Environment

City of Winnipeg

Remedial Action Plan
Former Dominion Bridge Operations Yard, 1460 Dublin Avenue – Winnipeg, Manitoba

Prepared by:

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Project Number:

60164142 (402.19.2.2)

Date:

March, 2011

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March 30, 2011

Ms. Joedi Pruden
Land Enhancement Coordinator. Real Estate Division
Planning, Property and Development Department
The City of Winnipeg
2nd Floor – 65 Garry Street
Winnipeg, Manitoba
R3C 4K4

Dear Ms. Pruden:

Project No: **60164142 (402.19.2.2)**

Regarding: **Remedial Action Plan, Former Dominion Bridge Operations Yard, 1460 Dublin Avenue, Winnipeg, Manitoba**

Please find attached four (4) hard copies of the above mentioned report. If you have any questions or concerns, please feel free to contact Scott Chapman M.Sc., P.Eng. at (204) 928-8471.

Sincerely,
AECOM Canada Ltd.

R. V. Typliski

Ron Typliski, P.Eng.
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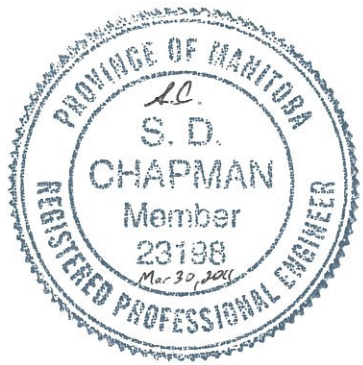
Revision Log

Revision #	Revised By	Date	Issue / Revision Description
1	S.Chapman	February 18, 2011	Draft Report Issued for Client Review
2	S. Biswanger	March 30, 2011	Final Report

AECOM Signatures



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APEGM
Certificate of Authorization
AECOM Canada Ltd. (MB)
No. 4671 Date: 2011/03/30

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1. Introduction

AECOM Canada Ltd. (AECOM) was retained by the City of Winnipeg to develop a Remedial Action Plan (RAP) for addressing the residual contaminants associated with historic activities at the former Dominion Bridge facility (the Site) located at 1460 Dublin Avenue in Winnipeg, Manitoba.

The purpose of this RAP is to describe activities to be undertaken to remediate soil, groundwater, sediment and surface water impacts identified at the subject property. This includes actions to mitigate any risks to human health or the environment presented by the identified impacts based on the current land use scenario.

1.1 Background

Formerly a bridge steel fabricating facility, the Site is currently owned by the City of Winnipeg and leased to several industrial manufacturing tenants. The Site was constructed in the early 1910s and is approximately 11 ha in size.

The Site consists of:

- A Main Shop with attached Works Office
- Galvanizing Shop and Stores Building
- Transept Shop with Grit Blast Room and Paint Shop attached to the north side of the Main shop
- Former Planning and Stock Office Building
- Former Manufacturing Building
- Gate Shop
- Shipping Office
- PCB Storage Shed
- Security Building

Omands Creek lies along the west property line of the Site and flows south towards the Assiniboine River, located approximately 3 km south. The location of the Site is shown in Figure 01 and a plan of the Site is shown in Figure 02.

Based on previous reports, it is believed that Omand's Creek was rerouted in the early 1900s. The original Omands Creek channel reportedly traversed the property in the approximate location of the west wall of the Main Shop building.

Underground Storage Tanks:
Phase II and III ESAs previously completed in 1999 identified several Areas of Potential Environmental Concern (APECs) and multiple Contaminants of Concern (COC) at the Site. Previous reports have also identified underground storage tanks (USTs) historically present at the site. Two USTs, formerly located north of the Gate Shop, were removed in 1990 along with approximately 2,700 m^3 of impacted soil. Two USTs were identified beneath the existing Paint Shop and were reportedly removed in the 1980s. A UST was also reportedly located along the north property line. Detailed removal records for the Paint Shop and north property boundary USTs were not available for confirmation.

Aboveground Storage Tanks:
Several aboveground storage tanks (ASTs) were historically located at the Site. Two (2) ASTs, each 2,270L in size containing gasoline and diesel fuel, were located approximately 150 m south of the Gate Shop. Previous reports noted surficial staining surrounding the ASTs. An AST containing solvents, which was believed to have secondary containment, was historically located south of the Paint Shop. An AST 27,000 L in size containing sulphuric acid

was located north of the Galvanizing Shop, and a sulphuric acid drum storage area was located on the west side of the Main Shop to the south of the Galvanizing Shop.

Additional APECs previously identified at the Site include:

- Drums of waste products including waste oil, cutting fluids and liquid paints were formerly stored in the area south of the Gate Shop
- Waste paint was stored in the area south of the stores building
- The banks of Omands Creek have been raised using solid waste materials, believed to contain considerable amounts of heavy metals, to prevent flooding of the property, especially along the southeast portion of the Creek
- A storage shed previously used to store polychlorinated biphenyls (PCB) is located at the south side of the property adjacent to Omands Creek
- The former Saskatchewan Avenue Landfill is located along the south side of the property near the security building

The results of the Phase III ESA conducted in 2010 by AECOM and the additional investigation work of March 2011 are summarized in the following sections and in the reports:

- "Phase III Environmental Site Assessment, Former Dominion Bridge Operations Yard, 1460 Dublin Avenue – Winnipeg, Manitoba" dated February, 2010.
- "Additional Site Investigation, Former Dominion Bridge Operations Yard, 1325 and 1355 Dublin Avenue, Winnipeg, Manitoba" dated March 30, 2011.

1.1.1 Impacts to Soil, Groundwater Sediment and Surface Water

Contaminants of concern (COC) at the Site include Petroleum Hydrocarbons (PHC), metals, and Polycyclic Aromatic Hydrocarbons (PAHs, both non-carcinogenic and carcinogenic). Based on the results of the site investigation, there are no Polychlorinated Biphenyl (PCB) or Volatile Organic Compound (VOC) impacts to soil or groundwater at the Site. Impacts to one or more media (soil, groundwater, sediment and surface water) presenting a risk to human health and the environment were identified at multiple areas of environmental concern (AECs) at the Site including:

Table 1-1 Estimated Extents of Impacted Soil

AEC	Impacted Media	Contaminant(s) of Concern (COC)
Paint Shop UST Area and West of Paint Shop	Soil	PHC, PAH
North Property Line UST Area	Soil Groundwater	Metals Metals
Waste Oil Drum Storage Area	Soil	PHC
Landfilling Area	Soil Groundwater	Metals Metals
Solvent AST Area	Soil	PHC, PAH
Diesel and Gasoline AST Area	Soil	PHC
Sulphuric Acid Drum Storage Area	Soil Groundwater	Metals Metals
Waste Paint Storage Area	Soil Groundwater	Metals Metals
Former Saskatchewan Avenue Landfill	Soil Groundwater	Metals Metals
Polychlorinated Biphenyls Storage Area	Soil Groundwater	Metals, PAH Metals
Omands Creek	Sediment Surface Water	Metals, PAH Total Metals, Dissolved Metals

AEC	Impacted Media	Contaminant(s) of Concern (COC)
South Crane Runway	Soil	PAH
Galvanizing Pit	Soil	Metals
Former Manufacturing Building	Soil	PAH
Former Planning and Stock Office Building	Soil	PHC, PAH, Metals

The total volume of soil impacted with these COC is conservatively estimated at 50,600 m^3 with depth of impacts ranging from surface to approximately 4 mBGS. Figure 02 indicates the estimated areas of impacts to soil.

The total estimated area of groundwater impacts at the Site is conservatively estimated at 24,370 m^2. Groundwater impacts have not been delineated vertically but based on the soil stratigraphy present at the Site, the nature of site impacts, and water well records in the area (clay/clay till soil extends approximately 15 m below the overburden to bedrock); it is very unlikely that the upper carbonate limestone aquifer has been impacted by site activities.

The total estimated volume of impacted sediments within Omands Creek based on available data is 4,775 m^3 extending the entire length of the Creek within the property limits.

PAH impacts to soil present at the Site, both carcinogenic and non-carcinogenic in nature, appear to be associated with the locations of rail lines on the property. PAH impacts were also identified in soil underneath the South Crane Runway, the Former Manufacturing Building, and the Former Planning and Stock Office Building. It is reasonable to assume that other crane runways on the property that use or have used treated lumber for the stacking of metal objects may also exhibit PAH impacts to soil. Based on the concentrations of PAHs present in the surface soil at the Site, the primary receptor at risk of exposure to the surficial non-carcinogenic PAH impacts is freshwater aquatic life associated with Omands Creek. Potential human exposure via surface soil contact is the governing exposure pathway associated with the exceedances of carcinogenic PAH criteria identified in the area.

With respect to Omands Creek, concentrations of metals and PAHs exceeding the sediment and surface water quality guidelines protective of aquatic life were identified over the assessed length of Omands Creek, including 60 m upstream of the Site and up to 100 m downstream of the Site, suggesting that off-site sources (potentially unrelated to the Site) of COC exist, in addition to the on-site sources. Impacts to Omands Creek via COC loading, either through historical placement of contaminated fill or through groundwater impacts, are particularly evident in the areas of the Sulphuric Acid Drum Storage Area and the Landfilling Area. However, the overall environmental impact of metal loading on Omands Creek via groundwater transport is relatively low (metals loading via groundwater transport contributes less than 2% of the maximum concentration measured in surface water samples collected from the Creek during this investigation and less than 8% of the applicable CCME water quality guidelines). In addition, as the COC concentrations downstream of the Site were only marginally above guideline values and were similar to upstream concentrations in the Creek, and as the Creek supports a limited biological community due to other habitat limitations, the environmental impact of downstream transport of COCs via the surface water vector is considered relatively small. The environmental risk of downstream COC transport via the sediment transport vector has not been fully quantified. This would require a screening level risk assessment. Also, based on the investigation results impacts to fish and fish habitat within Omands Creek are likely but the overall risk to Assiniboine River fish populations, in terms of impacts to the populations and to their suitability for consumption is low.

As field measurements were not possible for all COC at the Site, there are several areas at the Site where soil and groundwater impacts have not been fully delineated laterally or vertically with respect to metals and PAHs. This remedial action plan has been developed based on the present level of available information. However, additional

investigation, as recommended below, may improve the accuracy of the estimated areas and volumes of impacts and to further refine remedial cost estimates:

1. Assessment of potential PAH impacts to shallow soil associated with all rail lines on the property and the other crane runways where treated lumber has been or is currently used for the stacking of metal objects.
2. Further delineation of potential PHC, metal, and PAH impacts to shallow soil in the vicinity of the Former Manufacturing Building and Former Planning and Stock Office Building.

3. Further delineate the lateral and vertical extent of metals impacts in the Landfilling Area (delineation required to the southwest), the Waste Paint Storage Building (delineation required to the north, east and south), the Former Saskatchewan Avenue Landfill (delineation required in all directions), Polychlorinated Biphenyls Storage Area (delineation required to the north and northwest), and Galvanizing Pit (delineation required to the north, south and west).

4. Further delineate the lateral extent of metals impacts to groundwater at the North Property Line UST Area, the Landfilling Area, the Sulphuric Acid Drum Storage Area, the Waste Paint Storage Area, the Former Saskatchewan Avenue Landfill Area, and the Polychlorinated Biphenyls Storage Area.

1.2 Applicable Guidelines and Remediation Criteria

The following sections discuss the rationale and selection for site specific soil, sediment, surface water and groundwater quality guidelines to be used to compare the collected analytical results. Soil and groundwater quality guidelines established by the Canadian Council of the Ministers for the Environment (CCME) were selected based on the potential at-risk receptors and potential exposure pathways.

In order to determine the most appropriate guidelines for the Site, information such as land-use, soil types, the presence of groundwater as a potable source, the presence of surface water, potential receptors (human and environmental), potential pathways and potential contaminants of concern were considered.

1.2.1 Land-use

According to the City of Winnipeg, the Site and surrounding area is zoned heavy manufacturing industrial (M3) with additional land uses consisting of PDO airport vicinity and urban infill area (west end) (City of Winnipeg, 2008). This district is intended for light or heavy industrial development, including heavy manufacturing, storage, major freight terminals, waste and salvage, resource extraction, processing, transportation, major utilities, and other related uses, particularly those that require very large buildings, frequent heavy truck traffic for supplies and shipments, or that may require substantial mitigation to avoid sound, noise, and odour impacts to neighbouring properties (City of Winnipeg, 2008). Considering this information, guidelines for industrial land use were used.

The Site is currently leased to several manufacturing business tenants. In addition to various environmental receptors, the Site's land use suggests that company workers and visitors are potential receptors with respect to the PCOCs identified at the Site via exposure by dermal contact, inhalation and accidental ingestion. The most stringent CCME guidelines for human health and the environment for each of the pathways discussed were selected for the Site.

1.2.2 Groundwater Use

The Site and the City of Winnipeg rely on surface water drawn from Shoal Lake (a large isolated lake in south-east Manitoba on the border near the Province of Ontario) for drinking water. Water from Shoal Lake is transported 137

km to the City via a 135 km-long concrete pipe and an aqueduct. Water from the aqueduct is stored in the Deacon Reservoir before being treated in Winnipeg's water treatment facility.

Groundwater is currently not being used by the Site or the City of Winnipeg as a potable source. However, there is one (1) water well located on-site which, according to provincial water well records, formerly drew groundwater from a bedrock aquifer approximately 122 mBGS. The groundwater was used as cooling water for site operations and the well is located in the oil storage room in the Main Shop.

A shallow groundwater flow system with groundwater depths ranging from 0.39 meters below ground surface (mBGS) to 5.05 mBGS exists primarily within the silt unit beneath the Site. On-site groundwater monitoring conducted as part of the previous site investigation work suggests that shallow groundwater is flowing primarily towards the west to Omands Creek. Considering the depth of on-site shallow groundwater, historical reported shallow groundwater flow directions and the depth of Omand's Creek located on the south and west side of the property, it is likely that a hydraulic connection exists (i.e. – shallow groundwater at the site discharges into the Creek).

According to well logs in the vicinity of the site, approximately 10 to 15 m of fine-grained firm to stiff clay/clay till exists between the shallow water-bearing silt and bedrock aquifers beneath the Site (approximate depth of bedrock is 15 mBGS). The fine-grained clay/clay till is expected to provide sufficient stratigraphic separation from the shallow groundwater-bearing silt to protect underlying bedrock aquifers beneath the Site.

Considering the known depth of 122 m for a groundwater industrial supply (cooling water) well, the depth of shallow groundwater on-site, and the fact that potable water is supplied through a municipal distribution system, guidelines for the protection of groundwater as a potable source can be excluded and therefore do not apply to the Site.

1.2.3 Surface Water

As indicated in Section 1.1, Omands Creek is located along the south and west property boundaries. Section 1.1 discussed the diversion and western re-routing of Omand's Creek in the early 1900's from possibly the middle of the Site to its present location. Freshwater aquatic life (FWAL) such as fish species and invertebrates were identified in the creek and are potentially at risk with respect to the COCs identified on-site. Omands Creek is a tributary of the Assiniboine River which is located 3.0 km south of the Site.

Considering that FWAL exists within the creek, CCME guidelines for the protection of FWAL are appropriate for surface water at the Site.

1.2.4 Soil

Soil profiles previously identified on-site consist of gavel and/or sandy fill, underlain by a lacustrine clay unit. The clay is underlain by silt followed by clay/clay till. Fill material was documented from surface to 1.7 mBGS and the silt unit ranged from 0.5 mBGS to 3.0 mBGS. Clay/clay till extends until bedrock at an approximate depth of 15 mBGS. Particle size analyses conducted on soil samples collected from the Site suggest that the silt and underlying clay/clay till are fine-grained. COC were identified in the fill material and in the silt unit.

CCME guidelines for fine-grained surface soil (depths <1.5 mBGS) and subsoil (depths > 1.5 mBGS) are considered appropriate for the Site. In addition, considering the depths of COC, CCME guidelines for soil contact (dermal and eco-contact) and soil ingestion are also considered appropriate for the Site.

1.2.5 Applicable Site Selected Guidelines

The CCME guidelines utilize a risk-based approach allowing limited modification of the generic soil and groundwater quality guidelines in light of prescribed site-specific factors affecting contaminant mobility and receptor characterization. In other words, in cases where soil and groundwater concentrations exceed the generic Tier I guidelines, an analysis of risk factors specific to the site in question is acceptable in order to allow for a realistic assessment of the actual risks at the site. Using this approach (Tier 2), Soil Quality Guidelines (SQGs) and Water Quality Guidelines (WQG) are selected based on a step-through procedure eliminating the exposure pathways that do not apply to receptors in the vicinity of the site and finally selecting the appropriate and most conservative guideline remaining. The guidelines are protective of both human and environmental receptors.

1.2.5.1 Soil Quality Guidelines

Considering the information discussed in Sub-section 1.1, CCME Tier II SQGs and the CWS Tier I SQGs are used as comparison guidelines for soil samples discussed in this report. The 2007 CCME SQG for the Protection of Human Health (SQG_{HH}) for benzene contains guidelines for both 10^{-6} and 10^{-5} incremental risk. As Manitoba has adopted the 10^{-6} incremental risk value, the results obtained during this assessment will be compared to the 10^{-6} incremental risk guideline.

1.2.5.2 Groundwater Quality Guidelines

As stated in Sub-section 1.1.1, the CCME WQGs for potable groundwater do not apply to the Site. However, CCME WQGs for the protection of FWAL do apply and are used for the comparison of groundwater quality results discussed in this report.

1.2.5.3 Sediment Quality Guidelines

The CCME *Canadian Sediment Quality Guidelines* (*CSQG*) (CCME 2006) were applied to the sediment quality data collected during the aquatic survey.

1.2.5.4 Surface Water Quality Guidelines

The CCME *Canadian Water Quality Guidelines* (*CWQG*) for the protection of aquatic life (CCME 2006) were applied to the surface water quality data collected during the aquatic survey.

2. Site Information

2.1 Soil Stratigraphy

Site lithology consists of approximately 0.5 m to 2.0 m of fill material (sand, gravel and clay) underlain by an unconsolidated wet silt (1.0 m to 2.5 m) which is followed by a firm to stiff clay/clay till. Based on water well records in the area, the clay/clay till extends approximately 15 m below the wet silt to bedrock. The Site is level however the natural slope of the area is to the south approaching the Assiniboine River and to the west to Omands Creek.

2.2 Groundwater Conditions

Thirty-one (31) monitoring wells were installed as part of the 2010 AECOM investigation to assess groundwater quality, groundwater hydraulic conductivity and depth to groundwater.

At the Site, the measured depth to groundwater in November 2010 ranged between 0.356 mBGS in monitoring well MW10-49 and 5.05 mBGS in monitoring well MW10-40. Groundwater elevation ranged from 233.02 meters above sea level (masl) (MW10-67) to 228.98 masl (MW10-40).

Single well response tests were conducted on monitoring wells MW10-01, MW10-33, MW10-40, MW10-49, MW10-62 and MW10-70. Tests ranged between 8.3×10^{-7} m/s and 2.4×10^{-6} m/s with a geometric mean of 1.6×10^{-6} m/s. The hydraulic conductivity values and the average thickness of the silt unit (approximately 2.5 m) indicate the groundwater-bearing unit beneath the Site would not be considered a domestic use aquifer (DUA).

Based on the calculated hydraulic conductivities for the Site, shallow on-site groundwater has an average flow velocity of 11.7 m/yr, a potential maximum flow velocity of 19.5 m/yr and a potential minimum flow velocity of 6.8 m/yr towards Omands Creek.

3. Summary of Contaminant Type, Magnitude and Distribution

3.1 Contaminants of Concern

Section 1.1 discussed the previous ESAs conducted at the Site that summarized historical site operations and AECs. Contaminants of concern (COC) reported for the Site consist of petroleum hydrocarbons (PHC) Fractions F1 - F4, metals, polycyclic aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs).

Based on the results of previous ESAs, surface soil, groundwater, sediment and surface water within Omands Creek present risks of exposure to human health and the environment. As discussed in Section 1.1, impacted groundwater present at the Site does not pose any substantial risk of exposure to human receptors at the Site and the overall environmental impact of metal loading on Omands Creek via groundwater transport is relatively low. With respect to surface water, as the COC concentrations downstream of the Site were only marginally above guideline values and were similar to upstream concentrations in the Creek, and as the Creek supports a limited biological community due to other habitat limitations, the environmental impact of downstream transport of COCs via the surface water vector is considered relatively small. As such, impacts to groundwater and surface water identified at the Site are unlikely to pose a substantial risk to human health and the environment and therefore, direct remediation of this media is not included in this RAP. However, indirectly, the impacts that do exist are expected to decline via the actions proposed for addressing the other impacted media on the Site.

3.1.1 Soil Contamination

PHC, metals and PAH impacts have been identified at various AECs throughout the Site based on soil quality guidelines protective of both human and environmental receptors. Areas of impacted soil at the Site that may require treatment and/or disposal to meet the applicable guidelines (prior to site redevelopment and/or purchase) have been estimated on the basis of the assessment work completed to date (including data from 1999, 2010, and 2011). Figure 02 presents the estimated aerial extents of impacted soil at the Site. Table 3-1 summarizes the estimated aerial extent (m^2), the depth (m) and volume (m^3) of on-site impacts and also indicates the primary pathway of exposure associated with the impacted soil. The estimated areas and depths of impacted soil are conservative in nature, and generally assume that soil impacts extend to the next borehole or soil sample in which laboratory analysis has confirmed contaminant concentrations below the applicable soil quality guideline.

Table 3-1 Estimated Extents of Impacted Soil

AEC	COC	Estimated Area (m^2)	Estimated Depth of Impacts (m)	Total Estimated Volume [1] (m^3)	Primary Exposure Pathway
Paint Shop UST Area and West of Paint Shop	PHC (F2)	735	2.5	2,328	Management Limit
	PAH (non-carcinogenic)	550	1.5		Soil Contact $_{E}$
North Property Line UST Area	Metals	210	1.0	210	Soil Contact $_{HH,E}$
Waste Oil Drum Storage Area	PHC (F2 & F3)	1,358	1.0	1,358	Soil Contact $_{HH,E}$
Landfilling Area	Metals	10,100	2.5	25,250	Soil Contact $_{HH,E}$
Solvent AST Area	PHC (F2 & F3)	935	2.0	4,825	Management Limit
	PAH (non-carcinogenic & carcinogenic)	1,930	2.5		Soil Contact $_{HH,E}$
Diesel and Gasoline AST Area	PHC (F2 & F3)	80	2.0	160	Soil Contact $_{HH,E}$
Sulphuric Acid Drum Storage Area	Metals	2,796	1.5	4,194	Soil Contact $_{HH,E}$

AEC	COC	Estimated Area (m^2)	Estimated Depth of Impacts (m)	Total Estimated Volume [1] (m^3)	Primary Exposure Pathway
Waste Paint Storage Area	Metals	752	0.8	602	Soil Contact $_{HH,E}$
Former Saskatchewan Avenue Landfill	PAH (non-carcinogenic & carcinogenic)	235	1.5	1,854	Soil Contact $_{HH,E}$
	Metals	436	4.0		Soil Contact $_{HH,E}$
Polychlorinated Biphenyls Storage Area	PAH (non-carcinogenic)	375	3.0	2,461	Soil Contact $_{HH,E}$
	Metals	475	3.5		Soil Contact $_{HH,E}$
South Crane Runway	PAH (non-carcinogenic & carcinogenic)	4,840	1.0	4,840	Soil Contact $_{HH,E}$
Galvanizing Pit	Metals	436	2.0	800	Soil Contact $_{HH,E}$
Former Manufacturing Building	PAH	533	0.9	480	Soil Contact $_{HH,E}$
Former Planning and Stock Office Building	PHC (F2 & F3)	600	0.9	1,200	Soil Contact $_{HH,E}$
	PAH (non-carcinogenic & carcinogenic)	600	2.0		Soil Contact $_{HH,E}$
	Metals	600	0.9		Soil Contact $_{HH,E}$
			Total Approximate Volume:	**50,600**	

[1] Estimated volume represents total volume of impacted soil in a particular AEC, excluding overlapping soil volumes impacted by individual COC.

Notes:

1. Exposure Pathways denoted with "$_{HH}$" represent soil contact exposure presenting a potential risk to human health.
2. Exposure Pathways denoted with "$_{E}$" represent soil contact exposure presenting a potential risk to the environment

An estimated total soil volume of 50,600 m^3 is impacted with PHCs, metals and/or PAHs.

3.1.2 Sediment Contamination

Metals and PAH impacts have been identified in Omands Creek throughout the entire length of the Site based on sediment quality guidelines protective of environmental receptors (FWAL). Although the vertical extent of sediments impacts has not been confirmed, based on the observed decrease in contaminant concentrations with sediment depth, it is conservatively estimated that the sediments are impacted to a depth of 1 m below the bed of the Creek. Based on this assumption, Table 3-2 summarizes on-site sediment impacts in Omands Creek.

Table 3-2 Estimated Extent of Impacted Sediment

Location	COC	Estimated Area (m^2)	Estimated Volume (m^3)	Comments
AEC 11	Metals and PAHs	4,475	4,475	Not delineated vertically or upstream/downstream of Site.

4. Proposed Remedial Options

4.1 Remedial Options for Soil

During the 2010 Phase III ESA completed by AECOM and at the request of the City of Winnipeg, the Site was assigned a score as per the National Classification System for Contaminated Sites (NCSCS). The primary objectives of the NCSCS are to assess risks to human health and the natural environment under the current and future land use scenarios and to implement risk management solutions to mitigate those risks. The NCS score assigned to the Site following the 2010 Phase III ESA was 78.0, which corresponded to a classification of "Class 1, High Priority for Action". This score was not updated as part of the additional investigation work conducted in March 2011.

Various remediation methods were discussed with the City of Winnipeg and Manitoba Conservation in concept for the Site based on the gathered information. As a result, excavation of impacted material was selected as the most appropriate method of mitigation considering its costs and the near-term effectiveness of mitigating the potential exposure risks to humans and the environment present at the Site.

4.2 Remediation by Excavation

This remedial method involves the excavation of the impacted soil and sediment identified at the Site and transport of the impacted soil off-site for treatment at a suitable disposal location. Given the site conditions, contaminant types, depth of impacts and current industrial land use, excavation of impacted soil is the most effective method for removing the source of impacts at the Site and can achieve results in the near-term. It can address the soil contact pathway of exposure as well as the risk associated with impacted sediment contact by FWAL. As such, it is the proposed method for remediation.

In order to mitigate the risks associated with soil and sediment contact pathways of exposure, surficial impacts will be removed from the Site and replaced with clean fill. Following the removal of impacted sediments, the banks of Omands Creek will be armoured and be treated for erosion control to mitigate potential transport of impacted sediment back into the Creek from the Site

4.2.1 Excavation Activities

4.2.1.1 Soil

The total area of impacted surface soil requiring excavation at the Site is approximately 25,610 m^2. This area does not include potentially impacted soil present beneath buildings and other currently used infrastructure at the Site, including currently paved areas. The area of impacted surface soil requiring excavation is shown in Figure 03.

The impacted soil will be excavated using a tracked excavator, loaded into end-dump trucks, and transported off-site for treatment at a suitable soil treatment facility. Temporary stockpiles of excavated soil will be required in some areas to facilitate soil bulking and additional soil characterization required prior to transport off-site.

Once the primary margins of the excavation have been reached, confirmatory samples will be collected from the base and sidewalls and expedited to a certified laboratory for analysis. A minimum of one (1) discrete confirmatory sample will be collected within a grid based on 5 m increments. More closely spaced confirmation sampling may be necessary where thin identifiable layers are encountered.

The collected samples should be submitted for laboratory analysis of appropriate COC (based on location) to ensure that residual soils meet the selected site-specific SQGs protective of the soil contact exposure pathway for industrial land use and to document residual conditions for future comparison. Should any analytical result exceed the established remedial criteria, additional soil should be excavated and representative samples collected from the new limits of the excavation.

Excavated soils should be visually screened for impacts (i.e. stained and non-stained areas), and representative grab samples collected at regular intervals or at obvious stratigraphic boundaries along the excavation face. Organic vapour readings (e.g. GasTech) will be used as a preliminary screening tool during excavation activities in PHC impacted areas and to assist in the selection of samples for analysis. Excavation in those areas impacted by contaminants that are not easily field-identified will be guided based on the locations of previous investigation work.

There are two (2) options recommended for the excavation of impacted soil at the Site:

- Option 1: Soil Excavation – Depth of 0.3 m
- Option 2: Soil Excavation – Full Depth

Option 1 consists of excavating impacted surface soil to a uniform depth of 0.3 mBGS in the area of identified soil impacts. Soil samples will be collected from the base of the excavation within a grid based on 5 m increments and submitted for laboratory analysis to document residual conditions in the excavated area.

Option 2 consists of excavating all impacted soil from the Site to the maximum vertical extent of impacts (as indicated in Table 3-1). This option allows for unimpeded future industrial development of on areas of the Site that are currently free of buildings and infrastructure. Soil samples will be collected from the base of the excavation within a grid based on 5 m increments and submitted for laboratory analysis to confirm that all impacted soil has been excavated from each area. Soil samples will be collected from the walls of the excavation at an approximate lateral spacing of 5 m and in approximate vertical increments of 1 m. For excavations occurring proximate to current infrastructure in excess of a depth of 1 m, limited geotechnical and structural inspection will be required to assess potential impacts to infrastructure foundations. Temporary shoring measures (such as stockpiling of impacted material against the excavation walls overnight, etc.) should be incorporated as necessary.

Implementation of either soil excavation option (full excavation versus 0.3 m depth) is expected to vary depending on the area of the site and the needs of the City of Winnipeg. Following excavation activities associated with either Option 1 or Option 2, backfilling with suitable clean backfill material will be required. The type of material selected for backfilling will be appropriate to allow uninhibited access to roads currently in use on the property. Regardless, the minimum excavation depth of 0.3 m followed by clean fill replacement will sufficiently address the identified soil contact exposure concerns. The full depth excavation will also address the same concerns and allow for less restrictions on future excavation or development in those areas.

4.2.1.2 Sediment

Remediation of impacted sediment will include the excavation of sediment from the entire length (and width) of Omands Creek within the property limits. Based on the nature of metals and PAH impacts to sediment within the Creek, an excavation depth of 1 m is proposed. Armouring and slope stability measures will be incorporated following the excavation to mitigate the transport of impacted materials from the bank area of the site, back into the creek as sediment.

It is anticipated that the impacted sediment will be excavated in the fall season (low creek flow) using a tracked excavator, loaded into end-dump trucks, and transported off-site for treatment at a suitable soil treatment facility. Further assessment of Creek water elevations during this period will be required to assess the need for temporary

creek water diversion. Temporary stockpiles of excavated sediment will be required in some areas to facilitate soil bulking and additional soil characterization required prior to transport off-site. Dewatering of the excavated sediment may be required to improve handling and off-site disposal.

Communication with the Department of Fisheries and Oceans (DFO) regarding the proposed remedial methods and measures employed to mitigate impacts to the aquatic environment during remediation and creek restoration activities will be necessary. Erosion control during remedial activities will potentially be required. Viable creek restoration and habitat enhancement methods will be developed during remedial design and will consider elements such as the hydraulic properties of Omands Creek, slope stability analysis and erosion control.

4.2.2 Soil Disposal

As a majority of the metal and PAH concentrations in soil and sediment at the Site exceed the acceptance criteria for the City of Winnipeg's Brady Road Landfill, impacted soil and sediment from the Site requires disposal at a suitable disposal location such as the Mid-Canada Soil Treatment Facility.

Leachability assessment for impacted soil and sediment will be required prior to remediation activities to determine if any additional contaminated soil treatment technology such as stabilization may be required to reduce leachability prior to disposal at the designated disposal location and meet provincial and federal requirements.

4.3 Estimated Remediation Costs

Rough cost estimates have been prepared for the proposed remedial action plan incorporating soil and sediment excavation and disposal. Separate cost estimates were developed for the two (2) impacted soil excavation options (excavation depth of 0.3 m and full depth excavation) each broken out to two (2) parcels for remediation (Parcel A - north and Parcel B- south as requested by the City of Winnipeg, see Figure 3) but the assumptions used in the generation of estimated remedial costs were applied for each of the soil excavation options. Table 4-1 summarizes the cost breakdown by excavation option and parcel as well as creek remediation work. The costs shown for each remediation option and parcel represent the estimate to conduct the remediation work separately for each to allow comparison. The cost shown for the creek remediation assumes that the remediation of the entire on-site portion of the creek (as proposed above) will be conducted in conjunction with some combination of the soil remediation options. That is to say that the remediation of the creek assumes some cost savings gained via the soil remediation work (no matter which option or zone).

Table 4-1 Estimated Remediation Cost by Option and Zone

Area of Site	Option 1 (0.3 m Depth Soil Excavation)	Option 2 (Full Depth Soil Excavation)
Parcel A (North)	$764,000	$2,788,000
Parcel B (South)	$1,378,000	$6,911,000
Creek Bed	$954,000	$954,000
Total	$3,096,000	$10,653,000

Cost savings in the order of $200,000 would be expected to be realized in completing both the Parcel A and B work concurrently based on a reduction in effort with respect to mobilization costs, specifications and tendering, etc.

The total estimated cost for the excavation of impacted sediment from Omands Creek and excavation of soil as shown in Figure 3 to a depth of 0.3 m below grade is $2,899,000. The total estimated cost for the excavation of impacted sediment from Omands Creek and excavation of impacted soil as shown on Figure 3 to the full depth is $10,451,000. Details of these cost estimates are provided in Tables 4-2 and 4-3.

Assumptions:

- The cost estimates for each of remediation options assume the following:
- Soil density estimated at 2 tonnes/m^3
- Mid Canada Soil Treatment Facility can accept all excavated materials for treatment without requiring amendment
- Stabilization to reduce soil leachability prior to disposal at the designated disposal location and meet provincial and federal requirements is not required
- Excavation depth of 1 m in Omands Creek only requires infill of 0.5 m
- Armoured bank on Omands Creek approximately equal to footprint of creek bed, applied in 0.5 m thickness
- Cash allowanced assumed for compensation application/negotiations with DFO to allow remediation work on the creek bed and any related creek bypass work
- No significant delays encountered in obtaining appropriate approvals for the creek remediation work
- Specific compensation measures for creek work not included
- 50% contingency applied to soil volume estimates outside of Omands Creek
- Fill material required for excavated areas assumed equal to excavated material including contingency factor
- Revegetation limited to bank area only, remaining surfaces will be granular fill
- Limited Geotechnical /structural design/mitigation included for excavation work near structures
- Creek remediation limited to on-site portions of the creek
- Creek remediation to be completed in conjunction with remediation work on rest of site

Engineering costs include:

- Preparation of pre-tender cost estimate
- Preparation of specifications and tender document
- Development of site H&S plan for engineering staff (coordinated with contractor)
- Utility assessment
- Field inspection and contract administration
    - Mob and Demob
    - Monitoring well decommissioning in remediated areas
    - Initial topographic survey and site grading plan
    - Clearing of site debris
    - Overseeing excavation, conducting field screening and soil sampling
    - Creek excavation and armouring
    - Overseeing placement and grading of clean fill
- Closure report

5. Summary and Conclusion

The proposed remediation work presented in this report is based strictly on the review of historic site information, and the remedial options summarized are conceptual designs only.

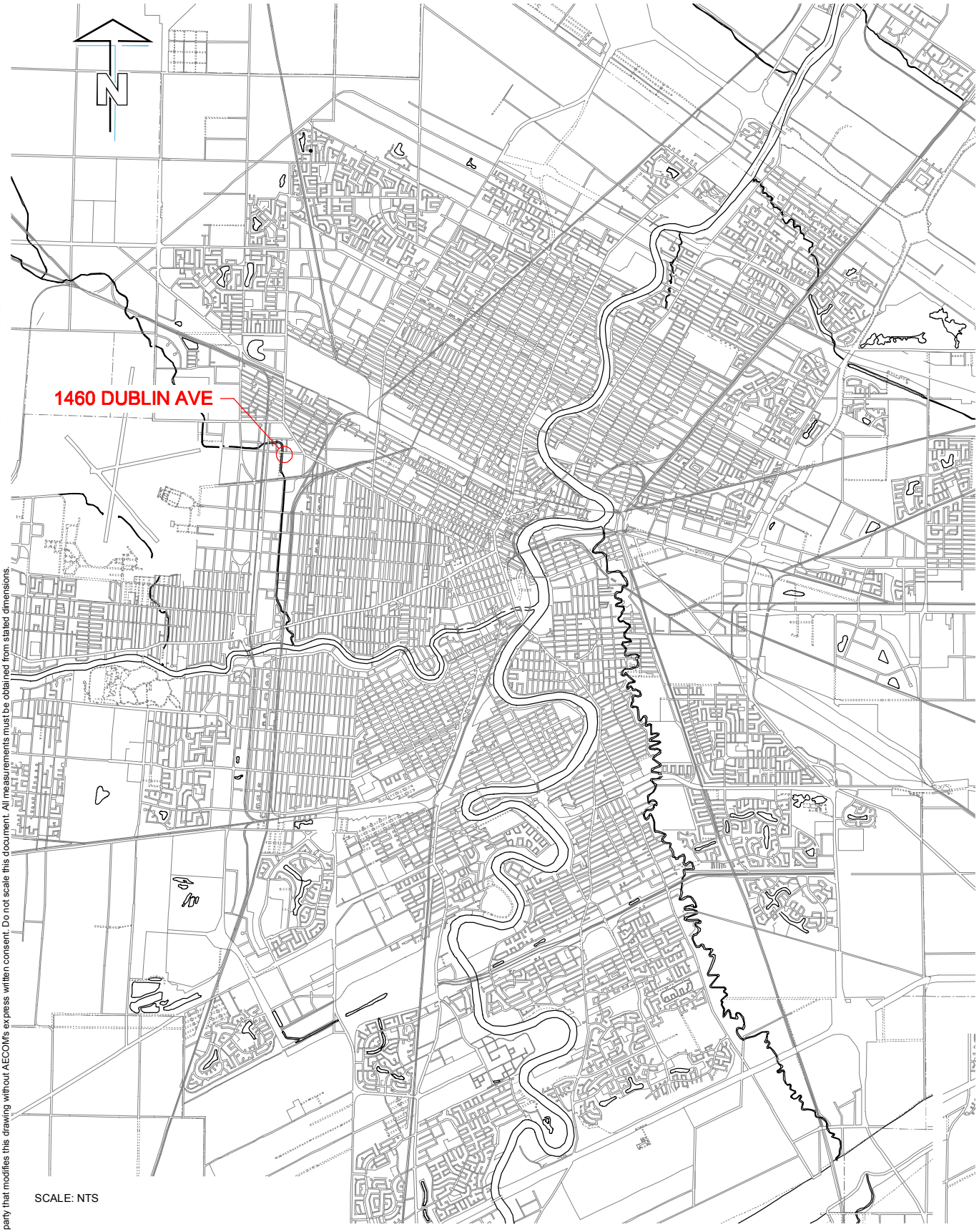
Based on the current knowledge about site conditions, there are three (3) possible exposure pathways of primary concern at the Site, namely:

- Exposures near-surface or at the surface based on contaminated soil contact, ingestion or inhalation;
- Exposures via the Management Limit exposure pathway, meaning that should this soil be exposed in the future during building demolition or construction works, there is a risk of exposure to those who may come in contact with the soil; and
- Contaminated sediment exposures to aquatic life in Omands Creek.

Given the site conditions, contaminant types, depth of impacts and current industrial land use, excavation of impacted soil is considered the most effective method for removing the source of impacts at the Site and can achieve results in the near-term. The proposed options each address the soil contact pathway of exposure as well as the risk associated with impacted sediment contact by FWAL.

The total estimated cost for the excavation of impacted sediment from Omands Creek and excavation of soil as shown in Figure 3 to a depth of 0.3 m below grade is $2,899,000. The total estimated cost for the excavation of impacted sediment from Omands Creek and excavation of impacted soil as shown on Figure 3 to the full depth is $10,451,000.
Remedial activity does not include areas underneath current infrastructure. Should any building or structures or major earthworks be undertaken at the Site in the future, consideration must be given to managing exposure and any impacts to soil left in place at the Site.

Figures



SCALE: NTS

City of Winnipeg
Dominion Bridge RAP
1460 Dublin Avenue

Remediation Activities

Figure - 01

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PROPERTY LINE

DUBLIN AVE

OMANDS CREEK

SASKATCHEWAN AVE

SITE LEGEND

1. GATE SHOP UST AREA
2. PAINT SHOP UST AREA
3. NORTH PROPERTY LINE UST AREA
4. WASTE OIL DRUM STORAGE AREA
5. LANDFILLING AREA
6. SOLVENT AST AREA
7. SULFURIC ACID DRUM STORAGE AREA
8. SULFURIC ACID AST AREA
9. DIESEL AND GASOLINE AST AREA
10. WASTE PAINT STORAGE AREA
11. FORMER SASKATCHEWAN AVENUE LANDFILL
12. POLYCHLORINATED BIPHENYLS STORAGE AREA
13. WEST OF PAINT SHOP AREA
14. WHEELABRATOR DUST
15. OMANDS CREEK
16. SOUTH CRANE RUNWAY
17. GALVANIZING PIT

0 20 40 m

SCALE 1:2000

IMAGE DATE : 2005

LEGEND

- BOREHOLE (AECOM)
- MONITORING WELL (AECOM)
- BOREHOLE (PRIOR TO 2010)

ESTIMATED EXTENT OF:

- PHC IMPACTED SOIL
- PAH IMPACTED SOIL
- METAL IMPACTED SOIL

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AECOM

City of Winnipeg
Dominion Bridge RAP
1460 Dublin Avenue

Estimated Extent of Impacts to Soil

Figure - 02

PROPERTY LINE

DUBLIN AVE

OMANDS CREEK

PARCEL A

PARCEL B

SASKATCHEWAN AVE

SITE LEGEND

1. GATE SHOP UST AREA
2. PAINT SHOP UST AREA
3. NORTH PROPERTY LINE UST AREA
4. WASTE OIL DRUM STORAGE AREA
5. LANDFILLING AREA
6. SOLVENT AST AREA
7. SULFURIC ACID DRUM STORAGE AREA
8. SULFURIC ACID AST AREA
9. DIESEL AND GASOLINE AST AREA
10. WASTE PAINT STORAGE AREA
11. FORMER SASKATCHEWAN AVENUE LANDFILL
12. POLYCHLORINATED BIPHENYLS STORAGE AREA
13. WEST OF PAINT SHOP AREA
14. WHEELABRATOR DUST
15. OMANDS CREEK
16. SOUTH CRANE RUNWAY
17. GALVANIZING PIT

0 20 40 m

SCALE 1:2000

IMAGE DATE : 2005

LEGEND

- BOREHOLE (AECOM)
- MONITORING WELL (AECOM)
- BOREHOLE (PRIOR TO 2010)

ESTIMATED EXTENT OF:

- PHC IMPACTED SOIL
- PAH IMPACTED SOIL
- METAL IMPACTED SOIL
- SEDIMENT EXCAVATION
- SURFACE SOIL EXCAVATION

City of Winnipeg
Dominion Bridge RAP
1460 Dublin Avenue

Remediation Activities

AECOM

Figure - 03

Tables

Table 4-2 Parcel A Remediation Cost Estimates

Item Description	Unit	Quantity	Unit Rate	Option 1: 0.3 m Surface Soil Excavation and Creek Remediation	Option 2: Full Depth Soil Excavation and Creek Remediation
Contractor Costs					
Mobilization of contractor/equipment					
Excavation of Sediments within Omands Creek					
Pump/silt fence, etc. for bypassing creek flow during dredging	Allowance				
Excavate top 1.0 m of creek bed	m^3	4,762			
Transport /disposal of dredged material at Mid-Canada Soil Treatment Facility	tonne	9,524			
Clean backfill for creek bed (0.5 m)	m^3	2,381			
Rip rap installation along creek (6-8" plus filter fabric)	m^3	4,762			
Cost for compensation work for DFO approval, riffle installation and gravel, etc.	Allowance				
Field Inspection and Contract Administration					
Fees for liaison with DFO for approval					
Engineering design of creek modifications/slope stabilization					
Sub-Total Creek Remediation					
Excavation of Impacted Surface Soil					
Remove/Replace Metals Impacted Soil - 0.3 m depth					
Excavation of impacted soil	m^3	3,851			
Replace with clean backfill	tonne	7,702			
Disposal of impacted soil	tonne	7,702			
Remove/Replace Impacted Soil - Full Depth					
Excavation of impacted soil	m^3	17,168			
Replace with clean backfill	tonne	34,335			
Disposal of impacted soil	tonne	34,335			
Demobilization of contractor/equipment					
Sub-Total Contractor Costs					
Engineering Costs Contract/Specification writing and Health & Safety Plan Field Inspection and Contract Administration Closure Report					
Sub-Total Engineering Costs					
Total Cost					

Table 4-3 Parcel B Remediation Cost Estimates

Item Description	Unit	Quantity	Unit Rate	Option 1: 0.3 m Surface Soil Excavation and Creek Remediation	Option 2: Full Depth Soil Excavation and Creek Remediation
Contractor Costs					
Mobilization of contractor/equipment					
Excavation of Sediments within Omands Creek					
Pump/silt fence, etc. for bypassing creek flow during dredging	Allowance				
Excavate top 1.0 m of creek bed	m^3	4,762			
Transport /disposal of dredged material at Mid-Canada Soil Treatment Facility	tonne	9,524			
Clean backfill for creek bed (0.5 m)	m^3	2,381			
Rip rap installation along creek (6-8" plus filter fabric)	m^3	4,762			
Cost for compensation work for DFO approval, riffle installation and gravel, etc.	Allowance				
Field Inspection and Contract Administration					
Fees for liaison with DFO for approval					
Engineering design of creek modifications/slope stabilization					
Sub-Total Creek Remediation					
Excavation of Impacted Surface Soil					
Remove/Replace Metals Impacted Soil - 0.3 m depth					
Excavation of impacted soil	m^3	7,830			
Replace with clean backfill	tonne	15,660			
Disposal of impacted soil	tonne	15,660			
Remove/Replace Impacted Soil - Full Depth					
Excavation of impacted soil	m^3	44,609			
Replace with clean backfill	tonne	89,217			
Disposal of impacted soil	tonne	89,217			
Demobilization of contractor/equipment					
Sub-Total Contractor Costs					
Engineering Costs Contract/Specification writing and Health & Safety Plan Field Inspection and Contract Administration Closure Report					
Sub-Total Engineering Costs					
Total Cost					