 11559 has a certificate of compliance using risk based standards▪ Current service station at 2103 West Broadway Avenue (circa 1963) is listed in the BC Site Registry (Site ID: 2739) as "Not assigned"; site has been classified as non high-risk▪ Upgrades at the Site in 1987 and subsequent drilling in 1993 indicated that hydrocarbons were present in soil and water at the site▪ Free product was periodically recovered from the Site between 1987 and 1995▪ Additional investigation concluded contamination still present on site▪ Off-site soil contamination observed south of Site underneath West Broadway Avenue at a depth of approximately 4.7 to 6.1 mbgs▪ Off-site groundwater contamination observed southwest of Site underneath West Broadway Avenue at a depth of approximately 5.2 to 7.6 mbgs▪ The impacted sites at West Broadway Avenue and at 2150 West Broadway Avenue filed notification of off-site migration and were classified as non-high risk▪ No indication of completion / confirmation of remediation on file for the service station at 2103 West Broadway Avenue	Confirmed contaminants : <ul style="list-style-type: none">▪ Hydrocarbons PCOCs: <ul style="list-style-type: none">▪ Chlorinated solvents (dry-cleaning)▪ VOCs▪ Metals	High	<p>Current and historical contamination has been identified to be present adjacent to and within the project alignment, with a high likelihood of contaminant migration into the excavation extents.</p> <p>Further assessment could be completed within the areas of planned excavation, in an effort to better define the contamination in these areas, to allow for more informed planning for work in these areas. A qualified environmental consultant should be present on site during excavation to characterize suspect contaminated media and provide recommendations for contamination management and/or off-site disposal, as necessary.</p>
Arbutus Street Laydown Yards and required property (Former Railway Right-of-Way, 2091 West Broadway Avenue, Maple Street North and South of West Broadway	City of Vancouver Shut Wah Yen	Commercial and Industrial	No specific concerns for the Maple Street Laydown Sites	PCOCs (assumed): <ul style="list-style-type: none">▪ Chlorinated solvents▪Hydrocarbons▪Metals▪VOCs	Moderate	<p>Further investigation of areas of potential environmental concern identified on the laydown properties requiring acquisition is recommended for baseline due diligence purposes prior to obtaining these properties.</p> <p>If soil, groundwater or soil vapour contamination is suspected during construction, a qualified environmental consultant should be present on site during excavation to characterize suspect contaminated media and provide recommendations for contamination management and/or off-site disposal, if necessary.</p>

Notes:

CSR	- Contaminated Sites Regulation
CL	- Commercial land use standards
IL	- Industrial land use standards
RL	- Residential land use standards
AWM	- Marine aquatic life water use standards
AWF	- Freshwater aquatic life water use standards
DW	- Drinking water standards
PCOCs	- Potential contaminants of concern
VOCs	- Volatile organic compounds
VPH	- Volatile petroleum hydrocarbons
LEPH	- Light extractable petroleum hydrocarbons (C10-C19)

SITE NAME: GREAT NORTHERN WAY EAST LAYDOWN YARD

SITE ADDRESS: 901-965 GREAT NORTHERN WAY

BC MOECCS SITE REGISTRY SITE ID: 1410, 13190

RISK RANKING AND REASONING: HIGH RISK

The site is ranked as **High Risk** due to known, but limited, contamination at the subject site. One Site Registry report is available for the area.

CURRENT OPERATIONS/ACTIVITIES:

- Low Rise Commercial (subject site) (901-965 Great Northern Way); and
- Medium Rise/Office Building (1077 and 1155 Great Northern Way) – Mountain Equipment Co-op

FORMER OPERATIONS/ACTIVITIES:

- Unknown (subject site, 901-965 Great Northern Way);
- Petroleum Products/produce water storage/aboveground/underground tank (1077 Great Northern Way and 1155 Great Northern Way);
- Auto/truck/bus/subway/other vehicle repair/salvage/wrecking (1077 Great Northern Way and 1155 Great Northern Way);
- Battery (Lead acid or other) recycling (1155 Great Northern Way);
- Miscellaneous industries, operations, or activities (drill manufacturing) (1155 Great Northern Way);
- Paint/lacquer/varnish manufacturing/formulation/recycle/wholesale bulk storage (1155 Great Northern Way);
- Waste oil, reprocessing, recycling or bulk storage (1155 Great Northern Way); and
- Welding or machine shops (1155 Great Northern Way)

POTENTIAL CONTAMINANTS OF CONCERN AND RELEASE/MIGRATION MECHANISMS:

Contaminants of concern include benzene, toluene, ethylbenzene, xylene (BTEX), volatile petroleum hydrocarbons (VPH), light end hydrocarbons (LEPH), heavy end petroleum hydrocarbons (HEPH), regulated metals, solvents, and glycol.

Potential release/migration mechanisms include possible leaks from underground fuel storage tanks, underground product distribution lines to the pumps, and spills from filling USTs and/or vehicles. Fill dirt, soil, gravel, sand or like materials from a contaminated site or from a source

used for any of the activities listed under Schedule 2. PCB-containing electrical transformers or capacitors either at grade, attached above ground to poles, located within buildings, or stored. Spills from bulk storage containers and leaks from manufacturing processes.

AVAILABLE REPORTS:

- **Site Registry Detail Report (1410) (1155 Great Northern Way, approximately 100 m to the east of the Site)** – Ordered April 12, 2015. BC MOECCS, last updated June 10, 2005.
 - **Phase 2 Environmental Site Assessment 1155 Great Northern Way, Vancouver, B.C. (September 30, 1994)** – Submitted to BC MOECCS from Norecol, Dames & Moore Inc. and Rogers Cable TV Ltd., October 7, 1994.
 - **Phase 1 Environmental Site Assessment and Underground Storage Tank Removal Program 1155 Great Northern Way, Vancouver, B.C. (September 30, 1994)** – Submitted to BC MOECCS from Norecol, Dames & Moore Inc. and Rogers Cable TV Ltd., October 7, 1994.
- **Site Registry Detail Report (13190) (1077 Great Northern Way, adjacent east of the Site)** – Ordered April 12, 2015. BC MOECCS, last updated January 25, 2013.
 - **Summary of Site Condition (September 12, 2012)** – Submitted to BC MOECCS from Golder Associates Ltd., September 12, 2012.
 - **Stage 2 Preliminary Site Investigation and Detailed Site Investigation, Mountain Equipment Co-Op, 1077 Great Northern Way, Vancouver BC (September 12, 2012)** – Submitted to BC MOECCS from Golder Associates Ltd., October 3, 2012.
 - **Stage 1 Preliminary Site Investigation, Mountain Equipment Co-Op, 1077 Great Northern Way, Vancouver BC (September 7, 2012)** – Submitted to BC MOECCS from Golder Associates Ltd., October 3, 2012.
 - **Quantitative Human Health and Ecological Risk Assessment, 1077 Great Northern Way, Vancouver BC (September 7, 2012)** – Submitted to BC MOECCS from Golder Associates Ltd., October 3, 2012.
 - **Summary of Site Condition (September 7, 2012)** – Submitted to BC MOECCS from Golder Associates Ltd., October 3, 2012.
 - **RE: Applicability of Drinking Water Standards, 1077 Great Northern Way, Vancouver, Golder Associates Project No. 08-1436-0068 (January 25, 2012)** – Submitted to BC MOECCS from Golder Associates Ltd., October 3, 2012.
 - **Applicability of Drinking Water Standards, 1077 Great Northern Way, Vancouver, Golder Associates Project No. 08-1436-0068 (December 19, 2011)** – Submitted to BC MOECCS from Golder Associates Ltd., October 3, 2012.

SUMMARY OF REVIEWED REPORTS:

Site Registry Detail Report (1410) (1155 Great Northern Way, approximately 100 m to the east of the Site)

- **Site Investigation Report Submitted (October 7, 1994)** – Note – Phase 1 and Phase 2 Environmental Site Assessments. Submitted to BC MOECCS from Norecol, Dames & Moore Inc. and Rogers Cable TV Ltd., October 7, 1994.
- **Record Status** – Active – Under Assessment.

Phase 2 Environmental Site Assessment 1155 Great Northern Way, Vancouver, B.C. (September 30, 1994)

- A Phase 2 Environmental Site Assessment was conducted for 1155 Great Northern Way (PID: 007-956-711).
- Four boreholes were advanced on the site (three completed as monitoring wells) to characterize potential contamination from APECs nearby (previous USTs, vehicle wash pit, paint shop, and an oil shed). Soil and groundwater samples were collected and analyzed for PCOCs, including: mineral oil and grease, metals, volatile organic compounds, total extractable hydrocarbons, light aliphatic hydrocarbons, benzene, toluene, ethylbenzene, and xylenes.
- Results indicated no exceedances of commercial/industrial land use standards at the time, except for zinc, which exceeded the criterion in one observation well.
- As there was no use of shallow groundwater used for drinking water in the area, drinking water standards did not apply at the time.
- Environmental receptors in the area (False Creek) would not be impacted by groundwater due to wide area fill. Groundwater flowing towards False Creek would encounter fill material and would likely be impacted prior to discharge into False Creek.
- The environmental consultant concludes that no further environmental assessment or subsurface investigation of the subject property is required.

Site Registry Detail Report (13190) (1077 Great Northern Way, adjacent east of the Site)

- **Site Profile Received (July 8, 2011)** – Submitted to BC MOECCS from Golder Associates, July 8, 2011.
- **Site Profile Reviewed (July 14, 2011)** – BC MOECCS, July 14, 2011.
- **Site Profile – Further Investigation Required by the Ministry (July 14, 2011)** – BC MOECCS, July 14, 2011.
- **Case Management Item (December 23, 2011)** – Request for Water Use Determination. Submitted to BC MOECCS from Golder Associates, December 23, 2011.
- **Site Risk Classified – Site is Non-High Risk (January 12, 2012)** – Submitted to BC MOECCS from Golder Associates, January 12, 2012.
- **Case Management Item (January 12, 2012)** – The site qualified for a drinking water exemption. Issued by BC MOECCS to Mountain Equipment Cooperative (Vancouver), January 12, 2012.

- **Preapproval of Contaminated Sites Instrument Application Issued (July 3, 2012)** – Preapproval involving risk assessments. Issued by BC MOECCS, July 3, 2012.
- **Certificate of Compliance Requested (October 3, 2012)** – Submitted to BC MOECCS by Mountain Equipment Cooperative (Vancouver) and Golder Associated Ltd., October 3, 2012.
- **Certificate of Compliance Issued Using Risk Based Standards (November 27, 2012)** – Issued on the recommendation of an Approved Professional (Mark Adamson) under Protocol 6 of the Contaminated Sites Regulation.

Required Actions: Also see instrument Schedule B, Condition 1 – The principal risk management conditions upon which the risk assessment is based include the following:

- Groundwater is not used for drinking water; and
- Soil is covered with buildings, pavement or 1 metre of clean fill

Condition 3 – Performance verification must be undertaken as specified

Condition 4 – Up-to-date records of performance verification actions and results must be maintained by the responsible person(s) or their agent. The records must be available for inspection by the director.

Condition 6 – Unless otherwise approved by the director, the structures and locations of buildings at the site and at neighbouring parcels must remain consistent with the range of building structures and locations described in the vapour assessment, and building depths at the site and at neighbouring parcels must remain the same as, or shallower than, the building depths chosen for the selection of vapour attenuation factors in the vapour assessment.

Issued by BC MOECCS to Mountain Equipment Cooperative (Vancouver) and Golder Associated Ltd., November 27, 2012.

- **Record Status** – Active – Remediation complete.

DISCUSSION OF FINDINGS:

Based on the information available, the Constructor should be aware that the following may be present at the Great Northern Way East Laydown Yard:

- Shallow contaminated soil beneath 901-965 Great Northern Way may be encountered during excavation or regrading. It is unlikely that contaminated soil will be encountered during work at the Great Northern Way East Laydown Yard, as no excavation is expected to occur.
- Hydrocarbon vapours may be encountered during work at 901-965 Great Northern Way. The need for site worker vapour respiratory protection will need to be evaluated.
- Contaminated groundwater may be present beneath 901-965 Great Northern Way. It is unlikely that contaminated groundwater will be encountered as no excavation is expected to occur.

POTENTIAL EXTENTS OF CONTAMINATION: 0 m³

Based upon following assumptions:

- As this is a materials laydown site only, it is expected that no subsurface works are required

CONSTRUCTION CONSIDERATIONS

Water disposal – It is unlikely that groundwater will be encountered during construction or regrading as any expected construction would have minimal and or superficial disturbance. If excavation water is encountered, excavation water management will be required; untreated discharge to the receiving environment is not permitted. Potential options include sanitary or storm water discharge via a permit, or off-site treatment and disposal.

Soil disposal – Previously reported contamination at 1077 Great Northern Way; potential for encountering during excavation or regrading. Contaminated soil encountered during construction of the Great Northern Way East Laydown Yard will require management in accordance with the *Contaminated Sites Regulation*, applicable city by-laws, and the Project Construction Specifications.

Vapour Inhalation – Mitigation plans should be in place for worker exposure, as there is potential for vapour inhalation due to the nature of historically identified contaminants.

SITE NAME: GREAT NORTHERN WAY STATION, STATION HOUSE, TUNNEL CONSTRUCTION EXCAVATION, AND LAYDOWN YARD

SITE ADDRESS: PART OF THORNTON STREET, 384 1ST AVENUE EAST, 1802 THORNTON STREET, 475-485 GREAT NORTHERN WAY

BC MOECCS SITE REGISTRY SITE ID: 1677, 7653, 13021, 15413

RISK RANKING AND REASONING: HIGH RISK

The site is ranked as **High Risk** due to known historic and current contamination.

CURRENT OPERATIONS/ACTIVITIES:

- Commercial (525 Great Northern Way)- Equinox Gallery;
- Emily Carr University of Art and Design (520 East 1st Avenue);
- Gravel lot (part of 475 Great Northern Way and 485 Great Northern Way);
- Commercial (520 East 1st Avenue) – READ Books;
- Roadway (part of Thornton Street); and
- British Columbia Institute of Technology (555 Great Northern Way)

FORMER OPERATIONS/ACTIVITIES:

- Industrial/Commercial (525-555 Great Northern Way)- Finning Canada; and
- Railway/Railyard (north adjacent and occupying 525-555 Great Northern Way)

POTENTIAL CONTAMINANTS OF CONCERN AND RELEASE/MIGRATION MECHANISMS:

Contaminants of concern include benzene, toluene, ethylbenzene, xylene (BTEX), volatile petroleum hydrocarbons (VPH), light end hydrocarbons (LEPH), heavy end petroleum hydrocarbons (HEPH), Polycyclic aromatic hydrocarbons (PAHs), regulated metals, and glycol.

Potential release/migration mechanisms include possible leaks from underground fuel storage tanks, underground product distribution lines to the pumps, and spills from filling USTs and/or vehicles. Also, there is the possibility of leaching of creosote from railway ties into surficial soils and/or groundwater.

AVAILABLE REPORTS:

555 & 577 Great Northern Way, approximately 70 m east of the Site

- **Site Registry Detail Report (1677)** – Ordered on April 12, 2015. BC MOECCS, last updated November 22, 2013.

- **Letter RE: Release Request – Development & Building Permit, Subdivision and Rezoning Application Lot Q of the Great Northern Way Campus, Great Northern Way, Vancouver, BC.** Submitted to BC MOECCS from George Szefer, Great Northern Way Trust, May 2, 2013.
- **Letter RE: Release Request – Development & Building Permit, Subdivision and Rezoning Application 685 Great Northern Way, Vancouver, BC.** Submitted to BC MOECCS from Keystone Environmental Ltd., May 11, 2001.
- **Letter RE: Supplemental Field Investigation.** Submitted to BC MOECCS from Next Environmental Inc., May 2, 2000.
- **Letter RE: Outstanding Issues.** Submitted to BC MOECCS from Next Environmental Inc, April 6, 2000.
- **Letter RE: Groundwater Monitoring.** Submitted to BC MOECCS from Next Environmental Inc, February 15, 2000.
- **Letter RE: Outstanding Issues.** Submitted to BC MOECCS from Next Environmental Inc, January 17, 2000.
- **Letter Report RE: AiP Application.** Submitted to BC MOECCS from Next Environmental Inc, November 22, 1999.
- **Letter RE: Outstanding Issues.** Submitted to BC MOECCS from Next Environmental Inc, November 10, 1999.
- **Letter RE: Outstanding Issues.** Submitted to BC MOECCS from Next Environmental Inc, October 25, 1999.
- **Letter RE: Outstanding Issues.** Submitted to BC MOECCS from Next Environmental Inc, October 12, 1999.
- **Environmental Stage 2 Preliminary Site Investigation at 555 Great Northern Way, Vancouver (June 24, 1999).** Submitted to BC MOECCS from Next Environmental Inc, July 13, 1999.
- **Confirmation of Remediation Report at 555 Great Northern Way, Vancouver.** Submitted to BC MOECCS from Next Environmental Inc. and Finning (Canada), June 24, 1999.
- **Letter Report RE: Special Waste Excavation, 555 Great Northern Way (May 18, 1999).** Submitted to BC MOECCS from Retec, July 13, 1999.
- **Confirmation of Remediation Report at 577 Great Northern Way, Vancouver (October 29, 1998).** Submitted to BC MOECCS from Next Environmental Inc. and Finning (Canada), July 13, 1999.
- **Environmental Stage 2 Preliminary Site Investigation at 577 Great Northern Way, Vancouver (October 28, 1998).** Submitted to BC MOECCS from Next Environmental Inc, July 13, 1999.

- **Letter Report RE: Finning Monitoring and Closure Report, Feb-Aug/1996, 735 Great Northern Way, Vancouver (October 29, 1996).** Submitted to BC MOECCS from Remedicon Remediation Consultants Ltd., July 13th, 1999.
- **Underground Storage Tank Removal, Finning Ltd., 555-735 Great Northern Way, Vancouver, BC (August 1, 1995).** Submitted to BC MOECCS from Remedicon Remediation Consultants Ltd., July 13, 1999.
- **Remediation Plan for Special Waste at 555 Great Northern Way (August 1, 1995).** Submitted to BC MOECCS from Remedicon Remediation Consultants Ltd., July 13, 1999.
- **Supplementary Environmental Investigation – Vancouver Finning Complex, 555 Great Northern Way (June 1, 1994).** Submitted to BC MOECCS from O'Connor Associates Environmental Inc. and Finning (Canada), October 12, 1999.
- **Environmental Investigation, Vancouver Finning Complex, 555 Great Northern Way (February 1, 1994).** Submitted to BC MOECCS from O'Connor Associates Environmental Inc. and Finning (Canada), October 12, 1999.

577, 655 & 735 Great Northern Way, approximately 230 m east of the Site

- **Site Registry Detail Report (7653)** – Ordered on November 5, 2017. BC MOECCS, last updated March 17, 2005.
 - **Recommendation for a Certificate of Compliance, Protocol 6, Protocol for Independent Remediation for Low to Moderate Risk Sites (December 17, 2001).** BC MOECCS, December 17, 2001.
 - **Report of Findings – Stage 1 Preliminary Site Investigation, Detailed Site Investigation and Remedial Action Report (December 17, 2001).** Keystone Environmental, December 17, 2001.

557 Great Northern Way, approximately 170 m east of the Site

- **Site Registry Detail Report (13021)** – Ordered October 29, 2017. BC MOECCS, last updated September 16, 2016.
 - **Summary of Site Condition (November 24, 2011).** Submitted to BC MOECCS from Keystone Environmental, January 4, 2012.
 - **Report of Findings, Stage 1 Environmental Site Assessment, 685 Great Northern Way, Vancouver, BC (May, 2011).** Submitted to BC MOECCS from Keystone Environmental, January 4, 2012.
 - **Report of Findings, Preliminary Site Investigation, Stage 2, 685 Great Northern Way, Vancouver, BC (November 1, 2011).** Submitted to BC MOECCS from Keystone Environmental, January 4, 2012.
 - **Addendum to Applicability of Drinking Water Standards 685, Great Northern Way, Vancouver, BC, Keystone Environmental Ltd. Project No. 10334 (1.0) (October 12,**

- 2011).** Submitted to BC MOECCS from Keystone Environmental Ltd., October 18, 2011.
- **Summary of Site Condition (August 25, 2011).** Submitted to BC MOECCS from Keystone Environmental Ltd., August 26, 2011.
 - **Applicability of Drinking Water Standards 685 Great Northern Way, Vancouver, BC. Keystone Environmental Ltd. Project No. 10334 (1.0) (August 25, 2011).** Submitted to BC MOECCS from Keystone Environmental Ltd., August 26, 2011.
 - **Applicability of Drinking Water Standards Volume 2 of 2 (August 1, 2011).** Submitted to BC MOECCS from Keystone Environmental Ltd., August 26, 2011.
 - **Applicability of Drinking Water Standards Volume 1 of 2 (August 1, 2011).** Submitted to BC MOECCS from Keystone Environmental Ltd., August 26, 2011.
 - **Geotechnical Report, Lot 3, Great Northern Way Campus, Vancouver, B.C. (March 30, 2010).** Submitted to BC MOECCS from Davies Geotechnical Inc., January 4, 2012.
 - **Report of Findings, Preliminary Soil Investigation, 557 Great Northern Way, Vancouver, BC. Project No. 10334 (1.0) (March 29, 2010).** Submitted to BC MOECCS from Keystone Environmental Inc., January 4, 2012.
 - **Certificate of Compliance, 555 and 577 Great Northern Way, Vancouver, BC (April 17, 2000).** Issued by BC MOECCS, January 4, 2012.
 - **Certificate of Compliance, 655 Great Northern Way, Vancouver, BC (March 10, 1999).** Issued by BC MOECCS, January 4, 2012.
 - **Environmental Stage 2 Preliminary Site Investigation at 577 Great Northern Way, Vancouver, B.C. (October 1, 1998).** Submitted to BC MOECCS from Next Environmental, December 6, 2011
 - **Confirmation of Remediation Report at 577 Great Northern Way, Vancouver, B.C. (October 1, 1998).** Submitted to BC MOECCS from Next Environmental, January 4, 2012.
 - **Environmental Stage 2 Preliminary Site Investigation at 655 Great Northern Way, Vancouver, BC (July 1, 1998).** Submitted to BC MOECCS from Next Environmental, January 4, 2012.
 - **Environmental Investigation, Vancouver Finning Complex, 555 Great Northern Way, Vancouver, British Columbia (February 1, 1994).** Submitted to BC MOECCS from Next Environmental, January 4, 2012.

525, 555 and 577 Great Northern Way, approximately 30 m northeast of the Site

- **Site Registry Detail Report (15413)** – Ordered October 29, 2017. BC MOECCS, last updated June 23, 2016.
 - **Confirmation of Remediation (April 29, 2016).** Submitted to BC MOECCS from PGL Environmental Consultants Ltd., June 10, 2016.

- **Summary of Site Condition (April 28, 2016).** Submitted to BC MOECCS from PGL Environmental Consultants Ltd., June 10, 2016.
- **Approval in Principle – 525 and 555 Great Northern Way, Vancouver, BC, Site ID: 15413. (April 29, 2015).** Submitted to BC MOECCS from PGL Environmental Consultants Ltd., June 10, 2016.
- **Summary of Site Condition (January 1, 2014).** Submitted to BC MOECCS from Pottinger Gaherty Environmental Consultants Ltd., January 1, 2014.
- **Stage 2 Preliminary Site Investigation, Detailed Site Investigation and Remedial Action Plan, Great Northern Way Campus, Great Northern Way, Vancouver (December 1, 2013).** Submitted to BC MOECCS from Pottinger Gaherty Environmental Consultants Ltd., December 1, 2013.
- **Stage 1 Preliminary Site Investigation, Great Northern Way Campus, Great Northern Way, Vancouver, BC (October 1, 2013).** Submitted to BC MOECCS from Pottinger Gaherty Environmental Consultants Ltd., October 1, 2013.
- **Water Use Determination Application Review, Remaining Portion of Lot Q of the Great Northern Way Campus, Great Northern Way, Vancouver, BC (June 1, 2013).** BC MOECCS, June 1, 2013.
- **Addendum to Water Use Determination – Lot Q of the Great Northern Way Campus, Part of Ministry of Environment Site 1677, Great Northern Way, Vancouver (May 22, 2013).** Submitted to BC MOECCS from Pottinger Gaherty Environmental Consultants Ltd. and Great Northern Way Trust, May 22, 2013.
- **Information Request ? Water Use Determination Application of Lot Q of the Great Northern Way Campus, Great Northern Way, Vancouver, BC (May 1, 2013).** BC MOECCS, May 1, 2013.
- **Water Use Determination, Lot Q of the Great Northern Way Campus (Part of MOE Site 1677), Great Northern Way, BC (March 21, 2013).** Submitted to BC MOECCS from Pottinger Gaherty Environmental Consultants Ltd. and Great Northern Way Trust, March 22, 2013.
- **Addendum to Water Use Determination – Lot Q of the Great Northern Way Campus, Great Northern Way, Vancouver, BC (March 1, 2013).** Submitted to BC MOECCS from Pottinger Gaherty Environmental Consultants Ltd., March 1, 2013.
- **Water Use Determination, Lot Q of the Great Northern Way Campus (March 1, 2013).** Submitted to BC MOECCS from Pottinger Gaherty Environmental Consultants Ltd., March 1, 2013.
- **Report of Findings Stage 1 Environment Site Assessment, 685 Great Northern Way, Vancouver, BC (May 1, 2011).** Submitted to BC MOECCS from Keystone Environmental Ltd., May 1, 2011.
- **Confirmation of Remediation Thornton Street Row, 555 Great Northern Way, Vancouver, BC (July 1, 2008).** Submitted to BC MOECCS from Keystone Environmental Ltd., July 1, 2008.

- **Finning Canada 555 and 577 Great Northern Way, Vancouver, BC (May 1, 2000).** Submitted to BC MOECCS from Next Environmental, May 1, 2000.
- **Finning Canada 555 and 577 Great Northern Way, Vancouver, BC (April 1, 2000).** Submitted to BC MOECCS from Next Environmental, April 1, 2000.
- **Finning Canada 555 and 577 Great Northern Way, Vancouver, BC (February 1, 2000).** Submitted to BC MOECCS from Next Environmental, February 1, 2000.
- **Finning Canada 555 and 577 Great Northern Way, Vancouver, BC (January 1, 2000).** Submitted to BC MOECCS from Next Environmental, January 1, 2000.
- **Finning Canada 555 and 577 Great Northern Way, Vancouver, BC (November 1, 1999).** Submitted to BC MOECCS from Next Environmental, November 1, 1999.
- **Finning Canada 555 and 577 Great Northern Way, Vancouver, BC BCMOELP #26250-20/844 (Site 1677) (November 1, 1999).** Submitted to BC MOECCS from Next Environmental, November 9, 1999
- **Finning Canada 555 and 577 Great Northern Way, Vancouver, BC (October 1, 1999).** Submitted to BC MOECCS from Next Environmental, October 1, 1999.
- **Letter Report RE: 555 and 577 Great Northern Way (August 1, 1999).** Submitted to BC MOECCS from Retec, August 1, 1999.
- **Environmental Stage 2 Preliminary Site Investigation at 555 Great Northern Way, Vancouver, BC (June 1, 1999).** Submitted to BC MOECCS from Next Environmental, June 1, 1999.
- **Confirmation of Remediation Report at 555 Great Northern Way, Vancouver, BC (June 1, 1999).** Submitted to BC MOECCS from Next Environmental, June 1, 1999.
- **Letter Report RE: Special Waste Excavation ? 555 Great Northern Way (May 1, 1999).** Submitted to BC MOECCS from Retec, May 1, 1999.
- **Confirmation of Remediation Report at 555 Great Northern Way, Vancouver, BC (October 1, 1998).** Submitted to BC MOECCS from Next Environmental, October 1, 1998.
- **Environmental Stage 2 Preliminary Site Investigation at 577 Great Northern Way, Vancouver, B.C. (October 1, 1998).** Submitted to BC MOECCS from Next Environmental, October 1, 1998.
- **Remediation Plan for Special Waste at 555 Great Northern Way (August 1, 1995).** Submitted to BC MOECCS from Remedicon Remediation Consultants Ltd., August 1, 1995.
- **Underground Storage Tank Removal, Finning Ltd., 555-735 Great Northern Way, Vancouver, BC (July 1, 1995).** Submitted to BC MOECCS from Remedicon Remediation Consultants Ltd., July 1, 1995.

- **Supplementary Environmental Investigation, Vancouver Finning Complex, 555 Great Northern Way, Vancouver, BC (February 1, 1994).** Submitted to BC MOECCS from O'Connor Associates Environmental Inc., February 1, 1994.
- **Environmental Investigation, Vancouver Finning Complex, 555 Great Northern Way, Vancouver, BC (February 1, 1994).** Submitted to BC MOECCS from O'Connor Associates Environmental Inc., February 1, 1994.
- **Transmittal Letter: Selected Interim Draft Borehole Records (October 19, 2017) (Varies along the alignment).** From Trevor Fitzell, Golder Associates to Lima Howlin, Stantec Consulting, October 19, 2017.

SUMMARY OF REVIEWED REPORTS:

555 & 577 Great Northern Way, approximately 70 m east of the Site

Site Registry Detail Report (1677)

- **Monitoring Report Submitted (September 13, 1995)** – Report in support of approval application. Submitted to BC MOECCS from Remedicon Remediation Consultants Ltd., September 13, 1995.
- **Waste Management Approval Issued (February 2, 1996)** – Issued by BC MOECCS to Remedicon Remediation Consultants Ltd., March 6, 1997. AS-14259 authorizes the storage and treatment of 126,000 kg of waste environmentally hazardous substances, solid, N.O.S. (xylenes) (hydrocarbon contaminated soil). Soil was delisted on March 6, 1997.
- **Monitoring Report Submitted (June 20, 1996)** – Note: Inadequate monitoring – Does not meet permit conditions. Required Actions: Submission of additional monitoring information. Submitted to BC MOECCS from Remedicon Remediation Consultants Ltd., January 21, 1996.
- **Monitoring Report Due (June 21, 1996)** – Required Actions: Submission of monitoring data as specified by approval. Letter requesting monitoring data lacking from submission. Requested by BC MOECCS from Remedicon Remediation Consultants Ltd., June 21, 1996.
- **Monitoring Report Submitted (July 17, 1996)** – Monitoring report received with no additional information than the previous submission. Submitted to BC MOECCS from Remedicon Remediation Consultants Ltd., July 17, 1996.
- **Monitoring Report Due (October 18, 1996)** – Letter to Remedicon requesting data required (Submission of requested data). Issued by BC MOECCS from Remedicon Remediation Consultants Ltd., October 18, 1996.
- **Monitoring Report Submitted (October 29, 1996)** – Submitted to BC MOECCS from Remedicon Remediation Consultants Ltd., October 29, 1996.
- **Case Management Item (December 15, 1997)** – Remediation closure letter prepared by Remedicon Consultants Ltd. has been submitted to BC Environment dated October 2,

1997. Submitted to BC MOECCS from Remedicon Remediation Consultants Ltd. on behalf of Finning Tractor & Equipment Company Limited, December 15, 1996.

- **Certificate of Compliance Requested without Inspection (August 3, 1999)** – Clarification of report information requested. Requested by Finning (Canada), August 3, 1999.
- **Approval in Principle Issued (November 24, 1999)** – Ministry could not concur that site eligible for Certificate of Compliance based on information provided to date. Requirement to address outstanding issues incorporated into Schedule B of Approval in Principle. Issued by BC MOECCS to Finning (Canada), November 24, 1999.
- **Certificate of Compliance Issued (May 17, 2000)** - Issued by BC MOECCS to Finning (Canada), May 17, 2000.
- **Case Management Item (March 22, 2013)** – TG6 water use determination requested – Review transferred to Site 15413. Submitted to BC MOECCS from Pottinger Gaherty Environmental Consultants Ltd. on behalf of Great Northern Way Trust, March 22, 2013.
- **Site Risk Classified – Site is non-high risk (October 17, 2013)** – Submitted to BC MOECCS from Pottinger Gaherty Environmental Consultants Ltd., October 17, 2013.
- **Record Status – Active: Under Assessment (November 22, 2013)**

Environmental Stage 2 Preliminary Site Investigation at 577 Great Northern Way, Vancouver (October 28, 1998)

- Metals contamination exceeding CSR IL soil standards in the northwest corner of the site and underneath the building was observed at the time of the investigation.
- Groundwater contamination for both metals and PAHs on site exceeded CSR Aquatic Life standards at the time. However, CSR Aquatic Life standards are deemed non-applicable at the site.
- High headspace vapour readings (> 11,000 ppm) were observed underneath the building and at the south edge of the site.
- Current CSR CL standards for both soil and groundwater may apply to the site and exceedances may be present.
- Due to separation distance and perceived groundwater flow to the north, contamination that may be present at 577 Great Northern Way is not likely to impact the Site.

Environmental Stage 2 Preliminary Site Investigation at 555 Great Northern Way, Vancouver (June 24, 1999)

- Previous environmental investigation concluded that soil and groundwater impacts exist east of the welding shop (present-day art gallery, 525 Great Northern Way) and west of the main building (555 Great Northern Way) in the vicinity of the UST basins. The USTs were removed in the mid-1990s.
- Metals contamination (antimony: 88 µg/g, tin: 193 µg/g, and zinc: 1290 µg/g) was observed in soils (depth of approximately 1.5 m to 2.1 m below grade) in the

southwestern section of the site and exceeded CSR IL standards at that time. Additionally, lead contamination (1060 µg/g) exceeded CSR IL standards at the time. Contaminated soil volume is estimated to be 170 m³. Metals contamination was likely due to imported fill of unknown origin and is characteristic throughout the site. Impacted soil don't appear to overlap with the Great Northern Way Station, Station House, or Laydown Yard.

- When metal concentrations are compared to present-day standards, the following metals exceed applicable CSR CL soil standards in the southwestern section of the site:
 - Arsenic (38 µg/g) for CSR CL Human Health Protection – Groundwater used for drinking water (10 µg/g) and Environmental Protection – Groundwater flow to surface water used by aquatic life – Fresh – Marine (10 µg/g);
 - Lead (1060 µg/g) for CSR CL Environmental Protection – Toxicity to soil invertebrates and plants (1000 µg/g); and
 - Zinc (1290 µg/g) for CSR CL Environmental Protection – Toxicity to soil invertebrates and plants (450 µg/g)
- Considering changes in CSR standards, additional boreholes located on site may have metal concentrations in soil that exceed present-day standards CSR CL standards, which haven't been covered in this summary due to extensive data available.
- PAHs in groundwater across the site were observed to exceed CSR standards for aquatic life at the time. However, BC MOECCS deemed no operable pathways for contaminants therefore CSR standards for protection of aquatic life did not apply at the site.
- Free product was observed in monitoring wells concentrated in the former UST basin east of the welding shop (present-day art gallery, 525 Great Northern Way) and to the west of the main building (555 Great Northern Way).
- Headspace vapour measurements in monitoring wells across the site varied from less than detection to > 11,000 ppm; generally observed to be higher concentrated in the former UST basin east of the welding shop (present-day art gallery, 525 Great Northern Way) and to the west of the main building (555 Great Northern Way). However, one monitoring well located in the far south of the site and within the proposed alignment of the Great Northern Way Station indicated 440 ppm headspace vapour.

577, 655 & 735 Great Northern Way, approximately 230 m east of the Site

Site Registry Detail Report (7653)

- **Certificate of Compliance Requested Without Inspection (December 16, 2001)** – Submitted to BC MOECCS from Finning International Inc. and Donald, William (rostered professional expert), December 17, 2001.
- **Certificate of Compliance Issued (WMA 27.6(2)) (December 17, 2001)** – Issued by BC MOECCS to Finning International Inc. and Donald, William, March 1, 2002.

Note – Issued on the advice of a rostered professional expert (William Donald) under Protocol 6 of the Contaminated Sites Regulation.

Required Actions: Amended Certificate of Compliance reissued on 2002-03-01 on the advice of a rostered professional expert (William Donald) under Protocol 6 of the Contaminated Sites Regulation.

- **Record Status** – Not Assigned.

Report of Findings – Stage 1 Preliminary Site Investigation, Detailed Site Investigation and Remedial Action Report (December 17, 2001)

- Site consists of the parcel approximately between present-day Fraser Street and Foley Street north of Great Northern Way.
- The Preliminary Site Investigation identified four on-site APECs:
 - One former underground waste oil tank at the northwest corner of the site;
 - Chemical storage area at the north property line south of the rail line;
 - Three former underground lube oil tanks at the southeast corner of the site; and
 - A previous excavation at the north property line.
- The Detailed Site Investigation concluded that soil and groundwater met CSR RL standards at the time of investigation with the exception of two locations; the north face of the existing excavation and in the former waste oil tank nest north of the 655 Great Northern Way building.
- Remediation of soil from the existing excavation in the northern portion of the site was completed to CSR RL standards for metals, except for one sample containing elevated levels of zinc on the boundary of the site. The sample was deemed not be representative of on-site soil quality, therefore the confirmatory sampling results are considered to meet CSR RL standards at the time of investigation.
- Remediation of soil from the existing waste oil tank nest north of the (now former) 655 Great Northern Way building was completed to CSR RL standards for extractable hydrocarbons.

Recommendation for a Certificate of Compliance, Protocol 6, Protocol for Independent Remediation for Low to Moderate Risk Sites (December 17, 2001).

- The Site (577, 655, and 735 Great Northern Way) has been remediated to residential land use and aquatic life water use for zinc, barium, selenium, and extractable petroleum hydrocarbons in soil.
- The certificate is qualified by the notations described in Schedule B:
 - It is recommended that a qualified environmental consultant be available to identify, characterize and appropriately manage any soil and/or groundwater materials of suspect environmental quality which may be encountered during any future subsurface work at the site.

557 Great Northern Way, approximately 170 m east of the Site

Site Registry Detail Report (13021)

- **Site Profile Received (May 19, 2011)** – Submitted to BC MOECCS from Keystone Environmental Ltd., May 19, 2011.
- **Site Profile – Further Investigation Required by the Ministry (May 25, 2011)** – Preliminary Site Investigation required. Issued by BC MOECCS, May 25, 2011.
- **Release of Approving Authority Under Acceptance of Independent Remediation Issued (May 26, 2011)** – Zoning, subdivision, development permit released under Scenario 5 (Site redevelopment). Issued by BC MOECCS, May 26, 2011.
- **Requirement(s) Imposed Under EMA Section 54(3)(D) (May 26, 2011)** – Determination that the site is not contaminated issued. Required Actions: Remediation must be completed within five years of the May 26, 2011 release letter. Remediation must be confirmed according to applicable legislation and Ministry guidance. Within 90 days of completing remediation, a report summarizing confirmation of remediation shall be submitted to the director. Issued by BC MOECCS, May 26, 2011.
- **Case Management Item (July 5, 2011)** – Protocol 6 Preapproval Application. Submitted to BC MOECCS from Keystone Environmental Ltd., July 5, 2011.
- **Case Management Item (July 22, 2011)** – Preapproval for submitting your application under Protocol 6 for a Certificate of Compliance that site 13021, (which is a portion of Site 1677) has been remediated to a residential land use standard has been approved. Issued by BC MOECCS to Keystone Environmental Ltd., July 22, 2011.
- **Case Management Item (August 8, 2011)** – Determination of drinking water standards requested. Requested by Keystone Environmental Ltd., August 8, 2011.
- **Site Risk Classified – Site is Non-High Risk (September 27, 2011)** – Submitted to BC MOECCS from Keystone Environmental Ltd., September 27, 2011.
- **Case Management Item (November 3, 2011)** – The site is considered to qualify for a drinking water exemption. Issued by BC MOECCS to Great Northern Way Campus Trust, November 3, 2011.
- **Final Determination of Contaminated Site Issued – Site Not Contaminated (February 16, 2012)** – Issued on the recommendation of an approved professional (Kenneth A. Evans) under Protocol 6 of the Contaminated Sites Regulation the site covered by this final determination is the metes and bounds description located at 685 Great Northern Way, Vancouver. Issued by BC MOECCS to Keystone Environmental, February 16, 2012.
- **Record Status** – Not Assigned

Report of Findings, Preliminary Site Investigation? Stage 1, 685 Great Northern Way, Vancouver, BC (November 1, 2011)

- The Stage 1 Preliminary Site Investigation identified one APEC of concern; on-site fill material of unknown origin.

- The study area was the present-day parking lot (685 Great Northern Way) and historically didn't appear to have any buildings on the premise.

525, 555 and 577 Great Northern Way, approximately 30 m northeast of the Site

Site Registry Detailed Report (15413)

- **Case Management Item (June 28, 2013)** – Water use determination letter issued by director – drinking water and aquatic life water used deemed not to apply to site in accordance with technical guidance document 6. Issued by BC MOECCS to Great Northern Way Trust, June 28, 2013.
- **Site Risk Classified – Site is non-high risk (December 20, 2013)** – Risk classification is for a portion of the site. 525 and 555 Great Northern Way (PID: 027-789-624) Classified as non-high risk. Submitted to BC MOECCS from Pottinger Gaherty Environmental Consultants Ltd., December 20, 2013.
- **Approval in Principle Requested (January 15, 2004)** – Requested by Pottinger Gaherty Environmental Consultants Ltd. on behalf of Great Northern Way Trust, January 15, 2004.
- **Approval in Principle Issued (April 24, 2014)** – Issued on the recommendation of an Approved Professional (Duncan Macdonald) under Protocol 6 of the Contaminated Sites Regulation. Issued by BC MOECCS to Great Northern Way Trust and Pottinger Gaherty Environmental Consultants Ltd., April 24, 2014.
- **Requirement(s) Imposed in Approval in Principle (April 24, 2014)** – Required Actions: A Statement signed by an Approved Professional must be submitted to the director annually within 90 days of the anniversary of the date of issue of this Approval in Principle. The statement must include the following:
 - A summary of remedial activities undertaken during the reporting period; and
 - An assessment of overall remediation progress, including evaluation in comparison to the actions and schedule set out in the plan(s) referenced above:

Refer to Condition 3 above should remedial progress differ substantially from the schedule set out in the approved plan(s). Remediation must be confirmed in accordance with applicable legislation and Ministry guidance. Within 90 days of completing remediation, a report summarizing confirmation of remediation must be prepared in accordance with section 49 (2) of the Contaminated Sites Regulation and submitted to the director. Issued by BC MOECCS, April 24, 2014.

- **Certificate of Compliance Requested (May 2, 2016)** – Submitted to BC MOECCS from Great Northern Way Trust and PGL Environmental Consultants Ltd., May 2, 2016.
- **Certificate of Compliance Issued Using Numerical Standards (June 21, 2016)** – Issued on the recommendation of an Approved Professional (Duncan Macdonald) under Protocol 6 of the Contaminated Sites Regulation. Issued by BC MOECCS to Great Northern Way Campus Ltd. and Pottinger Gaherty Environmental Consultants Ltd., June 21, 2016.
- **Record Status** – Not Assigned

**Stage 2 Preliminary Site Investigation, Detailed Site Investigation and Remedial Action Plan,
Great Northern Way Campus, Great Northern Way, Vancouver (December 1, 2013).**

- Site location pertains to 555 Great Northern Way and surrounding area; the report forms part of a submission to secure an Approval in Principle for the Site.
- All soil at the site did not exceed the CSR CL standards at the time of investigation. However, a CofC for residential land use was being sought for the site and the report compares values obtained against residential land use.
- Results of analyses conducted at the site were not compared against livestock ingestion/watering, drinking water, and aquatic life use as they the exposure pathways were deemed non-existent at the time. Human ingestion of contaminated soil and toxicity to soil invertebrates are mandatory at the site.
- Historically, area is comprised of fill material and was used to infill the False Creek basin.
- Approximate volumes of contaminated soil that does not meet RL standards within the Laydown Yard and/or Great Northern Way Station excavation extents are: approximately 700 m³ for the UST area west adjacent of 555 Great Northern Way (current BCIT maintenance building), approximately 1000 m³ for the UST area east adjacent of 525 Great Northern Way (Equinox Gallery), and approximately 50 m³ in the northwest corner of the site south of the rail line.
- The following are samples that did not exceed historical CSR CL standards but exceed current CSR CL standards in Schedule 3.1-Part 1 (intake of contaminated soil and toxicity to soil invertebrates and plants), or Schedule 3.1 Part 2 – Generic Numerical Standards to Protect Human Health, or Schedule 3.1, Part 3 – Generic Numerical Standards to Protect Ecological Health:
 - LEPH in UST area east of 525 Great Northern Way (5200 µg/g) for Schedule 3.1 Part 2 – Generic Numerical Standards to Protect Human Health (2000 µg/g);
 - Zinc in area north of 525 Great Northern Way (539 µg/g) Schedule 3.1-Part 1 – Numerical Soil Standards – Environmental Protection – Toxicity to Soil Invertebrates and Plants (450 µg/g)
- Several soil vapour sampling locations exceed current CSR CL Generic Numerical Vapour Standards. Overall, they appear to be aggregated in former UST locations, underneath on-site buildings, and at the north end of the Site. Sample areas where vapour concentrations exceeded were not delineated. It was recommended that any future buildings would have vapour management systems installed.

Varies along the alignment

Transmittal Letter: Selected Interim Draft Borehole Records

- Geotechnical investigation from Golder Associates in 2015 produced the following boreholes that represent APECs/AECs for the subject property:
 - **BH15-32** – Approximate location is 525 Great Northern Way. Black, odourous, high PID readings of < 0.1 to 493 ppm;

- **BH15-33** – Approximate location is 525 Great Northern Way. Dark brown, black organics, high PID readings of < 0.1 to 296 ppm;
- **BH15-34** – Approximate location is 525 Great Northern Way. Dark gray to dark brown, brown to black organics, PID readings of < 0.1 to 0.1 ppm;
- **BH16-02** – Approximate location is 577 Great Northern Way. Rotten egg odour, strong odour, railway tie, brown staining, PID readings of < 0.1 to 0.2 ppm;
- **BH16-03** – Approximate location is 555 Great Northern Way. Metal rebar, strong odour, wood debris, asphalt, construction debris, black staining, PID readings of < 0.1 to 0.2 ppm; and
- **BH16-04** – Approximate location is 525 Great Northern Way. Construction debris, wood debris, concrete slabs, black staining, brick fragments, no PID readings available

DISCUSSION OF FINDINGS:

Based on the information available, the following may be encountered at the Site during construction of the Great Northern Way Station, Station House, Emergency Exits/Ventilation Shafts, Laydown Area, and Cut-and-Cover section:

- It is likely that contaminated soil will be encountered during tunnel construction excavation beneath 525-555 Great Northern Way due to known APECs/AECs within the alignment. Four APECs and two AECs were identified within the excavation extents during the review:
 - One area of known contamination is located approximately 10 m south of an emergency exits/ventilation shafts within the station extents. Contamination was presumed to be hydrocarbons, based on high PID readings at a borehole (BH15-32) by Golder field personnel during a subsurface investigation in 2015.
 - The other known area of contamination is located south adjacent of the current Equinox Art Gallery building within the excavation extents. Contamination was presumed to be hydrocarbons, based on high PID readings at a borehole (BH15-33) by Golder field personnel during a subsurface investigation in 2015.
 - Four APECs (USTs, unknown if former or current) were identified east of the current Equinox Art Gallery building. One at approximately 20 m, two more north adjacent of the Emily Carr building, and another one approximately 20 m east of the eastern terminus of the excavated section.
- It is likely that hydrocarbon vapours will be encountered during tunnel construction excavation beneath 525-555 Great Northern Way due to high vapour readings during previous subsurface investigation in the southwest of the Site and the two AECs near the emergency exits/ventilation shafts and south of the current Equinox Art Gallery building, respectively.
- It is likely that contaminated groundwater will be encountered during tunnel construction excavation beneath 525-555 Great Northern Way due to APECs/AECs within the alignment that have been described above.

ESTIMATED IMPACTED SOIL VOLUME REQUIRING EXCAVATION: 6,600 m³

Based upon following assumptions:

- Entire footprint area of station, station house, and emergency exits are to be excavated to anticipated bedrock depth.
- Only contamination encountered and requiring excavation for the project requires management (contamination does not require delineation and removal outside of project areas).
- Based on previous investigations, there is a high probability of contaminated soils to require excavation. An estimate for high-risk sites (10% of total soil to be excavated) was assigned to provide an allowance.
- A total soil excavation volume of approximately 60,000 m³ (Station, Station house, emergency exits/ventilation shafts, and tunnel excavation)
- Assumed tunnel construction excavation width of 20 m, average depth to bedrock of 5 m, and a total approximate length of 380 m from approximately east of the station to Fraser Street.
- Assumed station excavation width of 20 m, average depth of 7.5 m, and a total length of 100 m for the main section and an excavation width of 50 m, average depth of 6 m, and a total length of 20 m for the eastern section (minus 25% due to overlap with station house)
- Station house excavation width of 8 m, average depth of 5 m, and a total length of 50 m. Emergency exits/ventilation shafts are covered under the station excavation footprint estimate.
- APECs/AECs located within the alignment excavation extents were assigned a volume of 100 m³ in addition to the 10% contingency. A total of 6 APECs/AECs were identified within the alignment excavation extents and a total contaminated volume of 600 m³ was used.

CONSTRUCTION CONSIDERATIONS

Water disposal – There is a potential to encounter groundwater during excavation of the Great Northern Way Station, Station House, Tunnel Construction, Emergency Exits/Ventilation Shafts, and Laydown Yard. There is a high potential that the water is contaminated. If contaminated groundwater is encountered, untreated discharge to the receiving environment is not permitted. Contaminated groundwater will require management in accordance with the *Contaminated Sites Regulation* and applicable city by-laws. Potential options may include sanitary or storm water discharge via a permit, or off-site treatment and disposal.

Soil disposal – Contaminated soils have previously been identified at 525 Great Northern Way, which may be encountered during excavation of the Great Northern Way Station, Station House, Tunnel Construction, and the Emergency Exits/Ventilation Shafts. Contaminated soil encountered during construction will require management in accordance with the *Contaminated Sites Regulation*, applicable city by-laws, and the Project Construction Specifications.

Vapour Inhalation – Mitigation plans should be in place for worker exposure, as there is potential for vapour inhalation due to the nature of historically identified contaminants. High vapour concentrations were observed in previous subsurface investigations throughout the Site.

SITE NAME: MOUNT PLEASANT STATION HOUSE, EMERGENCY EXITS/VENTILATION SHAFTS, EAST AND WEST LAYDOWN YARDS

SITE ADDRESS: PART OF 2501 AND 2509 MAIN STREET (MOUNT PLEASANT STATION HOUSE), PART OF QUEBEC STREET, PART OF EAST BROADWAY (EMERGENCY EXITS/VENTILATION SHAFTS), PART OF QUEBEC STREET (WEST LAYDOWN YARD), AND PART OF 2501 AND 2509 MAIN STREET (EAST LAYDOWN YARD)

BC MOECCS SITE REGISTRY ID: 1404, 4313, 12939

RISK RANKING AND REASONING: MODERATE RISK

The Site is ranked as **Moderate Risk** due to possible contamination on the Site associated with known contamination at neighbouring properties at the Mount Pleasant Station House and East Laydown Yard. The West Laydown Yard is considered to be low risk but has been included as part of this site. Multiple Site Registries are available for the area.

CURRENT OPERATIONS/ACTIVITIES:

West Laydown Yard

- Quebec Street south adjacent of East Broadway

East Laydown Yard

- Commercial (Part of 2501 Main Street) – Tim Hortons and
- Commercial (2509 to 2515 Main Street) – Various restaurants

Mount Pleasant Station House

- Commercial (Part of 2501 Main Street) – Tim Hortons and
- Commercial (Part of 2509 to 2515 Main Street) – Various restaurants

Mount Pleasant Station Emergency Exits/Ventilation Shafts

- Surface streets and sidewalks (Part of East Broadway and Quebec Street)

FORMER OPERATIONS/ACTIVITIES:

- Unknown (2509 Main Street) and
- Former drycleaners (138 East Broadway) west adjacent of East Laydown Yard and Station House

POTENTIAL CONTAMINANTS OF CONCERN AND RELEASE/MIGRATION MECHANISMS:

Contaminants of concern include benzene, toluene, ethylbenzene, xylene (BTEX), volatile petroleum hydrocarbons (VPH), light end hydrocarbons (LEPH), heavy end petroleum hydrocarbons (HEPH), regulated metals, glycol, solvents, and VOCs.

Potential release/migration mechanisms include possible leaks from underground fuel storage tanks, underground product distribution lines to the pumps, and spills from filling USTs and/or vehicles. Spills and improper disposal of dry cleaning fluids and solvents.

AVAILABLE REPORTS:

142 East Broadway, approximately west adjacent of the Site

- **Site Registry Detail Report (1404)** – Ordered April 12, 2015. BC MOECCS, last updated July 31, 2014.

285 East 10th Avenue, formerly 196 Kingsway Avenue, approximately 70 m east of southeast the Site

- **Site Registry Detail Report (4313)** – Ordered October 29, 2017. BC MOECCS, last updated August 18, 2016.
 - **Summary of Site Condition (May 11, 2016)** – Submitted to BC MOECCS from Keystone Environmental Ltd., May 30, 2016.
 - **Summary of Site Condition Site 4313/15492 (May 11, 2016)** – Submitted to BC MOECCS from Keystone Environmental Ltd., May 11, 2016.
 - **Stage 1 Preliminary Site Investigation Update, Detailed Site Investigation and Confirmation of Remediation, 285 East 10th Avenue, Vancouver, BC (April 29, 2016)** – Submitted to BC MOECCS from Keystone Environmental Ltd., May 11, 2016.
 - **Stage 1 Preliminary Site Investigation of 228 West Broadway, Vancouver, BC (June 24, 2010)** – Submitted to BC MOECCS (May 30, 2016)
 - **Underground Storage Tank Removal at 102-112 Kingsway, Vancouver, BC (September 5, 2007)** – Submitted to BC MOECCS from ACM Environmental Corporation, May 30, 2016.
 - **Stage 1 Preliminary Site Investigation of 102-112 Kingsway, Vancouver, BC (April 1, 2007)** – Submitted to BC MOECCS from ACM Environmental Corporation, May 30, 2016.
 - **Preliminary Site Investigation Stage 2 Environmental Assessment of 236 East Broadway, Vancouver, BC (March 1, 2007)** – Submitted to BC MOECCS from ACM Environmental Corporation, May 30, 2016.
 - **Stage 1 Preliminary Site Investigation of 236 East Broadway, Vancouver, BC (February 1, 2007)** – Submitted to BC MOECCS from ACM Environmental Corporation, May 30, 2016.
 - **Update of Due Diligence Investigation and the Phase 1 Environmental Site Assessment Report for the 188-196 Kingsway and 221 East 10th Avenue in Vancouver (April 26, 2006)** – Submitted to BC MOECCS from ACM Environmental Corporation, May 30, 2016.

- **Phase 1 Environmental Site Assessment: 188-196 Kingsway Avenue and 221 East 10th Avenue, Vancouver, BC (August 26, 2004)** – Submitted to BC MOECCS from Seacor Environmental Engineering Inc., May 30, 2016.
- **196 Kingsway, Vancouver, BC, Conceptual Remedial Plan (July 24, 1997)** – Submitted to BC MOECCS from Thurber Environmental Consultants Ltd., July 25, 1997.
- **196 Kingsway, Vancouver, BC, Contaminant Assessment (July 24, 1997)** – Submitted to BC MOECCS from Thurber Environmental Consultants Ltd., July 25, 1997.
- **Results of Confirmatory Sampling, Underground Tank Excavation UST-1, 196 Kingsway, Vancouver, BC (September 20, 1996)** – Submitted to BC MOECCS from Golder Associates Ltd., October 29, 1997.
- **Comments Concerning Soil Analyses Conducted at Underground Storage Tank UST-2, Jantzen Canada Inc. Facility, Vancouver, BC (September 18, 1996)** – Submitted to BC MOECCS from Golder Associates Ltd., October 29, 1997.
- **Results of Confirmatory Sampling Underground Tank Excavation UST-2, 196 Kingsway, Vancouver, BC (May 8, 1996)** – Submitted to BC MOECCS from Golder Associates Ltd., October 29, 1997.

77 East Broadway Avenue, approximately 20 m northwest of the Site

- **Site Registry Detail Report (5974)** – Ordered December 8, 2017. BC MOECCS, last updated October 29, 2010
 - The Site received a conditional Certificate of Compliance in 2001 after being issued a Preliminary Site Investigation Order

2509 Main Street, within excavation extents of the Site

- **Site Registry Detail Report (12939)** – Ordered November 5, 2017. BC MOECCS, last updated April 28, 2011.

SUMMARY OF REVIEWED REPORTS:

142 East Broadway, approximately west adjacent of the Site

Site Registry Detail Report (1404)

- **Concentration Criteria Used (November 15, 1994)** – BC MOECCS, November 15, 1994.
- **Record Status** – Active – Under Remediation.

285 East 10th Avenue, formerly 196 Kingsway Avenue, approximately 70 m east of southeast the Site

Site Registry Detail Report (4313)

- **Approval in Principle Requested (August 1, 1997)** – PSI/DSI and Remediation Plan submitted for review. Submitted to BC MOECCS from Thurber Environmental Consultants Ltd., August 1, 1997.
- **Approval in Principle Issued (March 3, 1998)** – Issued by BC MOECCS to Thurber Environmental Consultants Ltd. and Townline Ventures 17 Ltd., March 3, 1998.
- **Site Risk Classified – Site is Non-High Risk (May 11, 2016)** – Submitted to BC MOECCS by Keystone Environmental Ltd., May 11, 2016
- **Certificate of Compliance Requested (May 13, 2016)** – Submitted to BC MOECCS by Rize Alliance Properties Ltd. and Keystone Environmental Ltd., May 13, 2016
- **Certificate of Compliance Issued Using Numerical Standards (July 4, 2016)** – Issued on the recommendation of an Approved Professional (Michael Geraghty) under Protocol 6 of the Contaminated Sites Regulation. Issued by BC MOECCS to Rize Alliance Properties Ltd. and Keystone Environmental Ltd., July 4, 2016
- **Record Status** – Not Assigned.

Stage 1 Preliminary Site Investigation Update, Detailed Site Investigation and Confirmation of Remediation, 285 East 10th Avenue, Vancouver, BC (April 29, 2016)

- The site has had numerous historical APECs that have undergone various levels of remediation.
- The Detailed site investigation included the advancement of 17 locations on site. Soil contamination found on site was associated with poor fill quality and due to the depth of excavation of the redevelopment, remediation was not warranted. There was also LEPA contamination which exceeded the applicable standard, which was remediated by excavation. Groundwater and soil vapour exceedances were not observed. The site later received a Certificate of Compliance using numerical standards.
- Approximately 8,020 m³ of contaminated soil was removed from the site. Confirmatory samples indicated that all concentrations of the contaminants of concern fell below the CSR CL soil standards at the time. However, there was one sample at the wall extent (western edge of site) that exceeded the applicable standard but was considered to be associated with wide area fill (the fill had been used to infill Brewery Creek and ranges in depth from 1.5 to 6.5 mbgs) and not sourced from the site. Remediation of the fill material did not extend off-site.
- When compared to current CSR CL Standards, the wide-area fill on the western edge of the site exceeds the applicable CSR standards for the following:
 - Antimony (maximum concentration observed 97 µg/g) exceeded the CSR CL standard for soil for the Generic Numerical Soil Standards to Protect Ecological Health (40 µg/g);
 - Barium (maximum concentration observed 1,790 µg/g) exceeded the CSR CL standard for soil for the Numerical Soil Standards – Groundwater Used for Drinking Water (350 µg/g), Toxicity to Soil Invertebrates and Plants (1500 µg/g), and Groundwater Flow to Surface Water used by Aquatic Life (1500 µg/g);

- Copper (maximum concentration observed 1,060 µg/g) exceeded the CSR CL standard for soil for the Numerical Soil Standards – Toxicity to soil invertebrates and plants (300 µg/g);
- Lead (maximum concentration observed 5,620 µg/g) exceeded the CSR CL standard for the Numerical Soil Standards – Intake of contaminated soil (150 µg/g), toxicity to soil invertebrates and plants (1000 µg/g), and potential pH-based groundwater standards;
- Tin (maximum concentration observed 678 µg/g) exceeded the CSR CL standard for the Generic Numerical Soil Standards to Protect Ecological Health (300 µg/g); and
- Zinc (maximum concentration observed 2,900 µg/g) exceeded the CSR CL standard for the Numerical Soil Standards – Toxicity to soil invertebrates and plants (450 µg/g) and potential pH-based groundwater standards.

Independent remediation was complete via the Confirmation of Remediation submitted. The report was submitted to the BC MOECCS as part of the Certificate of Compliance submission. Site received a Certificate of Compliance using numerical based standards.

Summary of Site Condition (May 13, 2016)

- Submitted to BC MOECCS for Certificate of Compliance using numerical standards.
- A Stage 1 PSI, Stage 2 PSI, DSI, and Confirmation of Remediation have been completed for the site.
- No evidence of off-site migration and sampling has occurred off-site for PCOCs.

2509 Main Street, within excavation extents of the Site

Site Registry Detail Report (12939)

- **Notice of Independent Remediation Initiation Submitted (April 8, 2011)** - Submitted to BC MOECCS from D Kelly Environmental Consulting Ltd., April 8, 2011.
- **Notice of Independent Remediation Completion Submitted (April 8, 2011)** – Submitted to BC MOECCS from D Kelly Environmental Consulting Ltd., April 8, 2011.
- **Site Risk Classified – Site is Non-High Risk (April 21, 2011)** - Submitted to BC MOECCS from D Kelly Environmental Consulting Ltd., April 21, 2011.
- **Record Status** – Not Assigned.

DISCUSSION OF FINDINGS:

Based on the information available, the Constructor should be aware that the following may be encountered at the Site during construction of the Mount Pleasant Station House, Emergency Exits/Ventilation Shafts, East and West Laydown Yards:

- Contaminated soil beneath 2509 Main Street may be encountered during excavation of the Mount Pleasant Station House and emergency exits/ventilation shafts based on information available from the site registry (Site ID: 12939). The site was classified as non-high risk but was not issued a Certificate of Compliance, therefore contamination may still be present. The area to the east of the station house excavation extents is known to have imported fill of poor quality which has known metals contamination. Contaminated soil beneath 77 East Broadway may be encountered during excavation of the emergency exits/ventilations shafts. Additionally, a former dry cleaner was identified at 101 East Broadway, east adjacent of an emergency exit/ventilation shaft.
- Hydrocarbon vapours beneath 2509 Main Street may be encountered during excavation of the Mount Pleasant Station House and emergency exits/ventilation shafts based on information available from the site registry (Site ID: 12939). The site was classified as non-high risk but was not issued a Certificate of Compliance, therefore contamination may still be present. Additionally, a former dry cleaner was identified at 101 East Broadway, east adjacent of an emergency exit/ventilation shaft.
- Contaminated excavation water may be encountered beneath 2509 Main Street during excavation of the Mount Pleasant Station House and emergency exits/ventilation shafts based on information available from the site registry (Site ID: 12939). The site was classified as non-high risk but was not issued a Certificate of Compliance, therefore contamination may still be present. Additionally, a former dry cleaner was identified at 101 East Broadway, east adjacent of an emergency exit/ventilation shaft.

ESTIMATED IMPACTED SOIL VOLUME REQUIRING EXCAVATION: 270 m³

Based upon following assumptions:

- 250 m³ of the expected 5,000 m³ soil to be excavated for the station house is contaminated
- 20 m³ of the expected 430 m³ soil to be excavated for the emergency exits/ventilations shafts is contaminated
- Site registry ID 12939 (2509 Main Street) is within the excavation extents of the station house and east laydown yard. An allowance of 5% was assigned to account for chance finds at the Site.
- In addition, several APECs are located adjacent to the Emergency Exits/Ventilation Shafts sites and are therefore assigned a moderate risk ranking to account for chance finds
- Contamination is located within the extents of the station house and emergency exits/ventilation shafts and the area above the station will not be excavated
- No additional contamination migration from previously identified contaminant plume(s) or other source sites
- Contamination has not penetrated underlying bedrock
- No excavation needed for the laydown yard
- Based on the above, the volume of contaminated soil for the station house and emergency exits/ventilation shafts was calculated to be 5% of the 5430 m³ of the excavation

CONSTRUCTION CONSIDERATIONS

Water disposal – There is a potential to encounter water during excavation and there is a potential that the water is contaminated due to unknown contamination potential at 2509 Main Street and at 101 East Broadway. Excavation water management will be required; untreated

discharge to the receiving environment is not permitted. Contaminated groundwater will require management in accordance with the Contaminated Sites Regulation and applicable other permits. Potential options include sanitary or storm water discharge (may or may not require treatment) or off-site treatment and disposal.

Soil disposal – Previously reported contamination at adjacent properties; potential for encountering during excavation. Unknown contamination potential at 2509 Main Street due to lack of a Certificate of Compliance indicating site has been remediated to current CSR CL standards. A former dry cleaner at 101 East Broadway is considered as a potential source of contamination. Contaminated soil encountered during construction will require management/disposal in accordance with the Contaminated Sites Regulation, applicable city by-laws, and the Project Construction Specifications.

Vapour Inhalation – Mitigation plan should be in place for worker exposure, as there is potential for vapour inhalation due to the concentration of APECs that have VOCs as PCOCs.

SITE NAME: BROADWAY-CITY HALL STATION HOUSE, EMERGENCY EXITS/VENTILATION SHAFTS, AND LAYDOWN YARD

SITE ADDRESS: 496 AND PART OF 456 WEST BROADWAY, 455 WEST 10TH AVENUE (BROADWAY-CITY HALL STATION, STATION HOUSE, AND EMERGENCY EXITS/VENTILATION SHAFTS), 456/450/438/400 WEST BROADWAY AND 455 WEST 10TH AVENUE (LAYDOWN YARD)

BC MOECCS SITE REGISTRY SITE ID: 9113

RISK RANKING AND REASONING: LOW RISK

The Site is ranked as **Low Risk** based on the following:

A gas station was formerly located at 2590 Cambie Street (between 1960 and 1975), approximately 10 m southwest of the planned station house. This area was excavated during the construction of the current Broadway-City Hall station for the Canada Line; therefore, it is anticipated that contaminated soils (if any) would have likely been removed during the construction of the station.

A former service station, drycleaners, garage and auto wreckers was located at 507 (505) West Broadway Avenue, approximately 50 m northwest of an Emergency Exit/Ventilation Shaft. This property was issued a Certificate of Compliance (to numerical standards) in 2008 as it was redeveloped into the current commercial and office building, which includes underground parking levels; therefore, it is expected that contaminated soils would have likely been removed from this property. The regulatory standards have changed since that time, therefore there is a potential for soil/groundwater contamination that exceeds current standards on or adjacent to this property.

CURRENT OPERATIONS/ACTIVITIES:

- Broadway-City Hall Station (Canada Line, corner of Cambie Street and West Broadway Avenue);
- Surface Streets (Cambie Street and West Broadway Avenue); and
- Commercial Buildings (various) - bank, medical offices, restaurants, retail

FORMER OPERATIONS/ACTIVITIES:

- Former Service Station between 1960 to 1975 (2590 Cambie Street) and
- Former Service Station, Dry Cleaners, Garage and Auto wreckers (507 (505) West Broadway)

POTENTIAL CONTAMINANTS OF CONCERN AND RELEASE/MIGRATION MECHANISMS:

Contaminants of concern include benzene, toluene, ethylbenzene, xylene (BTEX), volatile petroleum hydrocarbons (VPH), light end hydrocarbons (LEPH), heavy end petroleum hydrocarbons (HEPH), regulated metals, glycol, and chlorinated solvents.

Potential release/migration mechanisms include possible leaks from underground fuel storage tanks, underground product distribution lines to the pumps, spills from filling USTs and/or vehicles, and spills/improper disposal of dry cleaning chemicals.

AVAILABLE REPORTS:

505 West Broadway Avenue and 2455 Cambie Street, approximately 50 m northwest of the Site

- **Site Registry Detail Report (9113)** – Ordered April 12, 2015. BC MOECCS, last updated April 11, 2008.
 - **Summary of Site Condition (December 21, 2007)** – BC MOECCS, December 21, 2007.
 - **Report of Findings, Preliminary Site Investigation – Stage 1, 2, Detailed Site Investigation and Confirmation of Remediation, 505 West Broadway, Vancouver (December, 2007).** Submitted to BC MOECCS from Keystone Environmental Ltd., December 1, 2007. Note: exact document date unknown.
 - **Report of Findings, Preliminary Site Investigation Stage 1, 505 and 525 West Broadway and 2455 Cambie Street, Vancouver BC (July 1, 2004).** Submitted to BC MOECCS from Keystone Environmental Ltd., July 1, 2004. Note: exact document date unknown.
 - **Preliminary Site Investigation (PSI) Results, 525 West Broadway, Vancouver, BC (November 27, 2003).** Submitted to BC MOECCS from Thurber Engineering Ltd., November 27, 2003.
 - **Report of Findings, Preliminary Site Investigation Stage 1, 505 West Broadway and 2455 Cambie Street, Vancouver, BC (October 1, 2003).** Submitted to BC MOECCS from Keystone Environmental Ltd., Oct 1, 2003.
 - **Phase 1 Environmental Property Assessment, 525 West Broadway, Vancouver, B.C (February 13, 1995).** Submitted to BC MOECCS from SRK-Robinson Inc., February 13, 1995.
- **Certificate of Compliance – 505 West Broadway, Vancouver, British Columbia (January 9, 2008).** BC MOECCS, January 9, 2008.

SUMMARY OF REVIEWED REPORTS:

505 West Broadway Avenue and 2455 Cambie Street, approximately 50 m northwest of the Site

Site Registry Detail Report (Site ID 9113)

- **Site Profile Received** - Site profile submitted by Keystone Environmental Ltd. to BC MOECCS August 30, 2004.
- **Site Profile Reviewed** – Further investigation required by the Ministry. Ministry permission granted to release the development permit because in the opinion of the director the issuance of the development permit would not pose significant threat or risk. Zoning and subdivision subsequently released on April 12, 2006 under the same provision. Required

Actions – Preliminary Site Investigation required. Release of subdivision application granted because in the opinion of the director, the release of the subject application would not pose significant risk or threat.

- **Notice of Independent Remediation Initiation Submitted** – Submitted by Keystone Environmental Ltd. to BC MOECCS, August 8, 2006.
- **Certificate of Compliance Issued Using Numerical Standards** – Issued on the recommendation of an approved professional (Kenneth A. Evans) under Protocol 6 of the Contaminated Sites Regulation. This notice was given for PID: 026-780-071. Issued by Doug G. Walton to PCI Cross Roads Development Inc., January 9, 2008.
- **Suspected Land Use:**
 - Appliance/equipment of engine repair/recondition/cleaning/salvage;
 - Auto/truck/bus/subway/other vehicle repair/salvage/wrecking;
 - Dry cleaning facilities/operation and dry cleaning chemical storage; and
 - Petroleum products dispensing facility, including service station/cardlot
- **Record Status** – Inactive- Remediation complete, April 11, 2008.

Certificate of Compliance – 505 West Broadway, Vancouver, British Columbia (January 9, 2008).

- Certificate of Compliance issued by BC MOECCS to PCI Cross Roads Development Inc. for PID number 026-780-071 (Lot 1, Block 340, District Lot 526, Group 1, New Westminster District Plan BCP25032).
- The certificate is qualified by the conditions described in Schedule B:
 - A qualified environmental consultant shall be available to identify, characterize, and appropriately manage any environmental media of suspect quality which may be encountered during any future subsurface work at the site.

DISCUSSION OF FINDINGS:

Based on the information available, there is a low likelihood of encountering contamination at the Site during construction of the Broadway-City Hall Station House and Emergency Exits/Ventilations Shafts.

A gas station was formerly located at 2590 Cambie Street (between 1960 and 1975). This area was excavated during the construction of the current Broadway-City Hall station for the Canada Line; therefore, it is anticipated that contaminated soils (if any) would have likely been removed during the construction of the station.

A former service station, drycleaners, garage and auto wreckers was located at 507 (505) West Broadway Avenue, approximately 50 m northwest of an Emergency Exit/Ventilation Shaft. This property was issued a Certificate of Compliance (to numerical standards) in 2008 as it was redeveloped into the current commercial and office building, which includes underground parking levels; therefore, it is expected that contaminated soils would have likely been removed from this property. The regulatory standards have changed since that time, therefore there is a

potential for soil/groundwater contamination that exceeds current standards may be present on or adjacent to this property.

ESTIMATED IMPACTED SOIL VOLUME REQUIRING EXCAVATION: 58 m³

Based upon the following assumptions:

- Based on desktop study findings, little to no contaminated soil is expected to require excavation. An estimate for low-risk sites (2% of total soil to be excavated) was assigned to provide an allowance;
- A total soil excavation volume of approximately 2, 860 m³;
- Entire footprint area of station house, and emergency exits/ventilation shafts are to be excavated to anticipated bedrock depth;
- Only contamination encountered and requiring excavation for the project requires management (contamination does not require delineation and removal outside of project areas);
- Contamination has not penetrated underlying bedrock; and
- No excavation needed for the Laydown Yard

CONSTRUCTION CONSIDERATIONS

Water disposal – Contamination was previously identified at neighbouring property (505 West Broadway Avenue); however, this property was reportedly remediated. There is a low likelihood of encountering contaminated groundwater during excavation. If contaminated groundwater is encountered, untreated discharge to the receiving environment is not permitted. Contaminated groundwater will require management in accordance with the Contaminated Sites Regulation and applicable city by-laws. Potential options may include sanitary or storm water discharge via a permit, or off-site treatment and disposal.

Soil disposal – Contamination was previously identified at neighbouring property (505 West Broadway Avenue); however, this property was reportedly remediated. There is a low likelihood of encountering contaminated soils during excavation. Contaminated soil encountered during construction will require management/disposal in accordance with the Contaminated Sites Regulation, applicable city by-laws, and the Project Construction Specifications.

Vapour Inhalation – There is a low likelihood of risks associated with vapour inhalation. If vapour concerns are identified during construction, the need for site worker vapour respiratory protection should be evaluated at the time of the work.

SITE NAME: FAIRVIEW-VGH STATION HOUSE, EMERGENCY EXITS/VENTILATION SHAFTS, NORTH, SOUTHEAST AND SOUTH LAYDOWN YARDS

SITE ADDRESS: 906 TO 916 WEST BROADWAY (FAIRVIEW-VGH STATION HOUSE), PART OF 988 WEST BROADWAY, PART OF 906 WEST BROADWAY, PART OF WEST BROADWAY (EMERGENCY EXITS/VENTILATION SHAFTS), AND PART OF LAUREL STREET (NORTH LAYDOWN YARD), PART OF LAUREL STREET, 925-935 WEST 10TH AVENUE (SOUTH LAYDOWN YARD AND REQUIRED PROPERTY).

BC MOECCS REGISTRY ID: 12131, 16295

RISK RANKING AND REASONING: LOW

The Site is ranked as **Low Risk** due to no known current contamination on or near the Site within the excavation extents of the station house, and the north and south laydown yard. The property at 988 West Broadway Avenue (Emergency Exits/Ventilation Shafts) and has a BC Site Registry ID (Site ID: 12131); however, the property was determined not to be contaminated by the BC MOECCS in May 2017. There is also an active dry cleaning business located north adjacent at 943 West Broadway.

CURRENT OPERATIONS/ACTIVITIES:

- Roadway (West Broadway);
- Redevelopment (988 West Broadway);
- Dry Cleaning Business (943 West Broadway);
- Multi-Unit Residential (various); and
- Commercial (various)

FORMER OPERATIONS/ACTIVITIES:

- Service Station (988 West Broadway). Presumed service station based on Site Registry information of commercial and industrial purposes or activities on the Site.

POTENTIAL CONTAMINANTS OF CONCERN AND RELEASE/MIGRATION MECHANISMS:

Contaminants of concern include benzene, toluene, ethylbenzene, xylene (BTEX), volatile petroleum hydrocarbons (VPH), light end hydrocarbons (LEPH), heavy end petroleum hydrocarbons (HEPH), regulated metals, glycol, and VOCs.

Potential release/migration mechanisms include possible leaks from underground fuel storage tanks, underground product distribution lines to the pumps, and spills from filling USTs and/or vehicles. Spills and improper disposal of dry cleaning fluids and solvents.

AVAILABLE REPORTS:

988 West Broadway, within Emergency Exits/Ventilation Shafts excavation extents

- **Site Registry Detail Report (12131)** – Ordered November 5, 2017. BC MOECCS, last updated August 18, 2017.
 - **Report of Findings Stage 1 and 2 Preliminary Site Investigation, 988 West Broadway, Vancouver, BC. (February 1, 2017).** Keystone Environmental Ltd., March 22, 2017.
 - **Report of Findings – Phase 1 Environmental Site Assessment 984 West Broadway, Vancouver, BC (July 1, 2011).** Keystone Environmental Ltd., July 1, 2011.
 - **Draft Reporting of Findings Phase 1 Environmental Site Assessment, 984 West Broadway, Vancouver, BC (July 1, 2011).** Keystone Environmental Ltd., June 27, 2013.
 - **Stage 1 Preliminary Site Investigation, 984 West Broadway, Vancouver, BC (January 1, 2010).** D. Kelly Environmental Consulting Ltd., Mar 22, 2017.

1050 West Broadway, approximately 130 m west of the Site

- **Site Registry Detail Report (16295)** – Ordered October 29, 201. BC MOECCS, last updated March 23, 2017.

SUMMARY OF REVIEWED REPORTS:

988 West Broadway, within Emergency Exits/Ventilation Shafts excavation extents

Site Registry Detail Report (12131)

- **Site Profile Received (February 20, 2010)** – Submitted to BC MOECCS from D. Kelly Environmental Consulting Ltd., February 20, 2010.
- **Site Profile Reviewed – Further Investigation Required by the Ministry (March 3, 2010)** – Required Actions - Preliminary Site Investigation Required. Issued by BC MOECCS, March 3, 2010.
- **Site Risk Classified – Site is Non-High Risk (November 29, 2011)** – Submitted to BC MOECCS from Keystone Environmental Ltd., November 29, 2011.
- **Release of Approving Authority Under Acceptance of Independent Remediation Issued (July 9, 2013)** – Note – Release of subdivision, zoning, demolition and development granted under Scenario 5. Issued by BC MOECCS, July 9, 2013.
- **Requirement(s) Imposed Under EMA Section 54(3)(D) (July 9, 2013)** – Remediation must be completed within five years of the July 9, 2013 Release Letter. Remediation must be confirmed according to applicable legislation and Ministry Guidance. Within 90 days of completing remediation, a report summarizing confirmation of remediation shall be submitted to the director. Issued by BC MOECCS, July 9, 2013.
- **Requirement(s) Imposed Under EMA Section 54(3)(D) (July 9, 2013)** – Note – Updated schedule provided. Remediation has not commenced at this time. Required Actions: A statement by an Approved Professional must be submitted annually to the director within

30 days of the anniversary of the July 9, 2013 Release Letter. Issued by BC MOECCS, July 9, 2013

- **Requirement(s) Imposed Under EMA Section 54(3)(D) (November 25, 2014)** – Note – Redevelopment is scheduled to begin in November 2015. Required Actions: A statement by an Approved Professional must be submitted annually to the director within 30 days of the anniversary of the July 9, 2013 Release Letter. Issued by BC MOECCS, November 25, 2014.
- **Requirement(s) Imposed Under EMA Section 54(3)(D) (September 23, 2015)** – Note – Update email provided. No contamination found to date. Required Actions: A statement by an Approved Professional must be submitted annually to the director within 30 days of the anniversary of the July 9, 2013 Release Letter. Issued by BC MOECCS, September 23, 2015.
- **Requirement(s) Imposed Under EMA Section 54(3)(D) (September 22, 2016)** – Required Actions: A statement by an Approved Professional must be submitted annually to the director within 30 days of the anniversary of the July 9, 2013 Release Letter. Issued by BC MOECCS, September 22, 2016.
- **Determination of Contamination Requested (March 10, 2017)** – Submitted to BC MOECCS from 984 Development Inc. and Keystone Environmental Ltd., March 10, 2017.
- **Preliminary Determination of Contaminated Site Issued – Site Not Contaminated (April 3, 2017)** – Issued on the recommendation of an Approved Professional (Michael Geraghty) under Protocol 6 of the Contaminated Sites Regulation. Issued by BC MOECCS to Keystone Environmental Ltd., April 3, 2017.
- **Final Determination of Contaminated Site Issued – Site Not Contaminated (May 11, 2017)** – Issued on the recommendation of an Approved Professional (Michael Geraghty) under Protocol 6 of the Contaminated Sites Regulation. Issued by BC MOECCS to 984 Developments Inc. and Keystone Environmental Ltd., May 11, 2017.
- **Record Status** – Not Assigned.

Report of Findings Stage 1 and 2 Preliminary Site Investigation, 988 West Broadway, Vancouver, BC. (February 1, 2017)

- The Stage 1 PSI identified the following APECs:
 - APEC 1 (On-Site)- Former automotive rental and fueling operations on the north portion of the Site (from the 1950s to the 1980s)
 - APEC 2 (On-Site)- Former dry cleaner located on the southeast portion of the Site (in the early 1990s)
 - APEC 3 (Off-Site) – Former dry cleaners at 999 West Broadway Avenue (from the early 1950s to the early 1970s)
 - APEC 4 (Off-Site) – Former dry cleaners at 2525 Oak Street (from the early 1940s or earlier to the late 1950s)

- The Stage 2 PSI investigated the APECs over three stages (prior to demolition of site building, following demolition, and following excavation)
- Soil, groundwater, and soil vapour were analyzed for the PCOCs and no exceedances were identified using the applicable CSR CL standards at the time.
- Compared to current CSR CL standards, there were also no exceedances.

1050 West Broadway, approximately 130 m west of the Site

Site Registry Detail Report (16295)

- **Notification received about likely or actual substance migration from neighbouring site (April 28, 2009)** – Submitted to BC MOECCS and Redekop Homes Ltd. from Alara Environmental, April 28, 2009.

DISCUSSION OF FINDINGS:

Based on the information available, the following may be encountered at the site during construction of the Fairview-VGH Station House, Emergency Exits/Ventilation Shafts, North and South Laydown Yard:

- Contaminated soil beneath 988 West Broadway may be encountered during excavation within the emergency exits/ventilation shafts excavation extents.
- Hydrocarbon vapours beneath 988 West Broadway may be encountered during excavation of the emergency exits/ventilation shafts.
- Contaminated excavation water beneath 988 West Broadway may be encountered during excavation of the emergency exits/ventilation shafts.

POTENTIAL EXTENTS OF CONTAMINATION: 110 m³

Based upon following assumptions:

- 70 m³ of the expected 3,600 m³ soil to be excavated is contaminated for the station house.
- 40 m³ of the expected 730 m³ soil to be excavated is contaminated for the emergency exits/ventilation shafts.
- No contamination present beneath 988 West Broadway.
- A low risk ranking (2%) was assigned to the station house and emergency exits/ventilation shafts.
- Contamination located within the extents of the station house and emergency exits/ventilations shafts.
- No additional contamination migration from previously identified contaminant plume(s) or other source sites.
- Contamination has not penetrated underlying bedrock.
- No excavation needed for the north and south laydown yards.
- Based on the above, the volume of the contaminated soil for the station and emergency exit/ventilation shaft section was calculated to be 110 m³, which includes the 1% contingency for the station and 5% contingency for the emergency exits/ventilations shafts.

CONSTRUCTION CONSIDERATIONS

Water disposal – There is a potential to encounter water during excavation of the emergency exit/ventilations shafts at 988 West Broadway and there is a potential that the water is contaminated. Excavation water management will be required. Contaminated groundwater will require management in accordance with the Contaminated Sites Regulation and applicable city by-laws. Potential options include sanitary or storm water discharge via a permit (may or may not require treatment), or off-site treatment and disposal.

Soil disposal – Potential for encountering contaminated soil during excavation of the emergency exit/ventilations shafts at 988 West Broadway Avenue. Contaminated soil encountered during construction will require management/disposal in accordance with the Contaminated Sites Regulation, applicable city by-laws, and the Project Construction Specifications.

Vapour Inhalation – Mitigation plan should be in place for worker exposure, as there is potential for vapour inhalation during excavation of the emergency exit/ventilation shaft at 988 West Broadway, due to the nature of historically identified contaminants.

SITE NAME: SOUTH GRANVILLE STATION HOUSE, EMERGENCY EXITS/VENTILATION SHAFTS, AND LAYDOWN YARD

SITE ADDRESS: 1453-1481 WEST BROADWAY (SOUTH GRANVILLE STATION); 1409-1451 WEST BROADWAY (LAYDOWN YARD); PART OF 1465 WEST BROADWAY (REQUIRED PROPERTY); AND PART OF 1409 WEST BROADWAY, PART OF 1465 WEST BROADWAY (EMERGENCY EXITS/VENTILATION SHAFTS)

BC MOE SITE REGISTRY SITE ID: 112, 293, 360, 1153, 3339, 9183, 20600

RISK RANKING AND REASONING: MODERATE RISK

The site is ranked as **Moderate Risk** due to known historic contamination at the neighbouring property to the north. Additionally, Emergency Exits/Ventilation Shafts at the east end of the station may be affected by contamination migrating from the current service station at 1398 West Broadway. Multiple Site Registries are available for the area which indicate areas of potential environmental concern.

CURRENT OPERATIONS/ACTIVITIES:

Station House

- Commercial (1465 West Broadway) –Restaurants

Emergency Exits/Ventilation Shafts

- Commercial (1451 West Broadway) – Athena Apparel
- Commercial (Part of 1481 West Broadway) – Breakfast Table Restaurant
- Surface sidewalks (Hemlock Street)

Laydown Yard

- Commercial (1409-1451 West Broadway) – Various restaurants

FORMER OPERATIONS/ACTIVITIES:

- Heating Oil Sales (1467 West Broadway)
- Sheet Metal Manufacturing (1445 West Broadway)
- Auto wrecker (1421 West Broadway)
- Garages (1412/1408 West Broadway and 2521 Hemlock Street)

POTENTIAL CONTAMINANTS OF CONCERN AND RELEASE/MIGRATION MECHANISMS:

Contaminants of concern include benzene, toluene, ethylbenzene, xylene (BTEX), volatile petroleum hydrocarbons (VPH), light end hydrocarbons (LEPH), heavy end petroleum

hydrocarbons (HEPH), polycyclic aromatic hydrocarbons (PAHs), regulated metals, glycol, and chlorinated solvents.

Potential release/migration mechanisms include possible leaks from underground fuel storage tanks, underground product distribution lines to the pumps, and spills from filling USTs and/or vehicles. Spills and improper disposal of degreasing solvents.

AVAILABLE REPORTS:

1455 West 10th Avenue, approximately 50 m south of the Site

- **Site Registry Detail Report (112)** – Ordered April 12, 2015. BC MOE, last updated January 31, 2002.
 - **Contamination Assessment of Firehall #4/South Granville Library, 1455-1475 West 10th Avenue, Vancouver (March 1, 1990)** – Notes: Missing. Submitted to BC MOE from Soilcon Laboratories Ltd. on behalf of City of Vancouver, Civic Buildings Department, May 22, 1990.

1398 West Broadway, approximately 50 m southeast of the Site

- **Site Registry Detail Report (293)** – Ordered November 5, 2017. BC MOE, last updated July 7, 2017.
 - **Broadway and Hemlock Esso Service Station, 1398 West Broadway, Vancouver, B.C., Location No. 995456 (January 26, 1998)**. Notes – Report may be considered notification of independent remediation. O'Connor Associates Environmental Inc., February 6, 1998.
 - **Broadway and Hemlock Esso Service Station, 1398 West Broadway, Vancouver, B.C., Location No. 995456. (March 6, 1996)**. Notes – Site Remediation Update Report. O'Connor Associates Environmental Inc., March 8, 1996).
 - **Esso Service Station, 1398 West Broadway, Vancouver, B.C. Location No. 90305 (March 12, 1992)**. O'Connor Associates Environmental Inc., March 18, 1992.
 - **Proposed Redevelopment of Esso Service Station, 1398 West Broadway, Vancouver, B.C., Station No. 995456 (January 10, 1992)**. O'Connor Associates Environmental Inc., January 13, 1992.
 - **Esso Service Station, 1398 West Broadway, Vancouver, B.C. Location No. 995456 (January 8, 1992)**. O'Connor Associates Environmental Inc., January 13, 1992.
 - **Esso Service Station, 1398 West Broadway, Vancouver, B.C. Location No. 995456 (June 28, 1991)**. O'Connor Associates Environmental Inc., July 4, 1991.
 - **Esso Service Station, 1398 West Broadway, Vancouver, B.C. Location No. 995456 (March 8, 1991)**. O'Connor Associates Environmental Inc., July 4, 1991.
 - **Texaco Service Station, (s/s 5456), 1398 West Broadway, Vancouver, B.C. (June 7, 1988)**. O'Connor Associates Environmental Inc., July 4, 1991.

2415 Granville Street, approximately 70 m northwest of the Site

- **Site Registry Detail Report (360)** – Ordered April 12, 2015. BC MOE, last updated October 18, 2001.
 - **Site at 2415 Granville Street Vancouver BC (February 18, 1993)** – Submitted to BC MOE from BSC Construction (II) Corporation on behalf of ORR Development Corp., February 18, 1993.

2403 Granville Street, approximately 80 m northwest of the Site

- **Site Registry Detail Report (1153)** – Ordered April 12, 2015. BC MOE, last updated October 18, 2001.
 - **2403 Granville Street, Vancouver, B.C. Groundwater Sampling in the Adjacent Lane Owned by the City of Vancouver (March 1, 1994)** – Submitted to BC MOE from Morrow Environmental Consultants Inc. on behalf of Petro-Canada, March 11, 1994.
 - **Environmental Upgrade Report (August 31, 1993)** – Submitted to BC MOE from Morrow Environmental Consultants Inc. on behalf of Petro-Canada, September 15, 1993.
 - **Decommissioning Assessment (June 30, 1992)** – Submitted to BC MOE from Morrow Environmental Consultants Inc. on behalf of Petro-Canada, September 30, 1992.

1476 West 8th Avenue, approximately 30 m north of the Site

- **Site Registry Detail Report (3339)** – Ordered April 12, 2015. BC MOE, last updated January 30, 2003.
 - **Screening Level Risk Assessment: Addendum to Closure Report on Soil Remediation Program (October 30, 1996)** – Submitted to BC MOE by Golder Associates Ltd. on behalf of Glaxo Wellcome and UMA Projects, October 31, 1996.
 - **Report on External Review – Supplementary Investigation (August 30, 1996)** – Comments on the external review of the PSI/DSI. Submitted to BC MOE from Agra Earth & Environmental Limited on behalf of Golder Associates Ltd., September 4, 1996.
 - **Supplementary Investigation (August 8, 1996)** – Submitted to BC MOE by Golder Associates Ltd. on behalf of Glaxo Wellcome and reviewed by Agra Earth & Environmental Limited, August 8, 1996.
 - **Girl Guides of Canada Environmental Stage 1 and Stage 2 Preliminary Site Investigation (June 1, 1996)** – Report on neighbouring property to the east. Submitted to BC MOE from SRK-Robinson Inc. on behalf of Girl Guides of Canada – BC Council and review by Agra Earth & Environmental Limited, August 8, 1996.

- **Investigation and Remediation (December 1, 1995)** – Submitted to BC MOE from Geoviro Engineering Ltd. on behalf of Glaxo Wellcome and reviewed by Agra Earth & Environmental Limited, August 8, 1996
- **Phase 1 Environmental Assessment and UST excavation (November 1, 1995)** – Submitted to BC MOE from Geoviro Engineering Ltd. on behalf of Glaxo Wellcome and reviewed by Agra Earth & Environmental Limited, August 8, 1996
- **Supplementary Information to Closure Report, 1476 West 8th Avenue, Vancouver, BC (October 1, 1995)** - Submitted to BC MOE from Golder Associates Ltd. on behalf of Glaxo Wellcome and reviewed by Jo Anne Aldridge, October 1 1995
- **Soil Remediation Program (September 10, 1995)** – Submitted to BC MOE from Golder Associates Ltd. on behalf of Glaxo Wellcome and reviewed by Jo Anne Aldridge, September 11, 1995

1424 West Broadway, south adjacent of the Site

- **Site Registry Detail Report (9183)** – Ordered April 12, 2015. BC MOE, last updated July 20, 2006.
 - **Memorandum – Technical Review, Environmental Investigations 1424 West Broadway, Vancouver, BC (Site #9183) March 23, 2006)** – Submitted to BC MOE from Hemmera Envirochem Inc., March 23, 2006.
 - **Letter-Recommendation for a Certificate of Compliance (March 22, 2006)** - Submitted to BC MOE from Hemmera Envirochem Inc., March 22, 2006.
 - **UST Removal and Site Remediation, 1424 West Broadway, Vancouver, BC (March, 2006)** - Submitted to BC MOE from Hemmera Envirochem Inc., February 1, 2006.
 - **Stage 1 and 2 Preliminary Site Investigation, 1424 West Broadway, Vancouver, BC (July 1, 2004)** - Submitted to BC MOE from Hemmera Envirochem Inc., July 1, 2004

West Broadway and Hemlock Street, adjacent east of the Site

- **Site Registry Detail Report (20600)** – Ordered November 5, 2017. BC MOE, last updated June 9, 2017.
- **Transmittal Letter: Selected Interim Draft Borehole Records (October 19, 2017)**. From Trevor Fitzell, Golder Associates to Lima Howlin, Stantec Consulting, October 19, 2017.

SUMMARY OF REVIEWED REPORTS:

1455 West 10th Avenue, approximately 50 m south of the Site

Site Registry Detail Report (112)

- **Review Requested (September 7, 1989)** – Requested by City of Vancouver, Civic Buildings Department, September 7, 1989.
- **Site Investigation Report Submitted (May 22, 1990)** – Submitted to BC MOE from Soilcon Laboratories Ltd. on behalf of City of Vancouver, Civic Buildings Department, May 22, 1990.
- **Letter of Comfort Issued (June 18, 1990)** – Submitted to City of Vancouver, Civic Buildings Department from BC MOE, June 18, 1990.
- **Concentration Criteria Approach Used (June 20, 1990)** – BC MOE, June 20, 1990
- **Remediation to Residential/Recreational/Agricultural Levels (Draft CMCS 21/11/89) (June 20, 1990)** – BC MOE, June 20, 1990.
- **Record Status** – Inactive – No further action.

1398 West Broadway, approximately 50 m southeast of the Site

Site Registry Detail Report (293)

- **Remediation Plan Report Submitted (April 2, 1992)** – Submitted to BC MOE from O'Connor Associates Environmental Inc. and Imperial Oil Limited, April 2, 1992.
- **Site Investigation Report Submitted (April 2, 1992)** – Submitted to BC MOE from O'Connor Associates Environmental Inc. and Imperial Oil Limited, April 2, 1992.
- **Remediation Plan Report Accepted (April 2, 1992)** – Issued by BC MOE to City of Vancouver, Permits & Lic. Dept., O'Connor Associates Environmental Inc. and Imperial Oil Limited, April 2, 1992.
- **Monitoring Report Due (May 31, 1996)** – BCE recommends that regular monitoring of the groundwater quality resume at the subject site. Issued by BC MOE to Imperial Oil Limited, May 31, 1996.
- **Notice of Independent Remediation Initiation Submitted (February 16, 1998)** – Confirmation sampling of the groundwater quality will be required following completion of independent remediation. Submitted by Imperial Oil Limited to BC MOE, February 16, 1998.
- **Site Profile Received (January 13, 2000)** – Submitted to BC MOE from Imperial Oil Limited, January 13, 2000.
- **Site Profile – No Further Investigation Required by the Ministry (January 27, 2000)** – Note – Applicant is remediating the site independently in accordance with clause 3.2.1 of the Ministry's Draft Guidance Document #4. Issued by BC MOE, January 27, 2000.

- **Notice of Independent Remediation Completion Submitted (September 22, 2000)** – Submitted to BC MOE from Imperial Oil Limited, September 22, 2000.
- **Site Risk Classified – Site is Non-High Risk (April 17, 2017)** – Submitted to BC MOE from Hemmera Envirochem Inc., April 17, 2017.
- **Site Risk Classified – Affected Site is Non-High Risk (April 17, 2017)** – Note – Affected parcel (West Broadway and Hemlock Street) adjacent to 1398 West Broadway, Site: 20600. Submitted to BC MOE from Hemmera Envirochem Inc., April 17, 2017.
- **Notification Received About Likely or Actual Substance Migration to Neighbouring Site (May 2, 2017)** – Note – Affected parcel (West Broadway and Hemlock Street) adjacent to 1398 West Broadway, Site: 20600. Submitted to BC MOE from Parsons, May 2, 2017.
- **Record Status** – Not assigned.

Broadway and Hemlock Esso Service Station, 1398 West Broadway, Vancouver, B.C., Location No. 995456 (January 26, 1998)

- Liquid hydrocarbons were detected at the water surface between 1992 and 1993, but have not been since the report date (1998).
- A groundwater recovery and treatment system was installed and since action, monitoring of the site was conducted at regular intervals.
- The average depth to the groundwater table was 2.8 m in 1997 and the historical groundwater flow has been to the north.
- Both offsite and on-site concentrations of dissolved hydrocarbon constituents have declined to levels below the referenced standards (1998) except for ethylbenzene in WP1. When compared to present-day standards, results did not exceed CSR Schedule 3.1 – Generic Numerical Water Standards.
- As of 1997, 366.6 m³ of water has been recovered and treated.
- The consultant recommends replacing the pump and treat system with bioventing and hydrogen peroxide additions to reduce the concentrations of residual hydrocarbons in the subsurface soils.

2415 Granville Street, approximately 70 m northwest of the Site

Site Registry Detail Report (360)

- **Site Investigation Report Submitted (February 18, 1993)** – Submitted to BC MOE from BSC Construction (II) Corporation on behalf of ORR Development Corp., February 18, 1993)
- **Letter of Comfort Issued (February 22, 1993)** – Submitted to BC MOE from ORR Development Corp., February 22, 1993.

2403 Granville Street, approximately 80 m northwest of the Site

Site Registry Detail Report (1153)

- **Site Investigation Report Submitted (September 30, 1992)** – Submitted to BC MOE from Morrow Environmental Consultants Inc. on behalf of Petro-Canada, September 30, 1992.
- **Concentration Criteria Approach Used (September 30, 1992)** – BC MOE, September 30, 1992.
- **Waste Management Approval Issued (October 5, 1994)** – AS-11632 Special Waste Delisted. Requested by Petro-Canada, October 5, 1992.
- **Determined Historical Special Waste Contaminated Site (October 5, 1992)** – BC MOE, October 5, 1992.
- **Remediation Completion Report Submitted (September 15, 1993)** – Submitted to BC MOE from Morrow Environmental Consultants Inc. on behalf of Petro-Canada, September 15, 1993.
- **Concentration Criteria Approach Used (December 3, 1993)** – BC MOE, December 3, 1993.
- **Letter of Comfort Issued (December 3, 1993)** – Requested by Petro-Canada, December 3, 1993.
- **Remediated to Residential/Recreational/Agricultural Levels (Draft CMCS 21/11/89) (December 3, 1993)** – BC MOE, December 3, 1993.
- **Monitoring Report Submitted (March 11, 1994)** - Submitted to BC MOE from Morrow Environmental Consultants Inc. on behalf of Petro-Canada, March 11, 1994.
- **Record Status** – Inactive- Remediation complete (October 18, 2001).

1476 West 8th Avenue, approximately 30 m north of the Site

Site Registry Detail Report (3339)

- **Detailed Site Investigation Report Submitted: External Review (August 6, 1996)** – External review by AGRA Earth & Environmental Limited of reports: Geoviro, Dec/95 investigation and remediation, 1476 West 8th Avenue Golder Associates. Aug/96 Supplementary Investigation, 1476 West 8th Avenue.

Required Actions: Sampling of soil and groundwater below the building following excavation; confirmation of groundwater flow direction. Submitted to BC MOE from Golder Associates Ltd. and reviewed by Jo-Ann Aldridge and AGRA Earth & Environmental Limited, September 18, 1996.

- **Preliminary Site Investigation Report Submitted: External Review (August 8, 1996)** – External review by AGRA Earth & Environmental Limited of reports: Geoviro, November 7/96 Report: Phase 1 ESA and UST Excavation; and SRK Robinson, June/96 Environmental Stage 1 & 2 Preliminary Site Investigation for the Neighbouring Property (Girl Guides of Canada). Submitted to BC MOE from Golder Associates Ltd. on behalf of Glaxo Wellcome and reviewed by AGRA Earth & Environmental Limited, August 8, 1996.

- **Site Investigation Report Under Review (September 11, 1996)** – Ministry letter to consultant to present results of the PSI/DSI review, included is the AGRA cover letter for the external report review.

Required Actions: Remediation Plan should include provisions to further sample soils within the footprint of the building, identify and classify contamination if any, and to investigate any north-northwestern migration of groundwater to confirm that migration off-site has not occurred. Also confirm groundwater flow direction. Issued by BC MOE and AGRA Earth & Environmental Limited to Golder Associates Ltd., September 11, 1996.

Certificate of Compliance Requested without inspection (September 11, 1996) – Request follows submission of "Soil Remediation Program, 1476 West 8th Avenue, Vancouver, BC." Submitted to BC MOE from Golder Associates Ltd., September 11, 1996.

- **Preliminary Site Investigation and Detailed Site Investigation Report Accepted (September 19, 1996)** – Acceptance of PSI and DSI review by AGRA of reports submitted by Golder Associates Ltd. Issued by BC MOE to AGRA Earth & Environmental Limited and Golder Associates Ltd., September 19, 1996.
- **Monitoring Report Submitted (October 1, 1996)** – Supplementary information to closure report, 1476 West 8th Avenue, Vancouver, BC.

Required Actions: Finalize technical report for C of C application. Submitted to BC MOE from Golder Associates Ltd., October 1, 1996.

- **Case Management Item (October 30, 1996)** – On-Site soils meet CMCS criteria for commercial/industrial. Slight groundwater exceedances for 1 PAH and aluminum, therefore no certificate of compliance issued. Off-site contamination to the east.

Required Actions: Screening assessment is being sent to provincial and regional offices. Surrey office to send fees assessment letter. Requested by Golder Associates Ltd. from BC MOE, October 30, 1996.

- **Remedial Plan Submitted with Risk Assessment: Internal Review (October 31, 1996)** – Screening level risk assessment: Addendum to closure report on soil remediation program, 1476 West 8th Avenue, Vancouver, BC.

Required Actions: Fees Assessment sent to Golder Associates (cc. to Uma Projects). Submitted by Golder Associates Ltd. to Uma Projects, October 31, 1996.

- **Risk Assessment/Risk Management Approach Used (November 26, 1996)** – Submitted to BC MOE from Golder Associates Ltd., November 26, 1996.
- **Remediated to Commercial Levels (November 26, 1996)** – BC MOE, November 26, 1996.
- **Certificate of Compliance Issued (November 26, 1996)** – Terms and conditions are attached in Schedule B. Issued by BC MOE, November 26, 1996.
- **Record Status** – Inactive – Remediation Complete, January 30, 2003.

1424 West Broadway, south adjacent of the Site

Site Registry Detail Report (9183)

- **Site Profile Received (October 19, 2004)** – Submitted to BC MOE from Hemmera Envirochem Inc., October 19, 2004.
- **Site Profile – Further Investigation Required by the Ministry (December 2, 2004)** – Release of development permit approved because in the opinion of the director, release would not pose a significant risk or threat.

Required actions: Preliminary Site Investigation required. BC MOE, December 2, 2004.

- **Certificate of Compliance Issued Using Numerical Standards (May 8, 2006)** – Issued on the recommendation of an Approved Professional (John Taylor) under Protocol 6 of the Contaminated Sites Regulation. Issued by BC MOE to Joey Tomato's Mediterranean Bar and Grill, May 8, 2006.
- **Record Status:** Inactive – Remediation complete, July 20, 2006.

Stage 1 and 2 Preliminary Site Investigation, 1424 West Broadway, Vancouver, BC (July 1, 2004)

- The Stage 1 review identified hazardous building materials in the building, which occupies approximately 50% of the site. A 500-gallon fuel UST and fuel pump were installed at the site in 1959. No records indicate that the UST has been removed.
- In addition to on-site APECs, off-site APECS include a historical auto garage and UST with periodic on-site fueling occurring for more than 30 years within a 57-year period. The APECs identified in the Stage 1 warranted a Stage 2 investigation.
- The Stage 2 investigation indicated the likely presence of an UST in the northeastern corner of the site and the presence of fill material over native sand.
- Soil and groundwater exceeding the applicable standards at the time were not identified. However, only two boreholes were advanced at the site (both to a depth of 6.1 m and located in the northeast corner of the site) and completed as monitoring wells.
- Inferred groundwater flow is north (towards the Site).

UST Removal and Site Remediation, 1424 West Broadway, Vancouver, BC (February 1, 2006)

- The UST identified during the Stage 2 investigation was removed in July of 2006.
- Results of samples taken of the fill material indicate no exceedances for BTEX, VPH, EPH, and PAHs. However, the concentration of zinc (793 mg/kg) exceeded the BC CSR CL standard at the time. The zinc concentrations also exceed the current CSR CL standard (450 µg/g).
- Approximately 27 m³ of the soil was excavated and disposed of during the first excavation in August 2005 and 11 confirmatory samples were submitted to the lab.
- Results of the confirmatory sampling indicated one sample of zinc and lead concentrations (1090 and 2090 mg/kg, respectively) collected from a section of the east

wall of the excavation exceeded the CSR CL soil standard for zinc and lead (600 and 2000 mg/kg, respectively) at that time.

- A second remedial excavation was conducted which removed approximately 7m³ of soil from the east wall and one confirmatory sample was taken (CS-EW-5). Lab results from confirmatory sampling indicated metal concentrations (lead 17 µg/g and zinc 49 µg/g) below the BC CSR CL standards at the time. Lead and zinc concentrations are also below current CSR CL and IL standards.
- The excavated area left over from the UST removal was backfilled with soil stockpiled on-site.

West Broadway and Hemlock Street, adjacent east of the Site

Site Registry Detail Report (20600)

- **Site Risk Classified – Site is Non-High Risk (April 17, 2017)** – Note – Source parcel is 1398 West Broadway, Site ID: 293. Submitted to BC MOE from Hemmera Envirochem Inc., April 17, 2017.

Various along the alignment

Transmittal Letter: Selected Interim Draft Borehole Records

- Geotechnical investigation from Golder Associates in 2017 produced one borehole that represents an area of potential environmental concern for the subject property.
 - **BH17-41** – Approximate location is the laneway north of West Broadway, east of Granville Street, Vancouver. Black organics, PID reading < 0.1 ppm.

DISCUSSION OF FINDINGS:

Based on the information available, the following may be encountered at the Site during construction of the South Granville Station House, Emergency Exits/Ventilation Shafts, and Laydown Yard:

- Contaminated soil may be encountered beneath 1453 -1481 West Broadway during excavation within the station house and emergency exit/ventilation shafts due to a former heat oil sales company at 1467 West Broadway, located within the excavation extents. In addition, there is contaminant migration between the current service station at 1398 West Broadway and the former service station, dry cleaners, and garage at 1412/1408 West Broadway and 2521 Hemlock Street, which may impact an emergency exit/ventilation shaft in the southeast of the Site.
- Hydrocarbon vapours may be encountered beneath 1453 -1481 West Broadway during excavation within the station house and emergency exit/ventilation shafts due to a former heat oil sales company at 1467 West Broadway, located within the excavation extents. In addition, there is contaminant migration between the current service station at 1398 West Broadway and the former service station, dry cleaners, and garage at 1412/1408 West Broadway and 2521 Hemlock Street, which may impact an emergency exit/ventilation shaft in the southeast of the Site.

- Contaminated excavation water may be encountered beneath 1453 -1481 West Broadway during excavation within the station house and emergency exit/ventilation shafts due to a former heat oil sales company at 1467 West Broadway, located within the excavation extents. In addition, there is contaminant migration between the current service station at 1398 West Broadway and the former service station, dry cleaners, and garage at 1412/1408 West Broadway and 2521 Hemlock Street, which may impact an emergency exit/ventilation shaft in the southeast of the Site.

ESTIMATED IMPACTED SOIL VOLUME REQUIRING EXCAVATION: 115 m³

Based upon following assumptions:

- Entire footprint area of station house, and emergency exits are to be excavated to anticipated bedrock depth.
- Only contamination encountered and requiring excavation for the project requires management (contamination does not require delineation and removal outside of project areas).
- Based on desktop study findings, there is a moderate probability of contaminated soil to require excavation. An estimate for moderate-risk sites (5% of total soil to be excavated) was assigned to provide an allowance.
- A total soil excavation volume of approximately 2,300 m³.
- Contamination has not penetrated underlying bedrock.
- No excavation needed for the Laydown Yard.

CONSTRUCTION CONSIDERATIONS

Water disposal – There is a potential to encounter water during excavation of the emergency exits/ventilations shafts to the east of the station across the street from 1398 West Broadway (current service station) and there is a potential that the water is contaminated. Excavation water management will be required if excavation water is contaminated; untreated discharge to the receiving environment is not permitted. Contaminated excavation water will require management in accordance with the *Contaminated Sites Regulation*, and other applicable requirements. Potential options include sanitary or storm water discharge via a permit (may or may not require treatment), or off-site treatment and disposal.

Soil disposal – Previously reported contamination at adjacent properties (1398 West Broadway); potential for encountering during excavation. Contaminated soil encountered during construction of the South Granville Station house, Emergency Exits/Ventilation Shafts, and adjacent laydown yard will require management/disposal in accordance with the *Contaminated Sites Regulation*, other applicable requirements, and the Project Construction Specifications.

Vapour Inhalation – Mitigation plan should be in place for worker exposure, as there is potential for vapour inhalation due to the nature of historically identified contaminants.

SITE NAME: ARBUTUS STREET LAYDOWN YARDS (NW LAYDOWN, NE LAYDOWN, SE LAYDOWN, SW LAYDOWN)

SITE ADDRESSES: 2090-2096 WEST 8TH AVENUE, 2091 TO 2097 WEST BROADWAY, PID: 023895837, 023895756, 023895519, AND 023895578 (NW LAYDOWN YARD/REQUIRED PROPERTY); PID: 15259005, 023895845, 015978427, AND 015977226 (SW LAYDOWN YARD); 2400 MAPLE STREET (NE LAYDOWN YARD); AND 2500 MAPLE STREET (SE LAYDOWN YARD)

BC MOE SITE REGISTRY SITE ID: 43, 2739, 6274, 11559, 15919, 18380

RISK RANKING AND REASONING: LOW TO HIGH RISK

The Laydown Yards around Arbutus Street are ranked as follows:

The **NW laydown yard/required property** is ranked as **high risk** due to multiple USTs (historical) and known contaminant migration in the area. In addition to known hydrocarbon impacts, there has been a dry-cleaning business at 2096 West Broadway, south adjacent of the site across West Broadway, since the 1960s.

The **NE laydown yard** is ranked as **low risk** due to no known areas of contamination present on the property or nearby.

The **SE laydown yard** is ranked as **high risk** due to known contamination in the property boundaries. Additionally, there was a former service station located adjacent east of the site, which is the source of contamination. The former service station has also impacted the property west of the site (2002-2084 West Broadway), which suggests contamination has migrated through the site.

The **SW laydown yard** is ranked as **moderate risk** due to no known contamination present on the property, but known historical contamination to the east of the site at 2002-2084 West Broadway. Additionally, there is an active drycleaner west adjacent of the site that has been in operation circa 1960s.

CURRENT OPERATIONS/ACTIVITIES:

NW Laydown Area:

- Commercial Building (2097 West Broadway) – cellular phone retail;
- Empty lot (2090-2096 West 8th Avenue);
- Bicycle path (PID: 023895837, 023895756, 023895519, and 023895578);
- Commercial Building (2091 West Broadway) – Dulux Paints;

NE Laydown Area:

- Roadway (2400 Maple Street)

SE Laydown Area:

- Roadway (2500 Maple Street)

SW Laydown Area:

- Bicycle path (PID:15259005, 023895845, 015978427, AND 015977226)

FORMER OPERATIONS/ACTIVITIES:

NW Laydown Area:

- Commercial Building (2097 West Broadway) – Roofing Contractor
- Empty lot (2090-2096 West Broadway) – Bio-remediation facility

POTENTIAL CONTAMINANTS OF CONCERN AND RELEASE/MIGRATION MECHANISMS:

Contaminants of concern include benzene, toluene, ethylbenzene, xylene (BTEX), volatile petroleum hydrocarbons (VPH), light end hydrocarbons (LEPH), heavy end petroleum hydrocarbons (HEPH), chlorinated solvents, hydrocarbon solvents, regulated metals, glycol and VOCs.

Potential release/migration mechanisms include possible leaks from underground fuel storage tanks, underground product distribution lines to the pumps, and spills from filling USTs and/or vehicles, leaking of dry cleaning machines, and improper storage and disposal of dry cleaning solvents.

AVAILABLE REPORTS:

Northeast corner of West Broadway and Arbutus Street, located within NW laydown yard extents

- **Site Registry Detail Report (43)** – Ordered April 12, 2015. BC MOE, last updated March 22, 2002 (available in the data room, see summary below).
 - **Assessment of a Bio-Remediation Facility at Broadway and Arbutus Streets in Vancouver (October 26, 1989).** Submitted to BC MOE from Soilcon Laboratories Ltd. and Sinson Investments Ltd., November 16, 1989.
 - **Site Assessment for Soil Contamination (with amendments) (May 1, 1989).** Submitted to BC MOE and Greater Vancouver Regional District from Soilcon Laboratories Ltd., Sinson Investments Ltd., and Terry Barkley Architects, June 5, 1989.
 - **Site Assessment for Soil Contamination (April 1, 1989).** Submitted to BC MOE and Greater Vancouver Regional District from Soilcon Laboratories Ltd., Sinson Investments Ltd., and Terry Barkley Architects, April 25, 1989.

2103 West Broadway, located approximately 20 m west of the NW laydown yard

- **Site Registry Detail Report (2739)** – Ordered October 29, 2017. BC MOE, last updated October 1, 2015.
 - **Letter Report – Management Plan for Hydrocarbon Contamination Identified at Shell Service 2103 West Broadway, Vancouver, BC (November 30, 1995).** Submitted to BC MOE from Morrow Environmental Consultants Inc. and Shell Canada Products Ltd., December 4, 1995 (available in the data room, see summary below).
 - **Letter Report – Management Plan for Off-Site Contamination Identified at Shell Service 2103 West Broadway, Vancouver, BC (November 29, 1995).** Submitted to BC MOE from Morrow Environmental Consultants Inc., December 4, 1995.
 - **Shell Canada Products Limited – Assessment of Off-Site Contamination, 2103 West Broadway, Vancouver, BC (November 29, 1995).** Submitted to BC MOE from Morrow Environmental Consultants Inc. and Shell Canada Products Limited, December 4, 1995.
 - **Letter Report – Management Plan for Off-Site Contamination Identified at Shell Service 2103 West Broadway, Vancouver, BC (November 29, 1995).** Submitted to BC MOE from Shell Canada Products Limited, December 4, 1995.
 - **Inspection of Soil During Service Station Redevelopment, 2103 West Broadway, Location Code: Co1303 (November 28, 1995).** Submitted to BC MOE from Morrow Environmental Consultants Inc., November 28, 1995.
 - **Shell Canada Products Limited – Site Report Status 2103 West Broadway, Vancouver, BC (August 2, 1995).** Submitted to BC MOE from Morrow Environmental Consultants Inc. and Shell Canada Products Ltd., December 4, 1995.

1996 West Broadway/2528 Maple Street, east adjacent of the SE Laydown Yard

- **Site Registry Report (6274)** – Ordered November 24, 2017. BC MOE, last updated January 25, 2013
 - **Summary of Site Condition (December 14, 2009).** Submitted to BC MOE from Keystone Environmental Ltd., December 18, 1999.
 - **Results of Stage 1 PSI Update, Pulse Development, 2550 Maple Street (at Broadway), Vancouver, BC., December 1, 2009.** Submitted to BC MOE from Hemmera Envirochem Inc., December 18, 2009.
 - **Remedial Closure: 2528 Maple Street, Vancouver, BC., December 1, 2009.** Submitted to BC MOE from Keystone Environmental Ltd., December 18, 1999.
 - **Stage 1 Preliminary Site Investigation: 1964 West Broadway, Vancouver, BC., April 1, 2005.** Submitted to BC MOE from Hemmera Envirochem Inc., December 18, 2009.

- **Confirmation of Remediation Report, Chevron Service Station #86, 1996 West Broadway, Vancouver, BC., June 1, 2004.** Submitted to BC MOE from Hemmera Envirochem Inc., June 1, 2004.
- **Soil and Groundwater Results – Draft, Former Chevron Service Station #86, 1996 West Broadway, Vancouver, BC., April 9, 2001.** Submitted to BC MOE from Hemmera Envirochem Inc. on behalf of Chevron Canada Limited, April 18, 2001.
- **Stage 1 Stage 2 PSI Chevron Service Station #86, 1996 West Broadway, Vancouver, BC Draft Report., June 1, 1999.** Submitted to BC MOE from Connor Pacific Environmental Technologies Inc., December 23, 2009.

2002-2084 West Broadway, east adjacent of the SW Laydown Yard and west adjacent of the SW Laydown Yard

- **Site Registry Detail Report (11559)** – Ordered April 12, 2015. BC MOE, last updated December 5, 2013
 - **Screening Level Risk Assessment, 2002-2084 West Broadway, Vancouver, BC (February 29, 2002).** Submitted to BC MOE from Next Environmental Inc., March 14, 2012.
 - **Stage 1 Preliminary Site Investigation Update, 2002-2084 West Broadway, Vancouver, BC (February 29, 2002).** Submitted to BC MOE from Next Environmental Inc., March 14, 2012.
 - **Detailed Site Investigation, 2002-2084 West Broadway, Vancouver, BC (February 29, 2002).** Submitted to BC MOE from Next Environmental Inc., March 14, 2012.
 - **Confirmation of Remediation, 2002-2084 West Broadway, Vancouver, BC (February 29, 2002).** Submitted to BC MOE from Next Environmental Inc., March 14, 2012.
 - **Summary of Site Condition (February 28, 2002).** Submitted to BC MOE from Next Environmental Inc., March 14, 2012.
 - **Environmental Stage 1 Preliminary Site Investigation, 2002-2084 West Broadway, Vancouver, BC (May 31, 2010).** Submitted to BC MOE from Next Environmental Inc., March 14, 2012.
 - **West Broadway Environmental Summary, West Broadway and Maple street, Vancouver, British Columbia (November 13, 2007).** Submitted to BC MOE from AMEC Earth Environmental, March 14, 2012.
 - **Environmental Liability Assessment 2080 and 2084 West Broadway, Vancouver, British Columbia (April 12, 2015).** Submitted to BC MOE from AMEC Earth Environmental, March 14, 2012.
 - **Detailed Site Investigation, 2000 West Broadway, Vancouver, British Columbia (May 30, 2003).** Submitted to BC MOE from AMEC Earth Environmental, March 14, 2012.

- **Stage 1 and Stage 2 Preliminary Site Investigation, 2000 West Broadway, Vancouver, British Columbia (May 29, 2003).** Submitted to BC MOE from AMEC Earth Environmental, March 14, 2012.
- **Stage 1 and 2 Preliminary Site Investigation and Hazardous Materials Survey, 2020 and 2030 West Broadway, Vancouver, British Columbia (May 28, 2003).** Submitted to BC MOE from AMEC Earth Environmental, March 14, 2012.
- **Amendment – Stage 2 Preliminary Site Investigation 2080 and 2084 West Broadway, Vancouver, British Columbia (April 4, 2003).** Submitted to BC MOE from URS Norecol Dames and Moore Inc., March 14, 2002.
- **Supplemental Drilling Investigations, 2080 and 2084 West Broadway, Vancouver, British Columbia (November 28, 2002).** Submitted to BC MOE from URS Norecol Dames and Moore Inc., March 14, 2002.
- **Stage 2 Preliminary Site Investigation, 2080 and 2084 West Broadway, Vancouver, British Columbia (September 24, 2002).** Submitted to BC MOE from URS Norecol Dames and Moore Inc., March 14, 2002.
- **Stage 1 Preliminary Site Investigation, 2080 and 2084 West Broadway, Vancouver, British Columbia (September 24, 2002).** Submitted to BC MOE from URS Norecol Dames and Moore Inc., March 14, 2002.
- **Limited Stage 2 Preliminary Site Investigation, 2020 and 2030 West Broadway, Vancouver, British Columbia (February 9, 2001).** Submitted to BC MOE from URS Norecol Dames and Moore Inc., March 14, 2002.
- **Phase 1 Environmental Assessment for the IGA and Liquor Store at 2020 and 2030 West Broadway, Vancouver, BC.** Submitted to BC MOE from URS Norecol Dames and Moore Inc., March 14, 2002.

Corner of Maple Street and West Broadway, within SE Laydown Yard extents

- **Site Registry Detail Report (15919)** – Ordered November 24, 2017. BC MOE, last updated December 11, 2013

Arbutus Street north of West Broadway, west adjacent of the NW Laydown Yard

- **Site Registry Detail Report (18380)** – Ordered November 5, 2017. BC MOE, last updated October 6, 2017.
 - **Human Health and Ecological Risk Assessment, Management Area (City MA) Associated with a Shell Service Station at 2103 West Broadway, Vancouver, BC. (July 21, 2017).** Submitted to BC MOE from SNC-Lavalin Environment Inc., August 16, 2017.
 - **Performance Verification Plan, Management Area (City MA) Associated with a Shell Service Station at 2103 West Broadway, Vancouver, BC. (July 21, 2017).** Submitted to BC MOE from SNC-Lavalin Environment Inc., August 16, 2017.

- **Summary of Communication in Regards to the COFC Application for Off-Site Management Area (City Management Area) Associated with the Shell Service Station at 2103 West Broadway, Vancouver, BC. (July 14, 2017).** Submitted to BC MOE from SNC-Lavalin Environment Inc., August 16, 2017.
- **Stage 2 Preliminary Site Investigations and Detailed Site Investigation, Management Area Associated with Shell Service Station at 2103 West Broadway (July 11, 2017).** Submitted to BC MOE from SNC-Lavalin Environment Inc., August 16, 2017.
- **Summary of Site Condition (for City MA) (July 1, 2017).** Submitted to BC MOE from SNC-Lavalin Environment Inc., August 16, 2017.
- **Email Entitled 2017 03-08 Site 2739 Preapproval Letter (June 19, 2017).** BC Ministry of Environment, August 16, 2017.
- **Stage 1 Preliminary Site Investigation, Shell Service Station, 2103 West Broadway, Vancouver, BC (Location Code: C01303) (June 6, 2017).** Submitted to BC MOE from SNC-Lavalin Environment Inc., August 16, 2017.
- **Protocol 6 Preapproval Application for Planned Management Area of C of C Applications Adjacent to Shell Station at 2103 West Broadway, Vancouver, BC (February 10, 2017).** Submitted to BC MOE from SNC-Lavalin Environment Inc., February 14, 2017.
- **Protocol 6 Preapproval Application for Planned Management Area of C of C Applications Adjacent to 2103 West Broadway and 2106 West 8th Avenue, Vancouver, BC. (August 7, 2015).** Submitted to BC MOE from SNC-Lavalin Environment Inc., September 8, 2015.
- **Determination of Applicability of Drinking Water Standards, 2103 West Broadway and 2106 West 8th Avenue, Vancouver, BC (April 15, 2014).** BC MOE, August 16, 2017.
- **Request for Water Use Determination, Shell Service Station, 2103 West Broadway and 2106 West 8th Avenue, Vancouver, BC MOE Site ID 2739 (June 7, 2013).** Submitted to BC MOE from SNC-Lavalin Environment Inc., August 16, 2017.

2150 West Broadway and West Broadway south-southwest of 2103 West Broadway, approximately 30 m southwest of the NW Laydown Yard

- **Site Registry Detail Report (18381)** – Ordered October 29, 2017. BC MOE, last updated September 30, 2015 (available in the data room, see summary below).
 - **Protocol 6 Preapproval Application for Planned Management Area of C of C Applications Adjacent to 2103 West Broadway and 2106 West 8th Avenue, Vancouver, BC (August 7, 2015).** Submitted to BC MOE from SNC-Lavalin Environment Inc., September 8, 2015.

Various across the alignment

- **Transmittal Letter: Selected Interim Draft Borehole Records (October 19, 2017).** From Trevor Fitzell, Golder Associates to Lima Howlin, Stantec Consulting, October 19, 2017.

SUMMARY OF REVIEWED REPORTS:

Northeast corner of West Broadway and Arbutus Street, located within NW laydown yard extents

Site Registry Detail Report (43)

- **Site Investigation Report Submitted** – Submitted by Soilcon Laboratories Ltd., April 25, 1989.
- **Remediation Plan Report Submitted** - Submitted by Soilcon Laboratories Ltd., May 29, 1989.
- **Other Waste System Numbers** – Requested by Sinson Investments Ltd., July 13, 1989.
- **Remediation Plan Report Accepted** – Received by Sinson Investments Ltd., July 13, 1989.
- **Monitoring Report Due** – Submitted by Soilcon Laboratories Ltd. to BC MOE, November 16, 1989.
- **Concentration Criteria Approach Used** – BC MOE, December 20, 1989.
- **Case Management Item** – Note: The paper file for this site is missing, BC MOE, March 20, 2002.
- **Record Status** – Active – Under remediation, March 22, 2002.

Site Assessment for Soil Contamination (with amendments) (May 1, 1989)

- Historical 900-gallon gasoline tank in the center yard (installed 1971).
- Smaller fuel oil tank located on the western side of structure.
- Tanks (gasoline tank and fuel oil tank) were removed during the preliminary site investigation and the area around the tanks trenched; with four additional inspection pits advanced.
- Visible petroleum and staining of the soil was noted along the west side of the gasoline tank from a depth of 1.2 m to a depth of 2.1 m (depth of the water table). The topsoil (organic horizons) was also stained and samples taken. Samples from pits around the UST were taken and submitted to the lab for analysis.
- Visible petroleum and staining of the soil was noted underneath the fuel oil tank. There was no visual evidence of contamination further away from the tank. Once removed, the fuel oil tank was found to be in poor condition with a substantial hole present. A sample from the tank area was sent to a lab for analysis.
- The following are results that exceed current CSR soil standards for Commercial (CL) land use:

- Test pit samples in the vicinity of the gasoline fuel tank exceed the CSR CL standard for lead for intake of contaminated soil (150 µg/g). In addition, pH was not measured and other CSR CL Standards that are pH dependent may exceed.
- Test pit samples to the northeast and northwest of the gasoline fuel tank exceed the CSR CL soil standard for Benzene for groundwater used for drinking water (0.035 µg/g).
- Test pit samples in the vicinity of the gasoline fuel tank exceed the CSR CL soil standard for Ethylbenzene for groundwater used for drinking water (15 µg/g).
- Test pit samples in the vicinity of the gasoline fuel tank exceed the CSR CL soil standard for Xylene for groundwater used for drinking water (6.5 µg/g) and groundwater flow to surface water used by aquatic life.
- In addition, some concentrations may exceed Hazardous Waste Regulations and may require separate disposal.
- Conclusions of the report indicate that no downward migration of contamination occurred; rather, it likely spread laterally across the water table. The spill was estimated to have been approximately 100 L and 84 m³ in volume; and has remained contained within the study area. Additional sampling was initiated to determine the extent of special waste and concluded approximately 30m³ of toluene and xylene special waste. The volume of contaminated material not classified as special waste was estimated to be 75 m³.
- The report also recommends that an underground bio-remediation facility be built to the property north adjacent to the subject site.

Assessment of a Bio-Remediation Facility at Broadway and Arbutus Streets in Vancouver (October 26, 1989)

- Bio-remediation processes were deployed at the northeast corner of West Broadway and Arbutus Street. Concentrations of contaminants of concern and exceedances of current CSR CL standards are as follows:
 - Benzene – 0.63 µg/g, exceeds the current CSR CL soil standard for Benzene for groundwater used for drinking water (0.035 µg/g).
 - Toluene – 4.13 µg/g, exceeds the current CSR CL soil standard for Toluene for groundwater flow to surface water used by aquatic life – freshwater (0.5 µg/g).
 - Ethylbenzene – 4.41 µg/g, meets the current applicable CSR CL soil standards.
 - Xylene – 30.5 µg/g, exceeds the current CSR CL soil standard for Xylene for groundwater used for drinking water (6.5 µg/g) and groundwater flow to surface water used by aquatic life (20 µg/g).
- Large reductions were achieved at the Site and met the Pacific Place Level C guideline at the time of completion. It was recommended that the Site be closed and previously contaminated soil be excavated and used as landfill capping material. Depending on

what CSR CL standards apply at the site; benzene, toluene, and xylenes may exceed current CSR CL soil standards.

2103 West Broadway, located approximately 20 m west of the NW laydown yard

Site Registry Detail Report (2739)

- **Site Investigation Report Submitted** – Submitted by Morrow Environmental Consultants Inc. to BC MOE, December 4, 1995. Note – Three reports submitted. Shell does not presently require formal comment regarding the submitted information.
- **Notification Received about likely or actual substance migration to neighbouring site (CSR 57 or 60.1)** – BC MOE, November 18, 2002.
- **Case Management Item** – Request for water use determination by Shell Canada Products Limited, June 17, 2013.
- **Case Management Item** – Drinking water use does not apply, BC MOE, April 15, 2014.
- **Site Risk Classified** – Site is non-high risk, BC MOE, September 28, 2015.
- **Site Risk Classified** – Site is non-high risk, BC MOE, September 29, 2015. Affected Site ID: 18380 (Management Area part of West Broadway and Arbutus Street).
- **Site Risk Classified** – Site is non-high risk, BC MOE, September 29, 2015. Affected Site ID: 18381 (2150 West Broadway, Vancouver, BC).
- **Record Status** – Not assigned.

Letter Report – Management Plan for Hydrocarbon Contamination Identified at Shell Service 2103 West Broadway, Vancouver, BC (November 30, 1995)

- USTs at the service station were replaced with fiberglass tanks in 1987. At the time, a recovery program was initiated with automated collection sumps installed across the site.
- Monitoring wells on the east and west sides of the site were connected and a soil vapour extraction system installed. However, vapour levels were deemed low enough to cease operation of the soil vapour extraction system in late 1989.
- The system was replaced in favour of a manual collection process involving bailers and together with the automated system, approximately 3,160 L of liquid hydrocarbon was removed from the subsurface of the site as of late 1989.
- Liquid hydrocarbons appear inconsistently in the monitoring wells in the southeast of the site.
- Soils that exceeded special waste levels were not excavated as the soils were generally below 4.0 m and the site is proposed for continued petroleum use.
- Groundwater quality at the site was not completed as liquid hydrocarbons were still present at the subsurface.

Shell Canada Products Limited – Assessment of Off-Site Contamination, 2103 West Broadway, Vancouver, BC (November 29, 1995)

- Additional subsurface investigation was carried out at the south edge of the service station and a soil vapour extraction system was installed.
- Four monitoring wells were installed, generally located in the southeast corner of the site.
- An off-site monitoring well to the southwest of the site across West Broadway had light hydrocarbon impacts. There were also additional off-site monitoring wells to the south, east, and west that exhibited hydrocarbon vapour impacts.
- Lateral extent of the contamination is defined to the east and west along the property line, south of the property underneath West Broadway, and along the building foundation south of West Broadway.
- Depth of contamination is in-between 4 and 6 m within a sand and gravel horizon. The finer grained soil above this horizon did not exhibit contamination.
- The following represents available soil samples with concentrations that exceed current applicable CSR CL soil standards:
 - Potential Benzene exceedances in samples in the southeast corner of the site. Described as potential exceedance because laboratory results are less than a value that exceeds the benzene CSR CL soil standard for groundwater used for drinking water standard (0.035 µg/L)
 - Ethylbenzene exceedances in samples in the southeast of the site for CSR CL soil standard for groundwater used for drinking water standard (15 µg/g)
 - Potential Toluene exceedances in samples in the southeast of the site for CSR CL soil standard for groundwater flow to surface water used by aquatic life – freshwater (0.5 µg/g). Toluene exceedance in a sample in the southeast of the site for CSR CL soil standard for groundwater flow to surface water used by aquatic life – freshwater (0.5 µg/g).
 - Xylenes exceedances in samples in the southeast of the site for CSR CL soil standard for groundwater used for drinking water standard (6.5 µg/g).
 - Light and total hydrocarbons were also measured but have no directly-comparable present-day standards.

1996 West Broadway/2528 Maple Street, east adjacent of the SE Laydown Yard

Site Registry Report (6274)

- **Site Profile Received (October 15, 1999)** – Submitted to BC MOE from Chevron Canada Limited, October 15, 1999.
- **Waste Management Act: Contaminated Sites Notations (October 21, 1999)** – Issued by BC MOE, October 15, 1999.

Note: Preliminary Site Investigation Report Required.

- **Notice of Independent Remediation Initiation Submitted (February 14, 2001)** – Submitted to BC MOE from Hemmera Envirochem Inc., February 14, 2001.
- **Notification Received About Likely or Actual Substance Migration to Neighbouring Site (Mar 19, 2002)** – Submitted to BC MOE and Vancouver City Health Department by Chevron Canada Limited, June 4, 2004.

Note: City of Vancouver notified if migration of contaminants from the subject site into adjacent roadways.

Required Actions: Update June 4, 2004 – Hemmera Envirochem issued another offsite notice.

- **Certificate of Compliance Requested Without Inspection (June 15, 2004)** – Submitted to BC MOE from Hemmera Envirochem Inc., June 15, 2004.
- **Certificate of Compliance Issued (June 18, 2004)** – Issued by BC MOE to Chevron Canada Limited, Taylor, John R (Rostered Expert), and City of Vancouver Environment Protection Branch, June 18, 2004.

Note: Issued for PID 006-963-692 and off-site roadway land on recommendation of Rostered Expert (John R Taylor) under Protocol 6 of the Contaminated Sites Regulation. The lands covered by this certificate are located at 1995 West Broadway and the offsite roadway and sidewalk described by the metes and bounds.

- **Site Profile Received (February 5, 2007)** – Submitted to BC MOE from Bastion Development Corporation, February 5, 2007.
- **Site Profile Reviewed – Further Investigation Required by the Ministry (Mar 19, 2007)** – Issued by BC MOE, March 19, 2007.

Note: Preliminary Site Investigation required. Release of the development permit granted because in the opinion of the Director the release would not present a significant threat or risk.

- **Certificate of Compliance Requested (December 22, 2009)** – Submitted to BC MOE from Keystone Environmental Ltd., December 22, 2009.
- **Certificate of Compliance Issued Using Numerical Standards (December 23, 2009)** – Issued by BC MOE to Keystone Environmental Ltd., December 23, 2009.

Note: Issued on the recommendation of an Approved Professional (Lori C. Larsen) under Protocol 6 of the Contaminated Sites Regulation. The lands covered by this certificate are located at 2528 Maple Street (PID 027 095 886).

- **Record Status** – Not Assigned.

2002-2084 West Broadway, west adjacent of the SW Laydown Yard and east adjacent of the SW Laydown Yard

Site Registry Detail Report (11559)

- **Site Profile Received (March 26, 2009)** – Submitted to BC MOE from Pinnacle International, Mar 26, 2009.
- **Site Profile Reviewed – Further Investigation Required by the Ministry (March 31, 2009)** – Note – Release of the development permit granted because in the opinion of the director the release would not pose significant threat or risk. The City of Vancouver will withhold the occupancy permit until an instrument is secured.

Required actions: Preliminary Site Investigation required. A Ministry instrument must be obtained prior to occupancy or reutilization of the land. BC MOE, March 31, 2009.
- **Notification Received About Likely or Actual Substance Migration to Neighbouring Site (September 15, 2009)** – Submitted to BC MOE from Next Environmental, September 15, 2009.
- **Notice of Independent Remediation Initiation Submitted (November 29, 2010)** – Submitted to BC MOE from Next Environmental, November 29, 2010.
- **Site Risk Classified - Site is Non-High Risk (November 29, 2010)** – Submitted to BC MOE from Next Environmental, November 29, 2010.
- **Site Risk Classified – Affected Site is Non-High Risk (November 29, 2010)** - Submitted to BC MOE from Next Environmental, November 29, 2010.
- **Preapproval of Contaminated Sites Instrument Application Requested (January 24, 2012)** - Submitted to BC MOE from Next Environmental Inc. on behalf of Mondiale Development Ltd., November 29, 2010.
- **Preapproval of Contaminated Sites Instrument Application Issued (January 30, 2012)** – Issued by BC MOE to Next Environmental Inc., January 30, 2012.
- **Notice of Independent Remediation Completion Submitted (February 28, 2012)** – Submitted to BC MOE from Next Environmental Inc., February 28, 2012.
- **Certificate of Compliance Requested (March 14, 2012)** – Requested by Mondiale Development Ltd. and Next Environmental, March 14, 2012.
- **Certificate of Compliance Issued Using Risk Based Standards (April 30, 2012)** – Note – Issued on the recommendation of an Approved Professional under Protocol 6 of the Contaminated Sites Regulation. Notice was given for Site PID: 028-033-540 and Affected Site. Conditions attached to COC. Issued by BC MOE to Mondiale Development Ltd. and Next Environmental, April 30, 2012.
- **Record Status** – Active – Remediation Complete.
- **Suspected Land Use** – Petroleum products, dispensing facility including service station/card lot.

Corner of Maple Street and West Broadway, within SE Laydown Yard extents

Site Registry Detail Report (15919)

- **Notification Received About Likely or Actual Substance Migration from Neighbouring Site (September 15, 2009)** – Submitted to BC MOE from Next Environmental, September 15, 2009.

Note: Affected parcel is 2002-2084 West Broadway, Vancouver. Site ID: 15919.

Arbutus Street north of West Broadway, west adjacent of the NW Laydown Yard

Site Registry Detail Report (18380)

- **Preapproval of Contaminated Sites Instrument Application Requested (September 8, 2015)** – Note – Source Site 2739. Submitted to BC MOE from SNC-Lavalin Environment Inc. on behalf of Shell Canada Products, September 8, 2015.
- **Site Risk Classified – Site is Non-High risk (September 29, 2015)** – BC MOE, September 29, 2015.
- **Preapproval of Contaminated Sites Instrument Application Issued (March 8, 2017)** – Issued by BC MOE to Shell Canada Products, March 8, 2017.
- **Certificate of Compliance Requested (August 15, 2017)** – Requested by Shell Canada Products and SNC-Lavalin Environment Inc., August 15, 2017.
- **Record Status** – Not assigned.

Human Health and Ecological Risk Assessment, Management Area (City MA) Associated with a Shell Service Station at 2103 West Broadway, Vancouver, BC. (July 21, 2017)

- Report refers to the City Management Area (portions of Arbutus Street and West Broadway) which is subdivided into the Roadway MA (CSR IL standards) and Backyards MA (CSR RL standards).
- Human Health Risk Assessment concluded that no operable pathways for contaminants of potential concern were found at grade within the city management area. Contaminants of potential concern exist at depths greater than 3 mbgs and concentrations exceeding drinking water standards across the city management area were identified. Therefore, groundwater from surface to 7 m depth must not be used as a source of drinking water. The assessment assumes the city management area will remain as is (i.e. with no buildings present).
- Ecological Risk Assessment identified ecological receptors in the subsurface soil and groundwater at the city management area. Since contaminants of potential concern are located > 1 mbgs, no potential operable exposure pathways were identified for terrestrial ecological receptors at the backyard management area and are not anticipated to be operable at the roadways management area. There is a potential for an exposure pathway between groundwater and deep rooting plants at the roadway management area; however, it is deemed unlikely.

Stage 2 Preliminary Site Investigations and Detailed Site Investigation, Management Area Associated with Shell Service Station at 2103 West Broadway (July 11, 2017)

- Hydrocarbon soil impacts were identified off-site to the southwest at depths between 4.7 and 6.1 mbgs (Roadway MA).
- VPH contamination at depths ranging between 2.8 m and 6.0 mbgs (Backyard MA).
- Groundwater contamination (benzene, ethylbenzene, and MTBE) was identified downgradient southwest of the site at depths ranging from 5.0 to 6.0 mbgs. Hydrocarbon groundwater contamination was inferred to be present in Arbutus Street based on analytical. Groundwater is generally to the southwest, however it is strongly influenced by the P3 sump at 2150 W Broadway
- Outdoor air concentrations were calculated and were less than the applicable standards.
- There were other areas of contamination (present and historical) to the north of the site but are not included in this summary.

2150 West Broadway and West Broadway south-southwest of 2103 West Broadway, approximately 30 m southwest of the NW Laydown Yard

Site Registry Detail Report (18381)

- **Preapproval of Contaminated Site Instrument Application Requested** – Submitted by SNC-Lavalin Inc. to BC MOE on request by Shell Canada Products, September 8, 2015. Note – Source site 2739.
- **Site Risk Classified** – Site is non-high risk, BC MOE, September 29, 2015. Note – Source site 2739.
- **Record Status** – Not assigned.

Protocol 6 Preapproval Application for Planned Management Area of C of C Applications Adjacent to 2103 West Broadway and 2106 West 8th Avenue, Vancouver, BC (August 7, 2015)

- Preapproval of Certificate of Compliance using risk-based standards for the City MA and 2150 MA. States that contaminant plume off-site is stable.
- States that if the Shell site was closed a Certificate of Compliance would be required by the owner/developer before it could be redeveloped.

Varies throughout the alignment

Transmittal Letter: Selected Interim Draft Borehole Records

- Geotechnical investigation from Golder Associates in 2015 and 2017 produced the following boreholes that represent areas of potential environmental concern for the subject property:
 - **BH15-06** – Approximate location is 2096 West 8th Avenue. Black and orange staining, garbage debris. No PID readings and sample(s) were not sent for analysis

- **BH17-48** – Approximate location is West Broadway, East of Arbutus Street. Orange staining /metallic odour. PID reading of up to 3.0 ppm; unknown if sample(s) were sent for analysis.

DISCUSSION OF FINDINGS:

Based on the information available, the following may be present at the Arbutus Street NE, NW, SW, and SE Laydown Yards:

- Shallow contaminated soil beneath 2097 West Broadway and 2096 West 8th Avenue may be present at the NW Laydown Yard. Shallow contaminated soil beneath 2500 Maple Street may be present at the SW Laydown Yard. It is unlikely contaminated soil will be encountered at the NW, NE, SE, and SW Laydown Yards as no excavation is expected to occur.
- Hydrocarbon vapours may be encountered during work at 2097 West Broadway and 2096 West 8th Avenue and 2500 Maple Street.
- Contaminated groundwater may be present beneath 2097 West Broadway and 2096 West 8th Avenue and 2500 Maple Street. It is unlikely that contaminated groundwater will be encountered at the NW, NE, SE, and SW Laydown Yards as no excavation is expected to occur.

ESTIMATED IMPACTED SOIL VOLUME REQUIRING EXCAVATION: 0 m³

Based upon following assumptions:

- It is expected that no subsurface works are required at the laydown site(s) and required property, other than that included for the Arbutus station house, etc. (identified in the report for Arbutus Station).

CONSTRUCTION CONSIDERATIONS

Water disposal – It is unlikely that groundwater will be encountered during construction or regrading as any expected construction would have minimal and or superficial disturbance.

Soil disposal –Contaminated soil encountered during construction or regrading will require management in accordance with the Contaminated Sites Regulation, applicable city by-laws, and the Project Construction Specifications.

Vapour Inhalation – Mitigation plans should be in place for worker exposure, as there is potential for vapour inhalation due to the nature of historically identified contaminants in the area.

SITE NAME: ARBUTUS STATION HOUSE, EMERGENCY EXITS/VENTILATION SHAFTS, AND TUNNEL CONSTRUCTION EXCAVATION

SITE ADDRESS: 2097 WEST BROADWAY AND 2096 WEST 8TH AVENUE (STATION HOUSE), 2084 WEST BROADWAY AND SIDEWALKS ON WEST BROADWAY (EMERGENCY EXITS/VENTILATION SHAFTS), AND WEST BROADWAY FROM APPROXIMATELY ARBUTUS STREET TO CYPRESS STREET (TUNNEL CONSTRUCTION EXCAVATION)

BC MOECCS SITE REGISTRY SITE ID: 43, 2739, 6274, 11559, 15919, 18380, 18381

RISK RANKING AND REASONING: HIGH RISK

Arbutus Station House is ranked as **High Risk** due to multiple USTs (historical) and known contaminant migration in the area of the proposed excavation. In addition to known hydrocarbon impacts emanating from the gas station at 2103 West Broadway, there has been a dry-cleaning business at 2096 West Broadway, south of the Site across West Broadway, since the 1960s.

In addition to the main station house, there are several emergency exits/ventilation shafts and the western section of the tunnel construction excavation that are adjacent to a service station (2103 West Broadway) that has known contamination migration off-site. This area is considered high risk.

The tunnel construction excavation from approximately Arbutus Street to Cypress Street is considered Moderate Risk for the purposes of calculating contingency soil contamination volumes.

Current Operations/Activities: Arbutus Station House and Tunnel Construction Excavation:

- City street right-of-way (West Broadway);
- Commercial Building (2097 West Broadway) – cellular phone retail; Empty lot (2090-2096 West 8th Avenue);
- Commercial Building (2091 West Broadway) – paint retail;
- Commercial/residential Building (2002-2084 West Broadway, off-site)
- Commercial/residential Building (1996 West Broadway/2528 Maple Street); and
- Retail Fuel Operation (2103 West Broadway, off-site) – Shell; and a Commercial Building (2096 West Broadway, off-site) – Fletchers Dry Cleaning business

Emergency Exits/Ventilation Shafts

- West Broadway, street and sidewalk areas (Varies along alignment) and
- Public space (2084 West Broadway)

FORMER OPERATIONS/ACTIVITIES:

- Commercial Building (2097 West Broadway) – Roofing Contractor;
- Empty lot (2090-2096 West Broadway) – Bio-remediation facility; and
- Service Station (1996 West Broadway/2528 Maple Street)

POTENTIAL CONTAMINANTS OF CONCERN AND RELEASE/MIGRATION MECHANISMS:

Contaminants of concern include benzene, toluene, ethylbenzene, xylene (BTEX), volatile petroleum hydrocarbons (VPH), light end hydrocarbons (LEPH), heavy end petroleum hydrocarbons (HEPH), chlorinated solvents, regulated metals, glycol, and VOCs.

Potential release/migration mechanisms include possible leaks from underground fuel storage tanks, underground product distribution lines to the pumps, spills from filling USTs and/or vehicles, leaking of dry cleaning machines, and improper storage and disposal of dry cleaning solvents.

AVAILABLE REPORTS:**Northeast corner of West Broadway and Arbutus Street, within excavation extents**

- **Site Registry Detail Report (43)** – Ordered April 12, 2015. BC MOECCS, last updated March 22, 2002.
 - **Assessment of a Bio-Remediation Facility at Broadway and Arbutus Streets in Vancouver (October 26, 1989).** Submitted to BC MOECCS from Soilcon Laboratories Ltd. and Sinson Investments Ltd., November 16, 1989.
 - **Site Assessment for Soil Contamination (with amendments) (May 1, 1989).** Submitted to BC MOECCS and Greater Vancouver Regional District from Soilcon Laboratories Ltd., Sinson Investments Ltd., and Terry Barkley Architects, June 5, 1989.
 - **Site Assessment for Soil Contamination (April 1, 1989).** Submitted to BC MOECCS and Greater Vancouver Regional District from Soilcon Laboratories Ltd., Sinson Investments Ltd., and Terry Barkley Architects, April 25, 1989.

2103 West Broadway, north adjacent of the Site

- **Site Registry Detail Report (2739)** – Ordered October 29, 2017. BC MOECCS, last updated October 1, 2015.
 - **Letter Report – Management Plan for Hydrocarbon Contamination Identified at Shell Service 2103 West Broadway, Vancouver, BC (November 30, 1995).** Submitted to BC MOECCS from Morrow Environmental Consultants Inc. and Shell Canada Products Ltd., December 4, 1995.
 - **Letter Report – Management Plan for Off-Site Contamination Identified at Shell Service 2103 West Broadway, Vancouver, BC (November 29, 1995).** Submitted to BC MOECCS from Morrow Environmental Consultants Inc., December 4, 1995.

- **Shell Canada Products Limited – Assessment of Off-Site Contamination, 2103 West Broadway, Vancouver, BC (November 29, 1995).** Submitted to BC MOECCS from Morrow Environmental Consultants Inc. and Shell Canada Products Limited, December 4, 1995.
- **Letter Report – Management Plan for Off-Site Contamination Identified at Shell Service 2103 West Broadway, Vancouver, BC (November 29, 1995).** Submitted to BC MOECCS from Shell Canada Products Limited, December 4, 1995.
- **Inspection of Soil During Service Station Redevelopment, 2103 West Broadway, Location Code: Co1303 (November 28, 1995).** Submitted to BC MOECCS from Morrow Environmental Consultants Inc., November 28, 1995.
- **Shell Canada Products Limited – Site Report Status 2103 West Broadway, Vancouver, BC (August 2, 1995).** Submitted to BC MOECCS from Morrow Environmental Consultants Inc. and Shell Canada Products Ltd., December 4, 1995.

1996 West Broadway/2528 Maple Street, south adjacent of the Site

- **Site Registry Report (6274)** – Ordered November 24, 2017. BC MOECCS, last updated January 25, 2013
 - **Summary of Site Condition (December 14, 2009).** Submitted to BC MOECCS from Keystone Environmental Ltd., December 18, 1999.
 - **Results of Stage 1 PSI Update, Pulse Development, 2550 Maple Street (at Broadway), Vancouver, BC., December 1, 2009.** Submitted to BC MOECCS from Hemmera Envirochem Inc., December 18, 2009.
 - **Remedial Closure: 2528 Maple Street, Vancouver, BC., December 1, 2009.** Submitted to BC MOECCS from Keystone Environmental Ltd., December 18, 1999.
 - **Stage 1 Preliminary Site Investigation: 1964 West Broadway, Vancouver, BC., April 1, 2005.** Submitted to BC MOECCS from Hemmera Envirochem Inc., December 18, 2009.
 - **Confirmation of Remediation Report, Chevron Service Station #86, 1996 West Broadway, Vancouver, BC., June 1, 2004.** Submitted to BC MOECCS from Hemmera Envirochem Inc., June 1, 2004.
 - **Soil and Groundwater Results – Draft, Former Chevron Service Station #86, 1996 West Broadway, Vancouver, BC., April 9, 2001.** Submitted to BC MOECCS from Hemmera Envirochem Inc. on behalf of Chevron Canada Limited, April 18, 2001.
 - **Stage 1 Stage 2 PSI Chevron Service Station #86, 1996 West Broadway, Vancouver, BC Draft Report., June 1, 1999.** Submitted to BC MOECCS from Connor Pacific Environmental Technologies Inc., December 23, 2009.

2002-2084 West Broadway, south and southwest adjacent of the Site

- **Site Registry Detail Report (11559)** – Ordered April 12, 2015. BC MOECCS, last updated December 5, 2013
 - **Screening Level Risk Assessment, 2002-2084 West Broadway, Vancouver, BC (February 29, 2002).** Submitted to BC MOECCS from Next Environmental Inc., March 14, 2012.
 - **Stage 1 Preliminary Site Investigation Update, 2002-2084 West Broadway, Vancouver, BC (February 29, 2002).** Submitted to BC MOECCS from Next Environmental Inc., March 14, 2012.
 - **Detailed Site Investigation, 2002-2084 West Broadway, Vancouver, BC (February 29, 2002).** Submitted to BC MOECCS from Next Environmental Inc., March 14, 2012.
 - **Confirmation of Remediation, 2002-2084 West Broadway, Vancouver, BC (February 29, 2002).** Submitted to BC MOECCS from Next Environmental Inc., March 14, 2012.
 - **Summary of Site Condition (February 28, 2002).** Submitted to BC MOECCS from Next Environmental Inc., March 14, 2012.
 - **Environmental Stage 1 Preliminary Site Investigation, 2002-2084 West Broadway, Vancouver, BC (May 31, 2010).** Submitted to BC MOECCS from Next Environmental Inc., March 14, 2012.
 - **West Broadway Environmental Summary, West Broadway and Maple street, Vancouver, British Columbia (November 13, 2007).** Submitted to BC MOECCS from AMEC Earth Environmental, March 14, 2012.
 - **Environmental Liability Assessment 2080 and 2084 West Broadway, Vancouver, British Columbia (April 12, 2015).** Submitted to BC MOECCS from AMEC Earth Environmental, March 14, 2012.
 - **Detailed Site Investigation, 2000 West Broadway, Vancouver, British Columbia (May 30, 2003).** Submitted to BC MOECCS from AMEC Earth Environmental, March 14, 2012.
 - **Stage 1 and Stage 2 Preliminary Site Investigation, 2000 West Broadway, Vancouver, British Columbia (May 29, 2003).** Submitted to BC MOECCS from AMEC Earth Environmental, March 14, 2012.
 - **Stage 1 and 2 Preliminary Site Investigation and Hazardous Materials Survey, 2020 and 2030 West Broadway, Vancouver, British Columbia (May 28, 2003).** Submitted to BC MOECCS from AMEC Earth Environmental, March 14, 2012.
 - **Amendment – Stage 2 Preliminary Site Investigation 2080 and 2084 West Broadway, Vancouver, British Columbia (April 4, 2003).** Submitted to BC MOECCS from URS Norecol Dames and Moore Inc., March 14, 2002.

- **Supplemental Drilling Investigations, 2080 and 2084 West Broadway, Vancouver, British Columbia (November 28, 2002).** Submitted to BC MOECCS from URS Norecol Dames and Moore Inc., March 14, 2002.
- **Stage 2 Preliminary Site Investigation, 2080 and 2084 West Broadway, Vancouver, British Columbia (September 24, 2002).** Submitted to BC MOECCS from URS Norecol Dames and Moore Inc., March 14, 2002.
- **Stage 1 Preliminary Site Investigation, 2080 and 2084 West Broadway, Vancouver, British Columbia (September 24, 2002).** Submitted to BC MOECCS from URS Norecol Dames and Moore Inc., March 14, 2002.
- **Limited Stage 2 Preliminary Site Investigation, 2020 and 2030 West Broadway, Vancouver, British Columbia (February 9, 2001).** Submitted to BC MOECCS from URS Norecol Dames and Moore Inc., March 14, 2002.
- **Phase 1 Environmental Assessment for the IGA and Liquor Store at 2020 and 2030 West Broadway, Vancouver, BC.** Submitted to BC MOECCS from URS Norecol Dames and Moore Inc., March 14, 2002.

Corner of Maple Street and West Broadway, approximately 50 m southeast of the Site

- **Site Registry Detail Report (15919)** – Ordered November 24, 2017. BC MOECCS, last updated December 11, 2013

Arbutus Street north of West Broadway, north and west adjacent of the Site

- **Site Registry Detail Report (18380)** – Ordered November 5, 2017. BC MOECCS, last updated October 6, 2017.
 - **Human Health and Ecological Risk Assessment, Management Area (City MA) Associated with a Shell Service Station at 2103 West Broadway, Vancouver, BC. (July 21, 2017).** Submitted to BC MOECCS from SNC-Lavalin Environment Inc., August 16, 2017.
 - **Performance Verification Plan, Management Area (City MA) Associated with a Shell Service Station at 2103 West Broadway, Vancouver, BC. (July 21, 2017).** Submitted to BC MOECCS from SNC-Lavalin Environment Inc., August 16, 2017.
 - **Summary of Communication in Regards to the COFC Application for Off-Site Management Area (City Management Area) Associated with the Shell Service Station at 2103 West Broadway, Vancouver, BC. (July 14, 2017).** Submitted to BC MOECCS from SNC-Lavalin Environment Inc., August 16, 2017.
 - **Stage 2 Preliminary Site Investigations and Detailed Site Investigation, Management Area Associated with Shell Service Station at 2103 West Broadway (July 11, 2017).** Submitted to BC MOECCS from SNC-Lavalin Environment Inc., August 16, 2017.
 - **Summary of Site Condition (for City MA) (July 1, 2017).** Submitted to BC MOECCS from SNC-Lavalin Environment Inc., August 16, 2017.

- **Email Entitled 2017 03-08 Site 2739 Preapproval Letter (June 19, 2017).** BC Ministry of Environment, August 16, 2017.
- **Stage 1 Preliminary Site Investigation, Shell Service Station, 2103 West Broadway, Vancouver, BC (Location Code: C01303) (June 6, 2017).** Submitted to BC MOECCS from SNC-Lavalin Environment Inc., August 16, 2017.
- **Protocol 6 Preapproval Application for Planned Management Area of C of C Applications Adjacent to Shell Station at 2103 West Broadway, Vancouver, BC (February 10, 2017).** Submitted to BC MOECCS from SNC-Lavalin Environment Inc., February 14, 2017.
- **Protocol 6 Preapproval Application for Planned Management Area of C of C Applications Adjacent to 2103 West Broadway and 2106 West 8th Avenue, Vancouver, BC. (August 7, 2015).** Submitted to BC MOECCS from SNC-Lavalin Environment Inc., September 8, 2015.
- **Determination of Applicability of Drinking Water Standards, 2103 West Broadway and 2106 West 8th Avenue, Vancouver, BC (April 15, 2014).** BC MOECCS, August 16, 2017.
- **Request for Water Use Determination, Shell Service Station, 2103 West Broadway and 2106 West 8th Avenue, Vancouver, BC MOECCS Site ID 2739 (June 7, 2013).** Submitted to BC MOECCS from SNC-Lavalin Environment Inc., August 16, 2017.

2150 West Broadway and West Broadway south-southwest of 2103 West Broadway, approximately 30 m southwest of the Site

- **Site Registry Detail Report (18381)** – Ordered October 29, 2017. BC MOECCS, last updated September 30, 2015.
 - **Protocol 6 Preapproval Application for Planned Management Area of C of C Applications Adjacent to 2103 West Broadway and 2106 West 8th Avenue, Vancouver, BC (August 7, 2015).** Submitted to BC MOECCS from SNC-Lavalin Environment Inc., September 8, 2015.

Various throughout the alignment

- **Transmittal Letter: Selected Interim Draft Borehole Records (October 19, 2017).** From Trevor Fitzell, Golder Associates to Lima Howlin, Stantec Consulting, October 19, 2017.

SUMMARY OF REVIEWED REPORTS:

Northeast corner of West Broadway and Arbutus Street, within excavation extents

Site Registry Detail Report (43)

- **Site Investigation Report Submitted** – Submitted by Soilcon Laboratories Ltd., April 25, 1989.
- **Remediation Plan Report Submitted** - Submitted by Soilcon Laboratories Ltd., May 29, 1989.
- **Other Waste System Numbers** – Requested by Sinson Investments Ltd., July 13, 1989.
- **Remediation Plan Report Accepted** – Received by Sinson Investments Ltd., July 13, 1989.
- **Monitoring Report Due** – Submitted by Soilcon Laboratories Ltd. to BC MOECCS, November 16, 1989.
- **Concentration Criteria Approach Used** – BC MOECCS, December 20, 1989.
- **Case Management Item** – Note: The paper file for this site is missing, BC MOECCS, March 20, 2002.
- **Record Status** – Active – Under remediation, March 22, 2002.

Site Assessment for Soil Contamination (with amendments) (May 1, 1989)

- Historical 900-gallon gasoline tank in the center yard (installed in 1971).
- Smaller fuel oil tank located on the western side of structure.
- Tanks (gasoline tank and fuel oil tank) were removed during the preliminary site investigation and the area around the tanks trenched; with four additional inspection pits advanced.
- Visible petroleum and staining of the soil was noted along the west side of the gasoline tank from a depth of 1.2 m to a depth of 2.1 m (depth of the water table). The topsoil (organic horizons) was also stained and samples taken. Samples from pits around the UST were taken and submitted to the lab for analysis.
- Visible petroleum and staining of the soil was noted underneath the fuel oil tank. There was no visual evidence of contamination further away from the tank. Once removed, the fuel oil tank was found to be in poor condition with a substantial hole present. A sample from the tank area was sent to a lab for analysis.
- The following are results that exceed current CSR soil standards for Commercial (CL) land use:
 - Test pit samples in the vicinity of the gasoline fuel tank exceed the CSR CL standard for lead for intake of contaminated soil (150 µg/g). In addition, pH was not measured and other CSR CL Standards that are pH dependent may exceed;

- Test pit samples to the northeast and northwest of the gasoline fuel tank exceed the CSR CL soil standard for Benzene for groundwater used for drinking water (0.035 µg/g);
- Test pit samples in the vicinity of the gasoline fuel tank exceed the CSR CL soil standard for Ethylbenzene for groundwater used for drinking water (15 µg/g);
- Test pit samples in the vicinity of the gasoline fuel tank exceed the CSR CL soil standard for Xylene for groundwater used for drinking water (6.5 µg/g) and groundwater flow to surface water used by aquatic life; and
- In addition, there were concentrations that exceeded the then-applicable Special Waste Regulation standards; as such, some concentrations may exceed Hazardous Waste Regulations and may require separate disposal at additional cost.
- Conclusions of the report indicate that no downward migration of contamination occurred; rather, it likely spread laterally across the water table. The spill was estimated to have been approximately 100 L and 84 m³ in volume; and has remained contained within the study area. Additional sampling was initiated to determine the extent of special waste and concluded approximately 30m³ of toluene and xylene special waste. The volume of contaminated material not classified as special waste was estimated to be 75 m³.
- The report also recommends that an underground bio-remediation facility be built to the property adjacent to the subject site.

Assessment of a Bio-Remediation Facility at Broadway and Arbutus Streets in Vancouver (October 26, 1989)

- Bio-remediation processes were deployed at the northeast corner of West Broadway and Arbutus Street. Concentrations of contaminants of concern and exceedances of current CSR CL standards are as follows:
 - Benzene – 0.63 µg/g, exceeds the current CSR CL soil standard for Benzene for groundwater used for drinking water (0.035 µg/g);
 - Toluene – 4.13 µg/g, exceeds the current CSR CL soil standard for Toluene for groundwater flow to surface water used by aquatic life – freshwater (0.5 µg/g);
 - Ethylbenzene – 4.41 µg/g, meets the current applicable CSR CL soil standards; and
 - Xylene – 30.5 µg/g, exceeds the current CSR CL soil standard for Xylene for groundwater used for drinking water (6.5 µg/g) and groundwater flow to surface water used by aquatic life (20 µg/g).
- Large reductions were achieved at the Site and met the Pacific Place Level C guideline at the time of completion. It was recommended that the Site be closed and previously contaminated soil be excavated and used as landfill capping material. As standards have changed since this time, benzene, toluene, and xylenes may exceed currently-applicable CSR CL soil standards.

2103 West Broadway, north adjacent of the Site**Site Registry Detail Report (2739)**

- **Site Investigation Report Submitted** – Submitted by Morrow Environmental Consultants Inc. to BC MOECCS, December 4, 1995. Note – Three reports submitted. Shell does not presently require formal comment regarding the submitted information.
- **Notification Received About Likely or Actual Substance Migration to Neighbouring Site (CSR 57 or 60.1)** – BC MOECCS, November 18, 2002.
- **Case Management Item** – Request for water use determination by Shell Canada Products Limited, June 17, 2013.
- **Case Management Item** – Drinking water use does not apply, BC MOECCS, April 15, 2014.
- **Site Risk Classified** – Site is non-high risk, BC MOECCS, September 28, 2015.
- **Site Risk Classified** – Site is non-high risk, BC MOECCS, September 29, 2015. Affected Site ID: 18380 (Management Area part of West Broadway and Arbutus Street).
- **Site Risk Classified** – Site is non-high risk, BC MOECCS, September 29, 2015. Affected Site ID: 18381 (2150 West Broadway, Vancouver, BC).
- **Record Status** – Not assigned.

Letter Report – Management Plan for Hydrocarbon Contamination Identified at Shell Service 2103 West Broadway, Vancouver, BC (November 30, 1995)

- USTs at the service station were replaced with fiberglass tanks in 1987. At the time, a recovery program was initiated with automated collection sumps installed across the site.
- Monitoring wells on the east and west sides of the site were connected and a soil vapour extraction system installed. However, vapour levels were deemed low enough to cease operation of the soil vapour extraction system in late 1989.
- The system was replaced in favour of a manual collection process involving bailers and together with the automated system, approximately 3, 160 L of liquid hydrocarbon was removed from the subsurface of the site as of late 1989.
- Liquid hydrocarbons appear inconsistently in the monitoring wells in the southeast of the site.
- Soils that exceeded special waste levels were not excavated as the soils were generally below 4.0 m and the site is proposed for continued petroleum use.
- Groundwater quality at the site was not completed as liquid hydrocarbons were still present at the subsurface.

Shell Canada Products Limited – Assessment of Off-Site Contamination, 2103 West Broadway, Vancouver, BC (November 29, 1995)

- Additional subsurface investigation was carried out at the south edge of the service station and a soil vapour extraction system was installed.
- Four monitoring wells were installed, generally located in the southeast corner of the site.
- An off-site monitoring well to the southwest of the site across West Broadway had light hydrocarbon impacts. There were also additional off-site monitoring wells to the south, east, and west that exhibited hydrocarbon vapour impacts.
- Lateral extent of the contamination is defined to the east and west along the property line, south of the property underneath West Broadway, and along the building foundation south of West Broadway.
- Depth of contamination is in-between 4 and 6 m within a sand and gravel horizon. The finer grained soil above this horizon did not exhibit contamination.
- The following represents available soil samples with concentrations that exceed current applicable CSR CL soil standards:
 - Potential Benzene exceedances in samples in the southeast corner of the site. Described as potential exceedance because laboratory results are less than a value that exceeds the benzene CSR CL soil standard for groundwater used for drinking water standard (0.035 µg/L);
 - Ethylbenzene exceedances in samples in the southeast of the site for CSR CL soil standard for groundwater used for drinking water standard (15 µg/g);
 - Potential Toluene exceedances in samples in the southeast of the site for CSR CL soil standard for groundwater flow to surface water used by aquatic life – freshwater (0.5 µg/g). Toluene exceedance in a sample in the southeast of the site for CSR CL soil standard for groundwater flow to surface water used by aquatic life – freshwater (0.5 µg/g);
 - Xylenes exceedances in samples in the southeast of the site for CSR CL soil standard for groundwater used for drinking water standard (6.5 µg/g); and
 - Light and total hydrocarbons were also measured but have no present-day standards.

1996 West Broadway/2528 Maple Street, south adjacent of the Site

Site Registry Report (6274)

- **Site Profile Received (October 15, 1999)** – Submitted to BC MOECCS from Chevron Canada Limited, October 15, 1999.
- **Waste Management Act: Contaminated Sites Notations (October 21, 1999)** – Issued by BC MOECCS, October 15, 1999.

Note: Preliminary Site Investigation Report Required.

- **Notice of Independent Remediation Initiation Submitted (February 14, 2001)** – Submitted to BC MOECCS from Hemmera Envirochem Inc., February 14, 2001.
- **Notification Received About Likely or Actual Substance Migration to Neighbouring Site (Mar 19, 2002)** – Submitted to BC MOECCS and Vancouver City Health Department by Chevron Canada Limited, June 4, 2004.

Note: City of Vancouver notified if migration of contaminants from the subject site into adjacent roadways.

Required Actions: Update June 4, 2004 – Hemmera Envirochem issued another offsite notice.

- **Certificate of Compliance Requested Without Inspection (June 15, 2004)** – Submitted to BC MOECCS from Hemmera Envirochem Inc., June 15, 2004.
- **Certificate of Compliance Issued (June 18, 2004)** – Issued by BC MOECCS to Chevron Canada Limited, Taylor, John R (Rostered Expert), and City of Vancouver Environment Protection Branch, June 18, 2004.

Note: Issued for PID 006-963-692 and off-site roadway land on recommendation of Rostered Expert (John R Taylor) under Protocol 6 of the Contaminated Sites Regulation. The lands covered by this certificate are located at 1995 West Broadway and the offsite roadway and sidewalk described by the metes and bounds.

- **Site Profile Received (February 5, 2007)** – Submitted to BC MOECCS from Bastion Development Corporation, February 5, 2007.
- **Site Profile Reviewed – Further Investigation Required by the Ministry (Mar 19, 2007)** – Issued by BC MOECCS, March 19, 2007.

Note: Preliminary Site Investigation required. Release of the development permit granted because in the opinion of the Director the release would not present a significant threat or risk.

- **Certificate of Compliance Requested (December 22, 2009)** – Submitted to BC MOECCS from Keystone Environmental Ltd., December 22, 2009.
- **Certificate of Compliance Issued Using Numerical Standards (December 23, 2009)** – Issued by BC MOECCS to Keystone Environmental Ltd., December 23, 2009.

Note: Issued on the recommendation of an Approved Professional (Lori C. Larsen) under Protocol 6 of the Contaminated Sites Regulation. The lands covered by this certificate are located at 2528 Maple Street (PID 027 095 886).

- **Record Status** – Not Assigned.

2002-2084 West Broadway, south and southwest adjacent of the Site

Site Registry Detail Report (11559)

- **Site Profile Received (March 26, 2009)** – Submitted to BC MOECCS from Pinnacle International, Mar 26, 2009.

- **Site Profile Reviewed – Further Investigation Required by the Ministry (March 31, 2009)** – Note – Release of the development permit granted because in the opinion of the director the release would not pose significant threat or risk. The City of Vancouver will withhold the occupancy permit until an instrument is secured.

Required actions: Preliminary Site Investigation required. A Ministry instrument must be obtained prior to occupancy or reutilization of the land. BC MOECCS, March 31, 2009.

- **Notification Received About Likely or Actual Substance Migration to Neighbouring Site (September 15, 2009)** – Submitted to BC MOECCS from Next Environmental, September 15, 2009.
- **Notice of Independent Remediation Initiation Submitted (November 29, 2010)** – Submitted to BC MOECCS from Next Environmental, November 29, 2010.
- **Site Risk Classified - Site is Non-High Risk (November 29, 2010)** – Submitted to BC MOECCS from Next Environmental, November 29, 2010.
- **Site Risk Classified – Affected Site is Non-High Risk (November 29, 2010)** – Submitted to BC MOECCS from Next Environmental, November 29, 2010.
- **Preapproval of Contaminated Sites Instrument Application Requested (January 24, 2012)** – Submitted to BC MOECCS from Next Environmental Inc. on behalf of Mondiale Development Ltd., November 29, 2010.
- **Preapproval of Contaminated Sites Instrument Application Issued (January 30, 2012)** – Issued by BC MOECCS to Next Environmental Inc., January 30, 2012.
- **Notice of Independent Remediation Completion Submitted (February 28, 2012)** – Submitted to BC MOECCS from Next Environmental Inc., February 28, 2012.
- **Certificate of Compliance Requested (March 14, 2012)** – Requested by Mondiale Development Ltd. and Next Environmental, March 14, 2012.
- **Certificate of Compliance Issued Using Risk Based Standards (April 30, 2012)** – Note – Issued on the recommendation of an Approved Professional under Protocol 6 of the Contaminated Sites Regulation. Notice was given for Site PID: 028-033-540 and Affected Site. Conditions attached to COC. Issued by BC MOECCS to Mondiale Development Ltd. and Next Environmental, April 30, 2012.
- **Record Status** – Active – Remediation Complete.
- **Suspected Land Use** – Petroleum products, dispensing facility including service station/card lot.

Corner of Maple Street and West Broadway, approximately 50 m southeast of the Site

Site Registry Detail Report (15919)

- **Notification Received About Likely or Actual Substance Migration from Neighbouring Site (September 15, 2009)** – Submitted to BC MOECCS from Next Environmental, September 15, 2009.

Note: Affected parcel is 2002-2084 West Broadway, Vancouver. Site ID: 15919.

Arbutus Street north of West Broadway, north and west adjacent of the Site

Site Registry Detail Report (18380)

- **Preapproval of Contaminated Sites Instrument Application Requested (September 8, 2015)** – Note – Source Site 2739. Submitted to BC MOECCS from SNC-Lavalin Environment Inc. on behalf of Shell Canada Products, September 8, 2015.
- **Site Risk Classified – Site is Non-High risk (September 29, 2015)** – BC MOECCS, September 29, 2015.
- **Preapproval of Contaminated Sites Instrument Application Issued (March 8, 2017)** – Issued by BC MOECCS to Shell Canada Products, March 8, 2017.
- **Certificate of Compliance Requested (August 15, 2017)** – Requested by Shell Canada Products and SNC-Lavalin Environment Inc., August 15, 2017.
- **Record Status** – Not assigned.

Human Health and Ecological Risk Assessment, Management Area (City MA) Associated with a Shell Service Station at 2103 West Broadway, Vancouver, BC. (July 21, 2017)

- Report refers to the City Management Area (portions of Arbutus Street and West Broadway) which is subdivided into the Roadway MA (CSR IL standards) and Backyards MA (CSR RL standards).
- Human Health Risk Assessment concluded that no operable pathways for contaminants of potential concern were found at grade within the city management area. Contaminants of potential concern exist at depths greater than 3 mbgs and concentrations exceeding drinking water standards across the city management area were identified. Therefore, groundwater from surface to 7 m depth must not be used as a source of drinking water. The assessment assumes the city management area will remain as is (i.e. with no buildings present).
- Ecological Risk Assessment identified ecological receptors in the subsurface soil and groundwater at the city management area. Since contaminants of potential concern are located > 1 mbgs, no potential operable exposure pathways were identified for terrestrial ecological receptors at the backyard management area and are not anticipated to be operable at the roadways management area. There is a potential for an exposure pathway between groundwater and deep rooting plants at the roadway management area; however, it is deemed unlikely.

Stage 2 Preliminary Site Investigations and Detailed Site Investigation, Management Area Associated with Shell Service Station at 2103 West Broadway (July 11, 2017)

- Hydrocarbon soil impacts were identified off-site to the southwest at depths between 4.7 and 6.1 mbgs (Roadway MA).
- VPH contamination at depths ranging between 2.8 m and 6.0 mbgs (Backyard MA).

- Groundwater contamination (benzene, ethylbenzene, and MTBE) was identified downgradient southwest of the site at depths ranging from 5.0 to 6.0 mbgs. Hydrocarbon groundwater contamination was inferred to be present in Arbutus Street based on analytical. Groundwater is generally to the southwest, however it is strongly influenced by the P3 sump at 2150 West Broadway Avenue.
- Outdoor air concentrations were calculated at less than the applicable standards.
- There were other areas of contamination (present and historical) to the north of the site but are not included in this summary.

2150 West Broadway and West Broadway south-southwest of 2103 West Broadway, approximately 30 m southwest of the Site

Site Registry Detail Report (18381)

- **Preapproval of Contaminated Site Instrument Application Requested (September 8, 2015)**
– Submitted by SNC-Lavalin Inc. to BC MOECCS on request by Shell Canada Products, September 8, 2015. Note – Source site 2739.
- **Site Risk Classified (September 29, 2015)** – Site is non-high risk, BC MOECCS, September 29, 2015. Note – Source site 2739.
- **Record Status** – Not assigned.

Protocol 6 Preapproval Application for Planned Management Area of C of C Applications Adjacent to 2103 West Broadway and 2106 West 8th Avenue, Vancouver, BC (August 7, 2015)

- Preapproval of Certificate of Compliance using risk-based standards for the City MA and 2150 MA. States that contaminant plume off-site is stable.
- States that if the Shell site was closed a Certificate of Compliance would be required by the owner/developer before it could be redeveloped.

Varies throughout the alignment

Transmittal Letter: Selected Interim Draft Borehole Records

- Geotechnical investigation from Golder Associates in 2015 and 2017 produced the following boreholes that represent areas of potential environmental concern for the subject property:
 - **BH15-06** – Approximate location is 2096 West 8th Avenue. Black and orange staining, garbage debris. No PID readings and sample(s) were not sent for analysis.
 - **BH17-48** – Approximate location is West Broadway, East of Arbutus Street. Orange staining /metallic odour. PID reading of up to 3.0 ppm; sample(s) were not sent for analysis.

DISCUSSION OF FINDINGS:

Based on the information available, the Constructor should be aware that the following may be encountered at the site during construction of the Arbutus Station House, Tunnel Excavation, and Emergency Exits/Ventilation Shafts:

- Shallow contaminated soil beneath 2097 West Broadway and 2096 West 8th Avenue may be encountered during excavation of the Arbutus Station House. It is likely that contaminated soil will be encountered during construction of the Arbutus Station House at 2097 West Broadway and 2096 West 8th Avenue as current soil contamination is likely present at the Site.

Shallow contaminated soil beneath West Broadway south of 2103 West Broadway (current gas station) will likely be encountered during tunnel construction excavation and excavation of the Emergency Exits/Ventilation Shafts.

In addition, contaminated soil beneath West Broadway north of 2500 Maple Street (intersection at West Broadway and Maple Street) may be encountered during tunnel construction excavation as notification of contamination migration was given for 2500 Maple Street and both the properties to the east and west have known historic contamination issues.

- Hydrocarbon vapours may be encountered beneath 2097 West Broadway and 2096 West 8th Avenue during excavation of the Arbutus Station House.

Hydrocarbon vapours will likely be encountered beneath West Broadway Avenue south of 2103 West Broadway Avenue (current gas station) during tunnel construction excavation and excavation of the Emergency Exits/Ventilation Shafts.

Hydrocarbon vapours may be encountered beneath West Broadway north of 2500 Maple Street (intersection at West Broadway Avenue and Maple Street) during tunnel construction excavation as notification of contamination migration was given for 2500 Maple Street and both the properties to the east and west have known historic contamination issues.

- Contaminated excavation water beneath 2097 West Broadway Avenue and 2096 West 8th Avenue may be encountered during excavation of the Arbutus Station House.

Contaminated excavation water beneath West Broadway Avenue south of 2103 West Broadway Avenue (current gas station) will likely be encountered during tunnel construction excavation and excavation of the Emergency Exit/Ventilation Shafts.

Contaminated excavation water beneath West Broadway Avenue north of 2500 Maple Street (intersection at West Broadway Avenue and Maple Street) may be encountered during tunnel construction excavation.

ESTIMATED IMPACTED SOIL VOLUME REQUIRING EXCAVATION: 5,830 m³ (30 m³ possible Hazardous Waste)

Based upon the following assumptions:

- The areal extent of contaminated soils identified by a previous investigation at the Station House property has not changed, and extends out with a similar footprint area under Arbutus Street. There may be additional contamination associated with the vacant lot (2096 West 8th Avenue) as it was once used as a bio-remediation facility for 2097 West Broadway (proposed Station House location). The depth "thickness" of impacted soils over this area is up to 3 metres.
- The northwest emergency exit is located adjacent to the known contamination emanating from 2103 West Broadway, so contaminated soil was calculated based on the footprint area of this exit and the thickness of contaminated soil indicated in previous reports.
- Although the station house and northwest emergency exit are classified as high-risk (based on known contamination, the remaining emergency exits are considered to be moderate risk and an estimate for moderate-risk sites (5% of total soil to be excavated) was assigned to provide an allowance.
- The Arbutus Station is to be excavated; therefore, soil removal is required for construction of the station under Broadway.
- Assumed tunnel construction excavation width of 20 m, average depth to bedrock of 12 m, and a total length of 416 m from approximately Arbutus street to Cypress Street. Includes area covered by the Arbutus Station and Crossover sections. Although the proposed Tunnel Construction Excavation is classified as high-risk, the majority of the excavation is considered to be moderate risk and an estimate for moderate-risk sites (5% of total soil to be excavated) was assigned to provide an allowance.
- Assumed the plumes delineated from the gas station at 2103 West Broadway have not changed from that indicated in previous investigation reports.
- Based on the above, the volume of contaminated soil for the excavated section was calculated to be 100 m³ adjacent to the gas station at 2103 West Broadway plus 5% of the remaining ~100,000 m³ of excavation.

CONSTRUCTION CONSIDERATIONS

Water disposal – Previously reported contamination and contaminant migration in neighbouring property (2103 West Broadway). Excavation water management will be required; untreated discharge to the receiving environment is not permitted. Contaminated groundwater will require management in accordance with the Contaminated Sites Regulation and applicable city by-laws. Potential options include sanitary or storm water discharge via a permit, or off-site treatment and disposal.

Soil disposal – Previously reported contamination migrating from the neighbouring property at 2103 West Broadway; contaminated soils are expected to be encountered during excavation. Contamination was identified at 2097 West Broadway in previous reports; there is a potential for encountering contaminated soils during excavation. Contaminated soil encountered during construction will require management/disposal in accordance with the Contaminated Sites Regulation, applicable city by-laws, and the Project Construction Specifications.

Vapour Inhalation – Mitigation plan should be in place for worker exposure, as there was vapour contamination identified in previous reports; therefore, there is potential for vapour inhalation risks due to the nature of historically identified contamination.

APPENDIX B

Contaminated Sites Issues Figures



DESIGNED	ES	17-12-13
		DATE
DRAWN	GH	17-12-13
		DATE
CHECKED	MR	17-12-13
		DATE
APPROVAL	DW	17-12-13
		DATE

REFERENCE DRAWING	
DWG No.	DESCRIPTION

REVISIONS				
DATE	BY	DESCRIPTION		REV
17-12-13	ES	FIRST ISSUE		A
19-05-02	KH	MOTI LOGO REPLACEMENT		B



BROADWAY SUBWAY PROJECT			
CONTAMINATED SITE ISSUES – OVERVIEW			
SCALE 1:7500	CONTRACT NO.	SUB CONSULTANT PROJECT NO.	115814099
DATE 17-12-13			
SHEET NO.	FIGURE 1		B

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Rev. PC
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	DATE	
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	DATE	
CHECKED	MR	16-03-02
	DATE	
APPROVAL	DW	16-03-02
	DATE	

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DATE	BY	DESCRIPTION		REV
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19-05-02	KH	MOTI LOGO REPLACEMENT		C



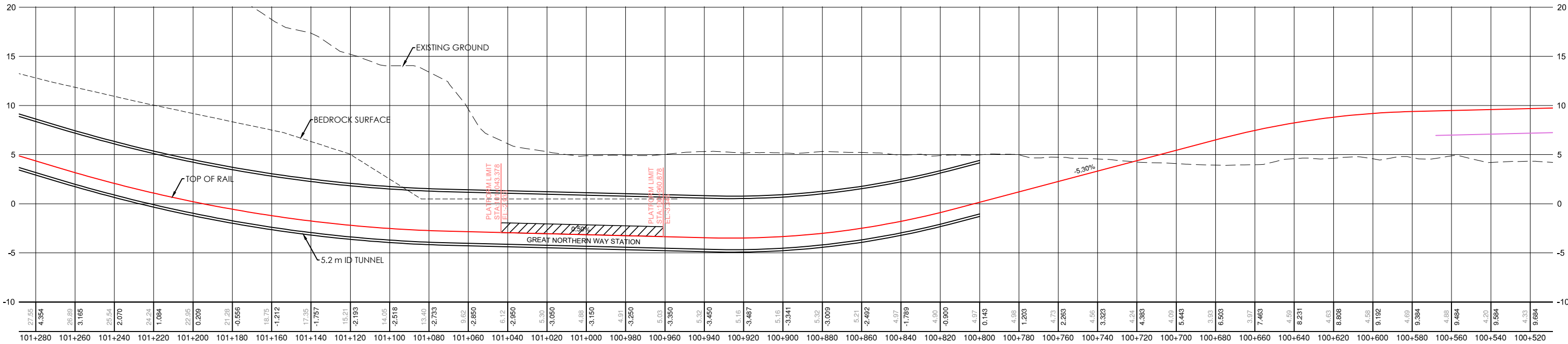
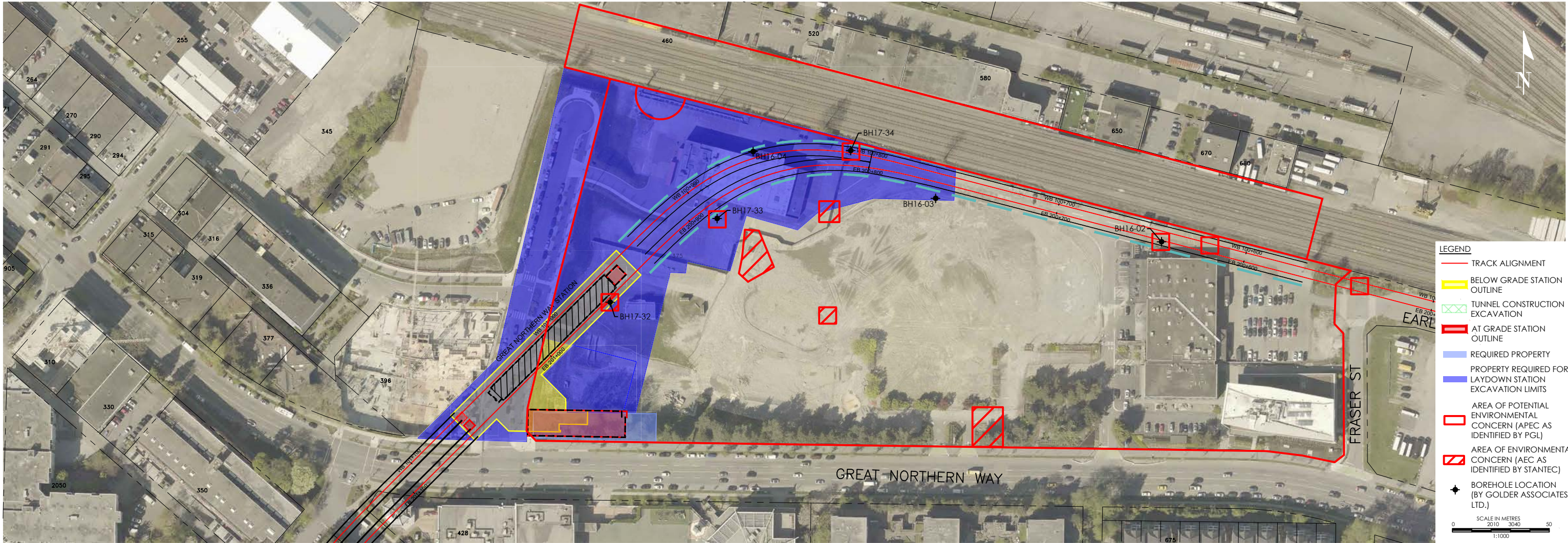
PROFESSIONAL SEAL



BROADWAY SUBWAY PROJECT
EAST END GUIDEWAY AND LAYDOWN
CONTAMINATED SITE ISSUES

SCALE 1:1000	CONTRACT NO.	SUB CONSULTANT	PROJECT NO.
DATE 16-03-02			115814099
SHEET NO.	FIGURE 2		C

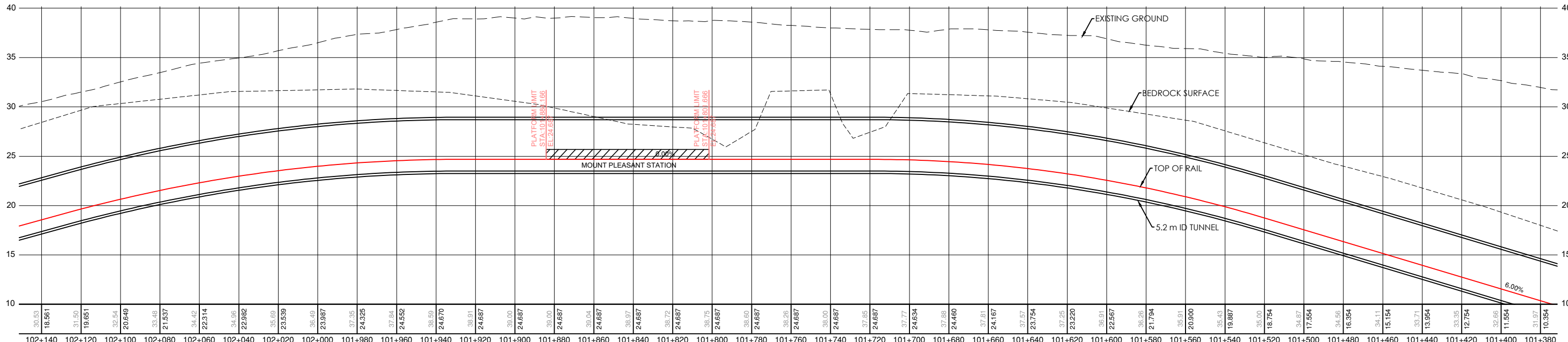
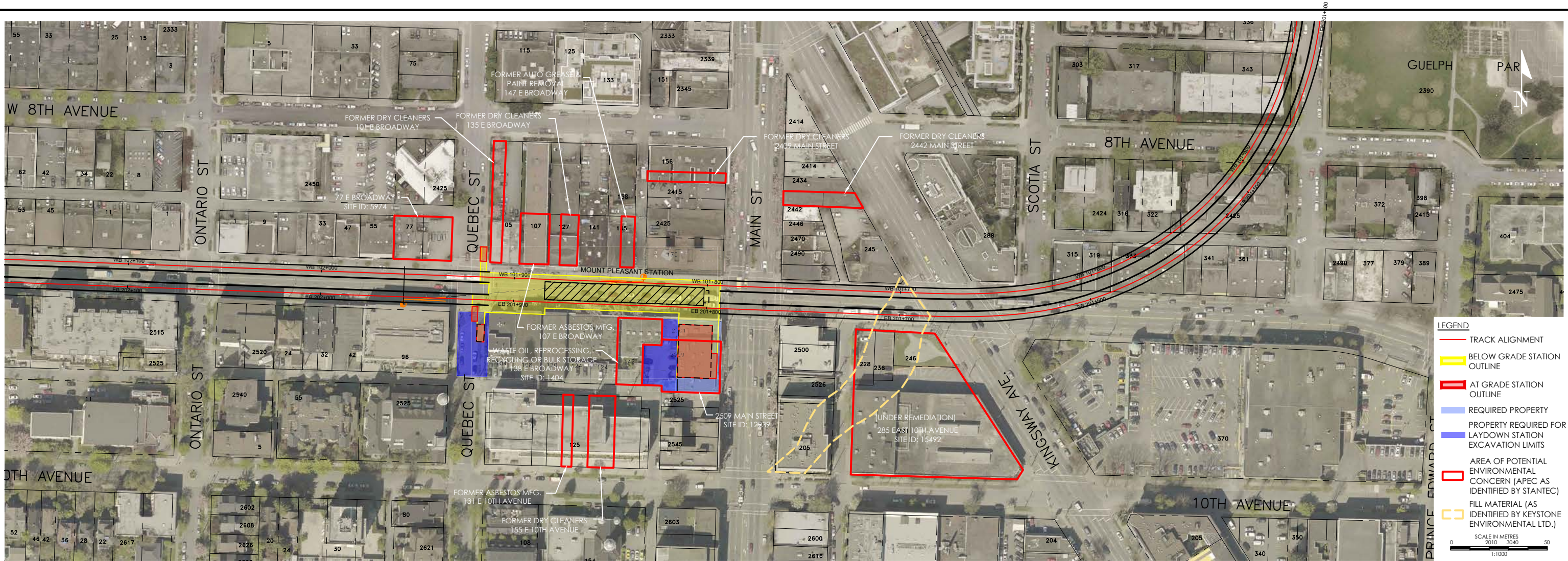
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DRAWN GH 16-03-02 DATE	DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV				GREAT NORTHERN WAY STATION AND LAYDOWN		
CHECKED MR 16-03-02 DATE			16-03-02	VDC	FIRST ISSUE	A				CONTAMINATED SITE ISSUES		
APPROVAL DW 16-03-02 DATE			17-12-13	ES	CONTAMINATED SITES 2017 UPDATES	B				ENVIRONMENTAL ISSUES		
			19-05-02	KH	MOTI LOGO REPLACEMENT	C				SUB CONSULTANT PROJECT NO. 115814099		
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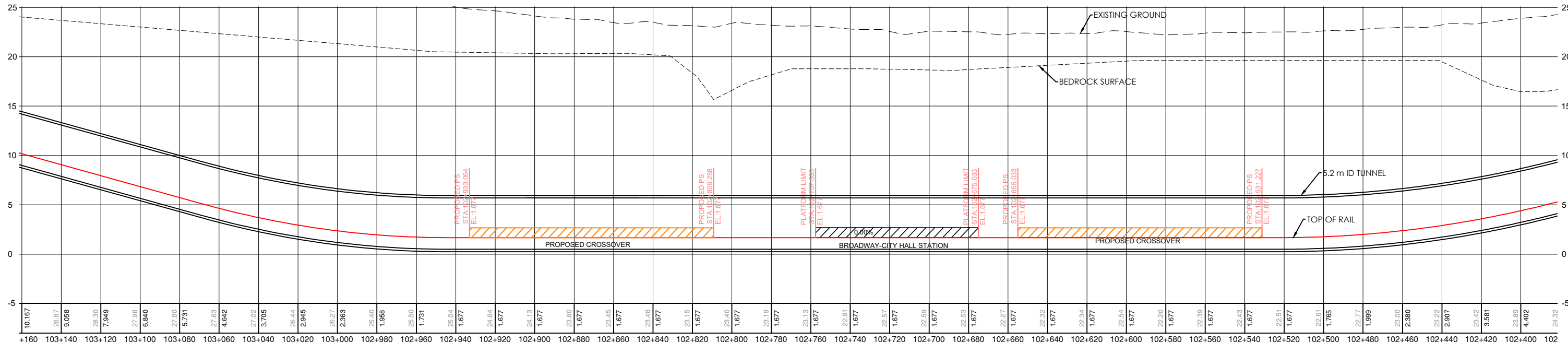
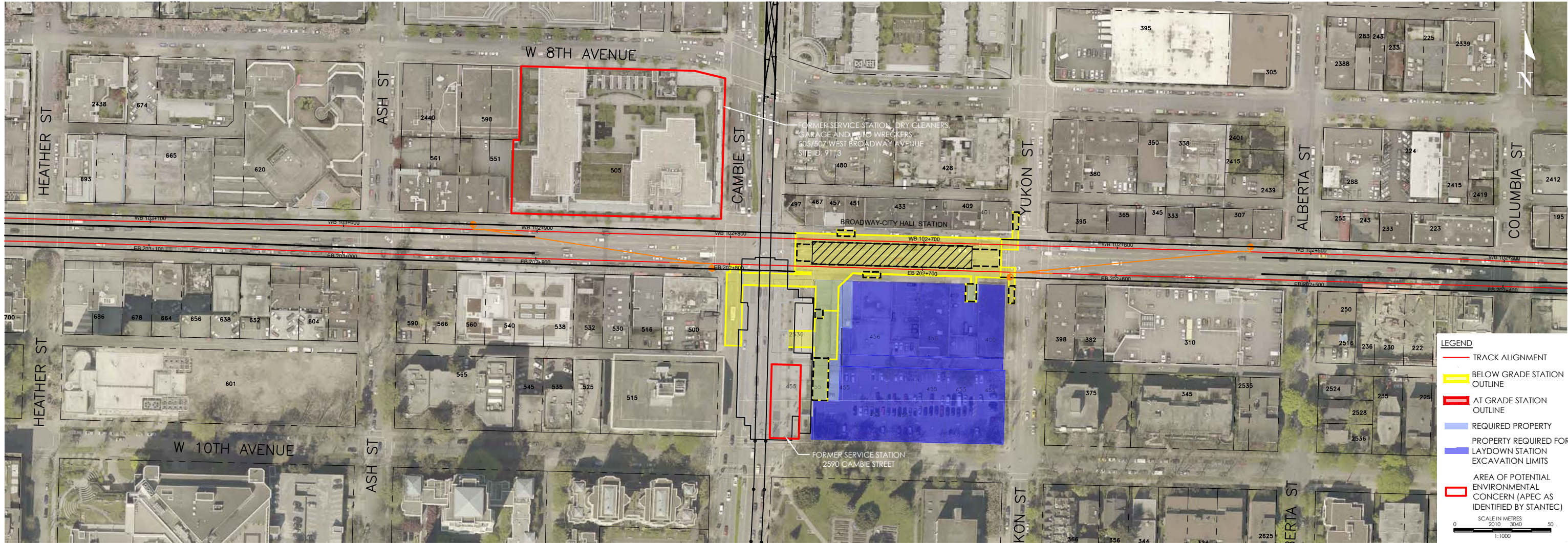
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APPROVAL DW 16-03-02 DATE			17-12-13	ES	CONTAMINATED SITES 2017 UPDATES	B				ENVIRONMENTAL ISSUES		
			19-05-02	KH	MOTI LOGO REPLACEMENT	C						
RAV-SNC-DSIZE-SHEET.dwg Rev. PC 358.8mm x 836.6mm METRIC											SCALE 1:1000 CONTRACT NO. 115814099	
											SUB CONSULTANT PROJECT NO. 115814099	
											SHEET NO. FIGURE 4	
											C	

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SUPERSEDES POINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO



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DRAWN	GH	16-03-02
CHECKED	MR	16-03-02
APPROVAL	DW	16-03-02

REFERENCE DRAWING		REVISIONS			
DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
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		17-12-13	ES	CONTAMINATED SITES 2017 UPDATES	B
		19-05-02	KH	MOTI LOGO REPLACEMENT	C



BROADWAY SUBWAY PROJECT

BROADWAY-CITY HALL STATION AND LAYDOWN

CONTAMINATED SITE ISSUES

ENVIRONMENTAL ISSUES

SCALE 1:1000

CONTRACT NO.

DATE 16-03-02

PROJECT NO.

SUB CONSULTANT

PROJECT NO.

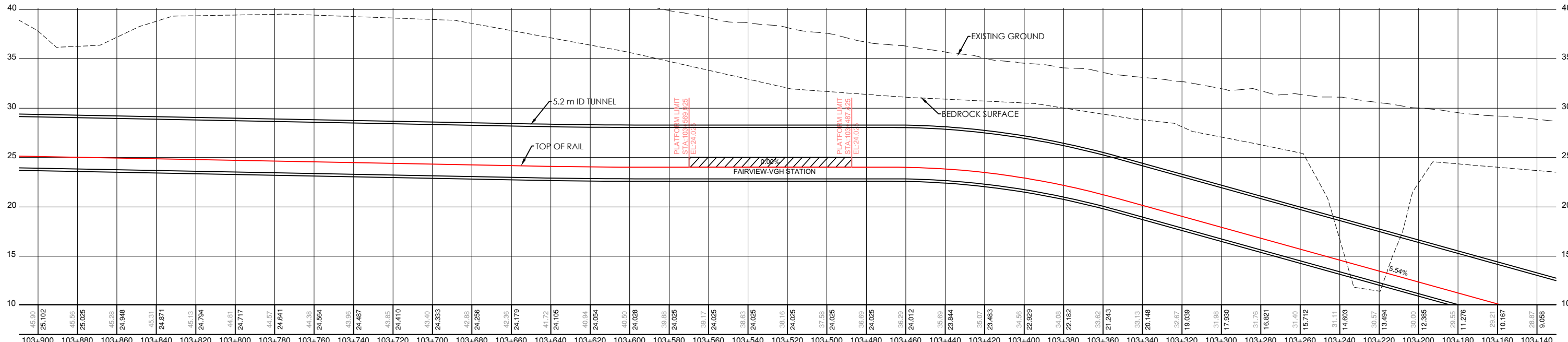
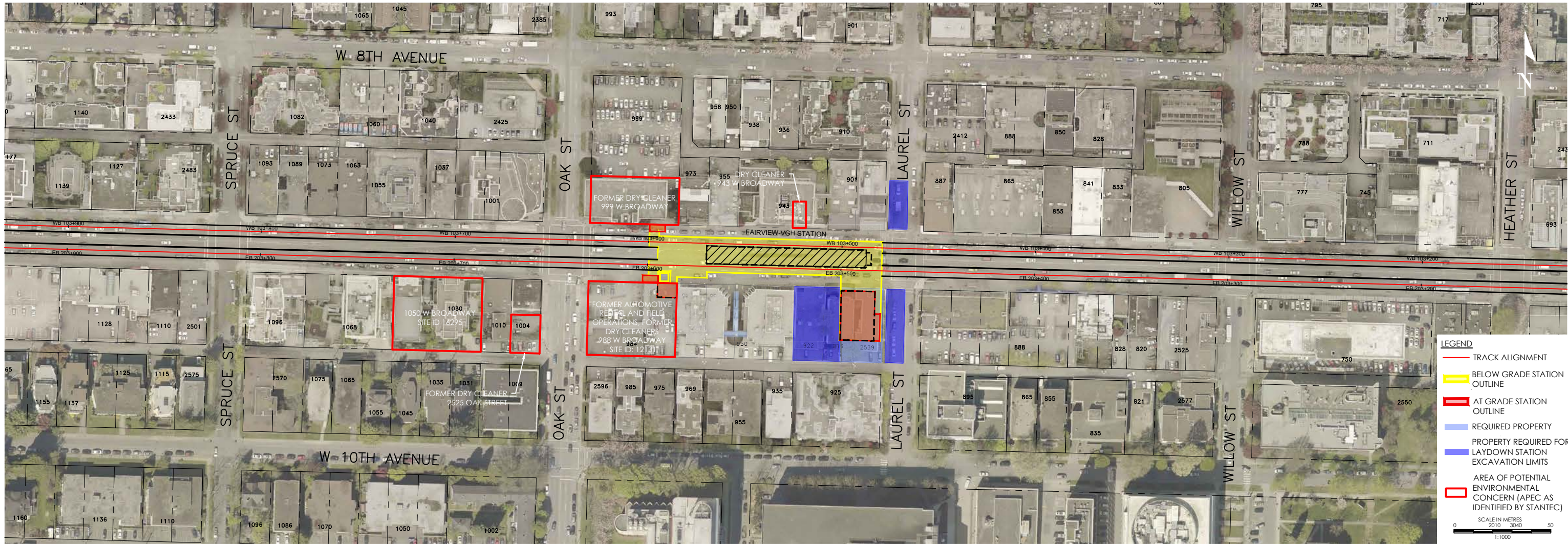
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FIGURE 5

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CHECKED	MR	16-03-02
APPROVAL	DW	16-03-02

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DWG No.	DESCRIPTION	DATE	BY	DESCRIPTION	REV
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		19-05-02	KH	MOTI LOGO REPLACEMENT	C



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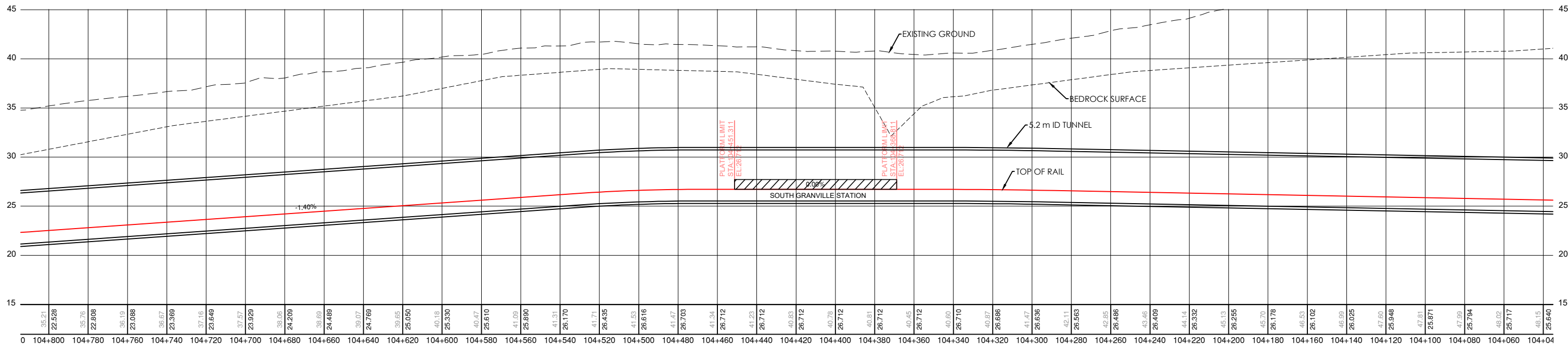
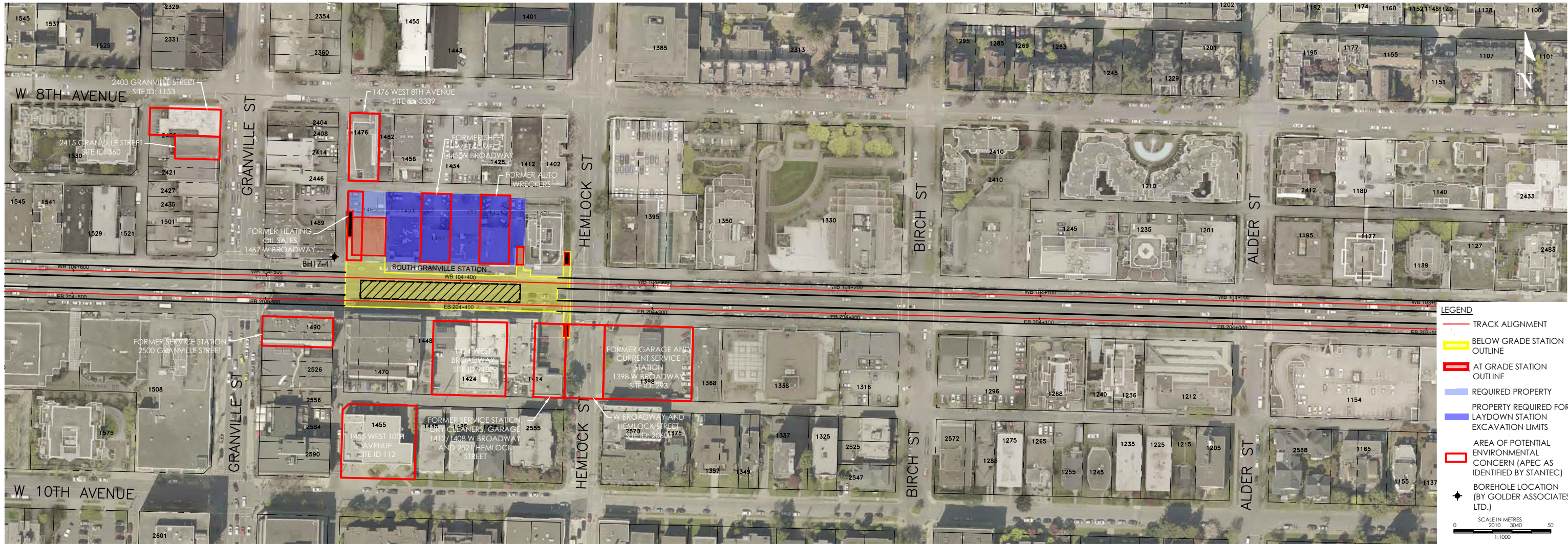


BROADWAY SUBWAY PROJECT
FAIRVIEW-VGH STATION AND LAYDOWN
CONTAMINATED SITE ISSUES
ENVIRONMENTAL ISSUES

SCALE 1:1000	CONTRACT NO.	SUB CONSULTANT PROJECT NO.
DATE 16-03-02		115814099
SHEET NO.	FIGURE 6	C

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SUPERSIDES POINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO



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CHECKED	MR	16-03-02
APPROVAL	DW	16-03-02

REFERENCE DRAWING	
DWG No.	DESCRIPTION

REVISIONS				
DATE	BY	DESCRIPTION	REV	
16-03-02	VDC	FIRST ISSUE	A	
17-12-13	ES	CONTAMINATED SITES 2017 UPDATES	B	
19-05-02	KH	MOTI LOGO REPLACEMENT	C	



PROFESSIONAL SEAL



BROADWAY SUBWAY PROJECT
SOUTH GRANVILLE STATION AND LAYDOWN
CONTAMINATED SITE ISSUES
ENVIRONMENTAL ISSUES

SCALE 1:1000
DATE 16-03-02
SHEET NO.

CONTRACT NO.

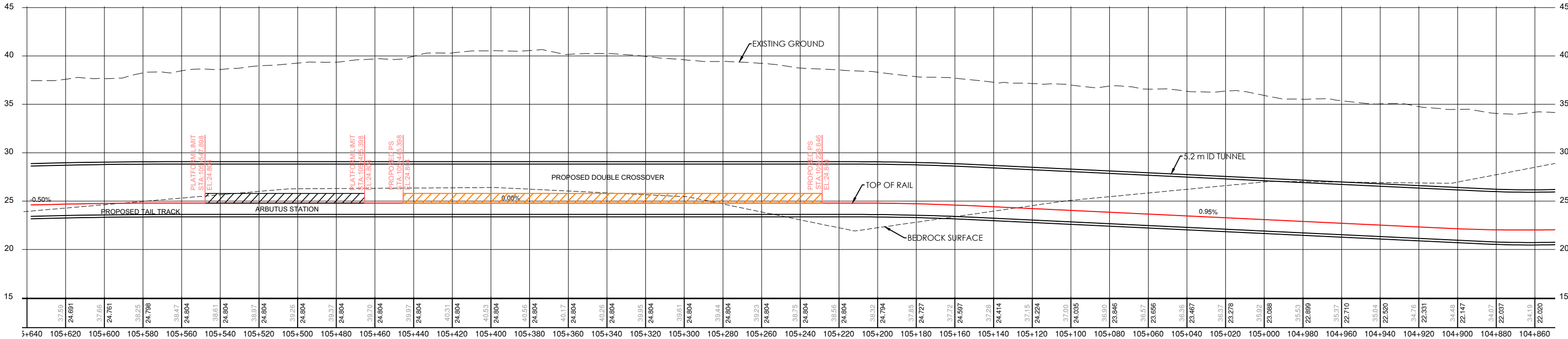
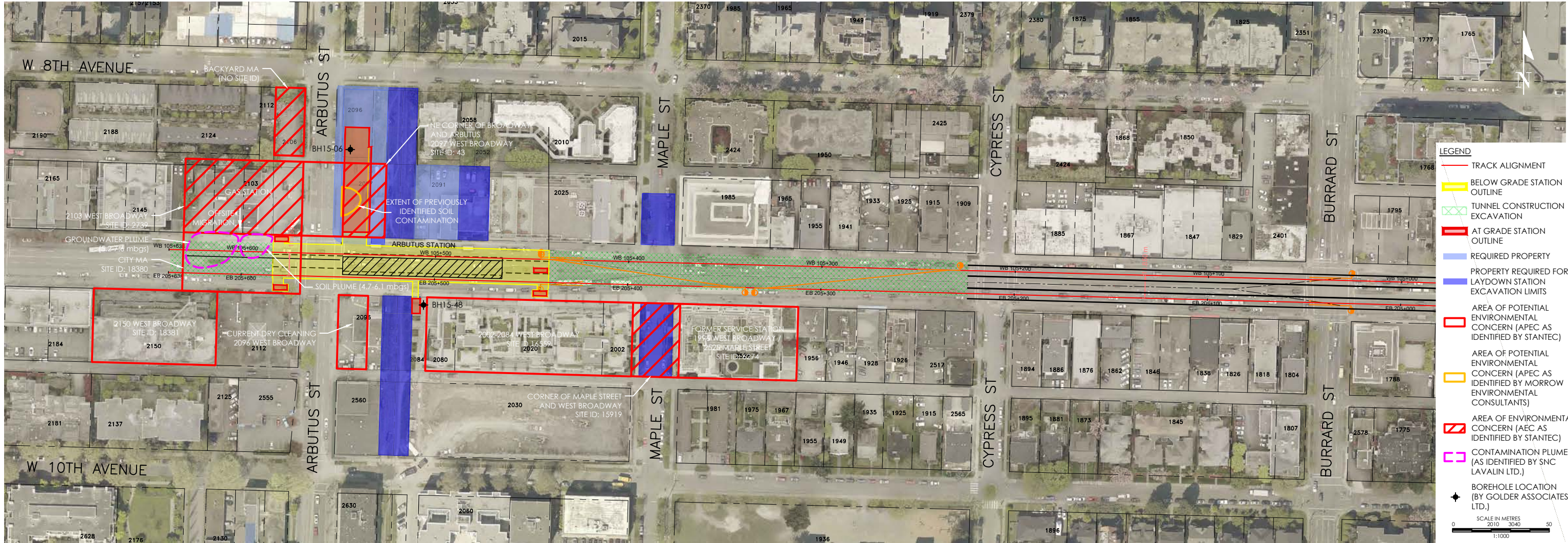
SUB CONSULTANT
PROJECT NO.

115814099

FIGURE 7

C

SUPERSIZES POINTS OF THIS NUMBER WITH LETTERS PREVIOUS TO



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CHECKED MR 16-03-02 DATE			16-03-02	VDC	FIRST ISSUE	A			CONTAMINATED SITE ISSUES	
APPROVAL DW 16-03-02 DATE			17-12-13	ES	CONTAMINATED SITES 2017 UPDATES	B			ENVIRONMENTAL ISSUES	
			19-05-02	KH	MOTI LOGO REPLACEMENT	C			SCALE 1:1000 CONTRACT NO. 115814099	
TAV-SNC-DSIZE-SHEET.dwg 558.8mm x 836.6mm METRIC								DATE 16-03-02 SUB CONSULTANT PROJECT NO. 115814099	SHEET NO. FIGURE 8	

