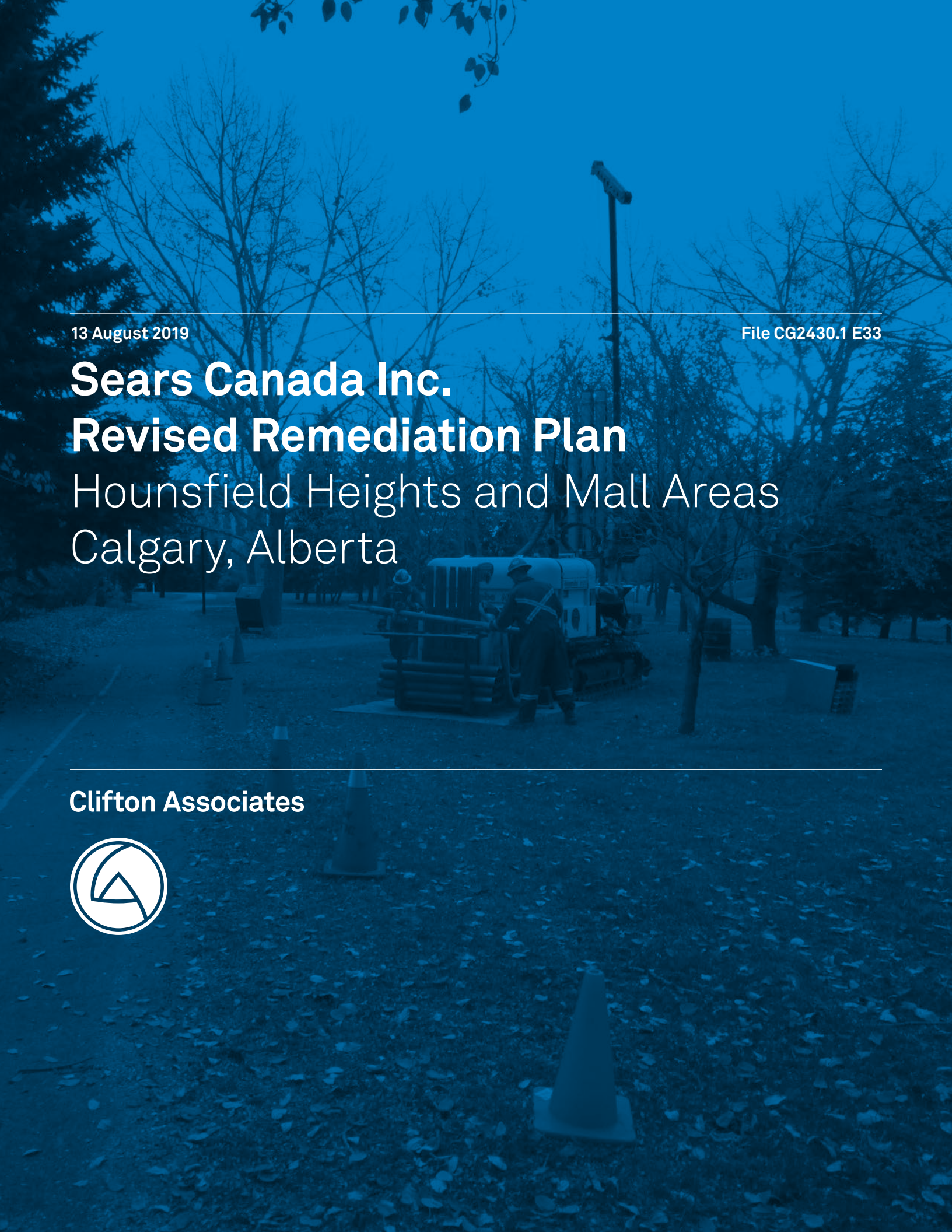


13 August 2019

File CG2430.1 E33

Sears Canada Inc.
Revised Remediation Plan
Hounsfield Heights and Mall Areas
Calgary, Alberta

Clifton Associates

Table of Contents

Appendices

List of Figures

1.0 Introduction

Clifton Associates Ltd., at the request of Mr. Greg Paliouras of Sears Canada Inc. (Sears), has prepared the following Revised Remediation Plan subsequent to submitting the "Remediation Plan" dated 17 December 2018 in response to Alberta Environment and Parks (AEPs) Environmental Protection Order No. EPO – 2018/01-SSR (EPO).

The EPO stated the "Remediation Plan" was to include:

- A proposal outlining the remediation and/or risk management plan (RMP) for all substances in, or under the lands and off-Site areas, including all soil, subsoil and groundwater;
- A detailed description of the work that will be undertaken for both the lands and off-site areas to meet the Soil Vapour guidelines as per the Soil Vapour Quality Guidelines for Hounsfield Heights and Mall Areas and the Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AEP Alberta Tier 1 Guidelines), as applicable for all other media; and
- A schedule to implement the Remediation Plan by March 2019.

A copy of the EPO has been attached in Appendix A of this document.

In context of the EPO, the "Lands" refers to the area located on the North Hill Mall property with the civic legal address of Plan 8210266, Block 21 that was previously owned by Sears and purchased by Concord North Hill GP Ltd. on 18 June 2015. The "Off-Site Areas" refer to any adjacent and down-gradient properties which have been impacted by the historical subsurface release originating from the automotive repair/gas bar ("service station") operated on the Lands between 1958 and 1995. Finally, the term "substances" refers to the presence of any residual petroleum hydrocarbons (PHCs) related to historical release from the former service station within the soil, subsoil and groundwater.

A Site Location Plan and Surrounding Land Use map has been presented as Figure 1 of the attachments. The Lands and Off-Site Areas have been visually depicted on Figure 2 of the attachments. For the remainder of this report, the term "Site" will be used to describe the combined areas of the Lands and Off-Site areas and is comprised of the "Mall Area" and the "Hounsfield Heights Area" as defined in Figure 3.

It is important to note that although this document is being referred to as the Revised Remediation Plan, as stated in the EPO, it is to include a proposal outlining the "remediation and/or risk management plan" for all substances at the Site. Based on the current understanding of the Site, the data gaps resulting from limited Site access within the Hounsfield Heights Area and the logistics of performing remediation in a densely populated urban environment, the proposed plan is risk management focused, with active remediation as a means of source removal and plume expansion control.

Since the submission of the Remediation Plan in December 2018, Sears received feedback from AEP requesting additional information and clarification related to specific components of the Remediation Plan in two separate letters dated 20 February 2019 and 31 May 2019. The letters and respective responses have been attached in Appendix B. The information provided within the responses has been incorporated into this Revised Remediation Plan.

Since submission of the Remediation Plan in December 2018, the following work has been completed at the Site:

- 2018 Fourth Quarter Groundwater Monitoring and Sampling and Reporting;
- 2019 Second Quarter Groundwater Monitoring and Sampling;
- 2019 Winter Soil Vapour Sampling Program and Reporting;
- 2019 Supplemental Soil Vapour Monitoring Points Installation, Monitoring and Reporting;
- Retrofitting of the Dual Phase Vapour Extraction (DPVE) system;
- Finalization of the activated carbon barrier design; and,
- North Hill Mall contaminant and hydrogeological characterization.

Where appropriate, the information obtained during the programs referenced above has been incorporated into this Revised Remediation Plan. One of the programs which has been completed since submission of the Remediation Plan was the North Hill Mall contaminant and hydrogeological characterization. The data obtained during this investigation has been used to update the contaminant and geological characterization presented in Sections 4.0 and 5.0, respectively. The investigation included the advancement of seven boreholes with the installation of eight monitoring wells. An updated Monitoring Well Location Map is presented in Figure 4 of the attachments. Sections 2.0 through 8.0 of this report will provide the necessary background information that has been used to form the basis of this Revised Remediation Plan and Schedule, which are presented in Sections 8.0 and 9.0, respectively.

2.0 Project Background

The current location of the Kal-Tire was originally developed as a service station and automotive centre in 1958. The service station was located at the North Hill Shopping Centre on a property owned by Sears and operated as a Sears Service Centre from 1958 to 1984. From 1984 to 1995, the location was operated under license as a Sunoco Service Station. An addition to the automotive centre building was constructed in 1982, and a separate gas bar kiosk was added in 1989. The original underground storage tanks (USTs) were replaced in 1984, and in October 1995, fuel storage and dispensing facilities at the gas bar were decommissioned. The former Sears Service Centre continues to operate under license to Kal-Tire.

Following the decommissioning of the service station in 1995, several environmental site assessments (ESAs) were completed in the Mall and Hounsfield Heights Areas, which revealed the presence of PHCs within the soil and groundwater, in addition to Liquid Petroleum Hydrocarbons (LPH). The PHCs and LPH are suspected to have resulted from a release from the USTs associated with the former automotive service station on the previously owned Sears property. A detailed description of the ESAs completed between 1995 and 2012 is presented in the *Updated Site Management Plan (2014) – North Hill Mall Area, Calgary, Alberta* (22 September 2014) and the *Updated Site Management Plan (2014) Final Version, Hounsfield Heights – Briar Hill Community, Calgary, Alberta* (11 July 2014).

The Updated Site Management Plans (SMPs) were created following a communication from AEP to Sears, requesting the following information:

- Fully delineate the dissolved plume south of 11th Avenue NW;
- Sample the groundwater adjacent to where it discharges to the surface in the southern portion of Zone 3 (south of 11th Avenue NW) and evaluate it for risk to ecological receptors;

- Delineate the soil gas/vapour plume at the Site;
- Assess potential risks from indoor air infiltration of PHC vapours in areas where the vapour inhalation pathway exceeds guidelines, and in areas where it has been determined that elevated soil gas/vapours are present;
- Establish a soil gas monitoring program on properties that may be at risk from vapour ingress to indoor air. Compare current needs with those previously identified in the Clifton response to Alberta ESRD regarding the soil vapour monitoring (5 April 2007);
- Implement additional remediation techniques to deal with the expanding dissolved phase plume. As previously discussed, this could include enhanced bioremediation. Monitored natural attenuation is not appropriate while LPH is being removed and the dissolved plume is not stable. Multiple remediation approaches are needed to address the PHC impacts;
- Review the groundwater monitoring and sampling program to ensure there is adequate coverage based on current conditions and trends; and
- Apply the AEP 2016 Tier 1 Guidelines to monitoring well locations along 11th Avenue NW and include these wells in the groundwater monitoring and sampling program.

A copy of the communication provided by AEP is presented in Appendix A of the attachments.

To address these requirements, Clifton conducted a series of investigations and prepared plans for approval, including monitoring well abandonment, borehole drilling and well installation, indoor air quality assessment, soil vapour sampling plan preparation and implementation, a revised Detailed Quantitative Human Health and Ecological Risk Assessment (DQHHERA) and additional delineation.

The above investigations are documented in the following reports:

- Updated Site Management Plan – Groundwater Monitoring Wells Abandonment Report – Hounsfield Heights and North Hill Mall, Calgary, Alberta (Clifton, March 2015);
- Sampling Plan for the Limited Indoor Air Quality Assessment of Five Homes Along 11th Avenue in Hounsfield Heights (Intrinsik, July 2014);
- Subsurface Investigation – Mall and Hounsfield Heights Areas, Calgary, Alberta (Clifton, January 2016);
- Revised Soil Vapour Monitoring Program (Update Fall 2016) – Hounsfield Heights and North Hill Mall, Calgary, Alberta (Clifton, October 2016);
- Soil Vapour Monitoring Points Installation Report – Hounsfield Heights and North Hill Mall, Calgary, Alberta (Clifton, October 2016);
- Human Health and Ecological Risk Assessment for the Hounsfield Heights and North Hill Mall Areas, Calgary, Alberta (Intrinsik, April 2017); and
- Supplemental Phase II Environmental Site Assessment – Hounsfield Heights and Briar Hill Community, Calgary, Alberta (Clifton, June 2018).

In June 2019, Clifton completed a subsurface investigation within the former excavation area to provide further hydrogeological and contaminant characterization. The results of the investigation have been incorporated into this Revised Remediation Plan. A formal report documenting the results of this investigation has not yet been completed. The newly advanced boreholes and monitoring wells are presented in Figure 5 which also depicts the areal extent of the remedial excavation completed in 2006 and 2007.

In addition to completing these investigations, routine groundwater monitoring and sampling has been conducted since the implementation of the Updated SMP. The following reports document the groundwater monitoring and sampling program since 2015:

- 2015 Third Quarter Monitoring and Sampling Report – Hounsfield Heights and Briar Hill Community, Calgary, Alberta (Clifton, 2015);
- 2015 Fourth Quarter Monitoring and Sampling Report – Hounsfield Heights and Briar Hill Community, Calgary, Alberta (Clifton, 2015);
- 2016 Second Quarter Monitoring and Sampling Report – Hounsfield Heights and Briar Hill Community, Calgary, Alberta (Clifton, 2016);
- 2016 Fourth Quarter Monitoring and Sampling Report – Hounsfield Heights and Briar Hill Community, Calgary, Alberta (Clifton, February 2017);
- 2017 Second Quarter Monitoring and Sampling Report – Hounsfield Heights and Briar Hill Community, Calgary, Alberta (Clifton, July 2017);
- 2018 Second Quarter Monitoring and Sampling Report – Hounsfield Heights and Briar Hill Community, Calgary, Alberta (Clifton, May 2018); and
- 2018 Fourth Quarter Monitoring and Sampling Report – Hounsfield Heights and Briar Hill Community, Calgary, Alberta (Clifton, January 2019).

The 2019 Second Quarter Monitoring and Sampling event has been completed, however, a report documenting the results of this investigation has not yet been compiled.

Upon approval of the Soil Vapour Monitoring Program and installation of the soil vapour probes, Clifton conducted the following soil vapour sampling programs as part of the on-going risk management of the Site:

- Soil Vapour Monitoring Report, Spring 2016 – Hounsfield Heights and North Hill Mall, Calgary, Alberta (Clifton, December 2016);
- Soil Vapour Monitoring Report, Winter 2017 – Hounsfield Heights and North Hill Mall, Calgary, Alberta (Clifton, July 2017);
- Soil Vapour Monitoring Report, Summer 2017 and Spring 2018 – Hounsfield Heights and North Hill Mall, Calgary, Alberta (Clifton, May 2018);
- Soil Vapour Monitoring Report, Winter 2019 – Hounsfield Heights and North Hill Mall, Calgary, Alberta (Clifton, April 2019); and
- Supplemental Soil Vapour Monitoring Points Installation and Monitoring Report, Hounsfield Heights and North Hill Mall, Calgary, Alberta (Clifton, June 2019).

All reports referenced above can be accessed for review through the AEP Environmental Site Assessment Repository database by entering a PBL search for Plan 8210266.

3.0 Site Overview

The Site consists of two distinctive areas - the Hounsfield Heights Area and the North Hill Mall (Mall) Area, defined as follows:

- The Hounsfield Heights Area is bound by: the southern edge of the LRT line to the north; 14th Street NW to the east; 10th Avenue SW (extending west to 17A Street NW) to the south; and, 17A Street NW to the west. The area is zoned as residential, as it primarily consists of single detached dwellings with basements. There are three areas of the Site that are zoned as Special Purpose: Hounsfield Heights Park; a parcel of land along 10th Avenue SW between 16th Street NW and 16th A Street NW; and the area between the LRT line and 13th Avenue NW; and
- The Mall Area is bound by: 16th Avenue NW to the north; 14th Street NW to the east; the northern edge of the LRT line to the south; and the western edge of the North Hill Centre property and a line extending south to the northern edge of the LRT line to the west.

Capitol Hill, a residential area, is located to the north of the Site. To the east is SAIT Polytechnic and the Alberta College of Art & Design. Hillhurst and Briar Hill, both residential communities, are found south and west of the Site, respectively.

The Site topography is characterized by a gently south-sloping river valley plateau on the northern portion of the Site, and a more moderately sloping valley wall towards the southeast portion. The Site varies in elevation from approximately 1,094 m above sea level (m asl) in the northwestern corner along 13th Avenue NW, to approximately 1,068 m asl in the southeastern corner, north of the intersection of 15th Street NW and 10th Avenue NW.

4.0 Site Geology and Hydrogeology

4.1 Lithology

The observed lithology in the upper layers of the Site includes: an upper silty sand unit, a clayey silt unit with occasional interbedded fine silt lenses; and, a lower interbedded sandy silt unit with coarse silt seams. However, the lithology significantly differs with depth and varies from north to south, as units' outcrop on the hillside.

Thirteen lithologic cross-sections were developed to visually characterize the geology under the Site. The lithological cross-sections are presented in Appendix C1. Following completion of the subsurface investigation within the Mall Area in June 2019, two new lithological cross-sections were created (L-L' and M-M'). In addition to this, a new unit, Unit 6, was defined as the former excavation backfill material located within the parking lot to the west of Kal-Tire.

4.1.1 North – Mall Area

4.1.1.1 Unit 1 – Upper Silty Sand

The upper silty sand unit consisted of a brown, well-sorted, fine- to medium-grained, loose sand near the surface that transitioned to a silty sand through the formation, with more clays near the base. Trace gravels were found in the material and the sand becomes wet near the base. The unit is approximately three and a half to five meters thick in the northern portions of the Mall Area, and decreases in thickness from west to east, while increasing in thickness as the unit extends to the south.

4.1.1.2 Unit 2 – Upper Clayey Silt

The upper clayey silt unit consists of a brown, moist, plastic clay near the top of the unit that transitioned to a silty clay or clayey silt through the formation, with more silt near the base. Trace sand and gravels are found in the material.

The unit is approximately two meters thick in the northwestern portions of the Mall Area, and increases in thickness from west to east, to approximately four meters. The unit increases in thickness as the unit extends to the south to a maximum thickness of approximately nine meters in the west within the northern section of the Hounsfield Heights Area. In general, as the formation moves towards the east, the unit thickens and then maintains a relatively constant thickness of approximately four meters.

4.1.1.3 Unit 3 – Middle Sandy Silt

The middle silty sand unit consists of a brown, fine-grained, loose sand near the top of the formation that transitions to a silty sand through the formation, with more clays near the base. Trace gravels are found in the unit, and the sand is wet throughout. The unit is approximately seven to ten meters thick in the northern portions of the Mall Area, and decreases in thickness from west to east, while increasing in thickness as the unit extends to the south in the central portion of the Site. The unit decreases in thickness from north to south in the western portion of the Site, while maintaining a constant eight meters in thickness on the eastern portion of the Site.

4.1.1.4 Unit 4 – Lower Clayey Silt

The lower clayey silt unit consists of a grey, medium-plastic clay near the surface of the unit that transitions to a silty clay or clayey silt through the formation, with more clay near the base. The unit is approximately three meters thick in the west-central portions of the Site, at the northern portions of the Hounsfield Heights Area. In the western portions of the Site, the unit pinches out midway into the Hounsfield Heights Area. In the north-central portions of the Mall Area, the unit is approximately eight meters thick and decreases in thickness from north to south, to approximately one meter in the far south. In the eastern portions of the Site, the unit maintains a consistent one to three-meter thickness, decreasing in thickness to the south.

4.1.1.5 Unit 5 – Undefined Silty Sands and Gravels

Unit 4 is underlain by deposits of silt, sand, and gravel. This underlying unit is quite variable, and insufficient stratigraphic data is available to establish this as a consistent, defined unit. For the purposes of this Remediation Plan, we have identified the unit underlying Unit 4 as Unit 5 – Undefined Silty Sands and Gravels.
Unit 5 is a silty sand and gravel unit consisting of a rounded gravel with loose sand, occasional cobbles, and trace silt and clay. The gravel is wet throughout.

4.1.1.6 Unit 6 - Excavation Fill

The former excavation backfill material completed within the Mall Area consists of a mixture of the upper silty sand, upper clayey silt and middle sandy silt units which were encountered during the excavation. The material was treated on-site and returned to the excavation. The excavation extent is depicted in Figure 5 of the attachments and reached a maximum depth of approximately 10 to 13 m bgs. The fill material is depicted in cross-section C-1.13 and C-1.14 of Appendix C1.

4.1.2 Central – Hounsfield Heights Area

The lithology in the central portion of the Site is very much as described for the Mall Area, except that the river valley slope begins a steep decline to the south.

4.1.3 Hounsfield Heights Area

The lithology in the southern portion of the Site is as previously described; however, there is a significant slope between 13th Avenue NW and 11th Avenue NW. This elevation change has Unit 1 truncating near 11th Avenue, while

Unit 2 is continuous in the western portions of the Site to midway between 11th Avenue NW and 10th Avenue NW. Unit 2 truncates at the surface south of 11th Avenue NW in the central and eastern portions of the Site.

Several residential properties (beginning approximately 50 m south of 11th Avenue NW) have Unit 3 soils at or near the surface. Homes with basements or foundations crossing the 1,078 m asl reference have likely encountered the top of Unit 3. Therefore, homes built on the 1,081 m asl surface contour that have basements are likely in contact with Unit 3. Based on work completed in 2017 and 2018, Unit 3 truncates north of 10th Avenue NW.

4.2 Hydrogeology

There are currently 128 groundwater monitoring wells on-Site which include the recently installed monitoring wells in June 2019. Each well has been screened across a selected lithologic interval to collect representative samples to characterize the groundwater specific to that unit. The groundwater elevation on-Site varies from 1061 m above sea level (asl) to 1086 m asl.

The groundwater flow direction is consistently determined for the uppermost four lithologic units. A discussion of the groundwater flow direction for Units 1 to 4 is provided below, and in Appendix C2. The data used to derive the groundwater flow directions maps presented in Appendix C2 was obtained from the 2018 Fall Groundwater Monitoring and Sampling Program as was provided in the original Remediation Plan. The data presented in these maps has been consistent since the 1900 series monitoring wells were installed and a change to these maps using the 2019 Groundwater Monitoring and Sampling data is not anticipated. Unit 6, defined as Excavation Fill was not incorporated into the hydrogeological assessment of the Site as the base of the excavation encountered within the boreholes was right at the interface of the groundwater elevation within that area of the Site. As a result, the monitoring wells installed as part of the investigation were limited to Unit 3. If groundwater monitoring wells were installed within Unit 6, they would likely be dry.

4.2.3 Unit 1 – Upper Silty Sand

The groundwater flow direction in Unit 1 has generally been to the south-southwest (Figure C.2-1, Appendix C2). In the Fall 2018 groundwater monitoring and sampling event completed by Clifton, only five groundwater monitoring wells in Unit 1 had enough water to be used for development of a potentiometric surface.

4.2.4 Unit 2 – Upper Clayey Silt

The interpreted groundwater flow direction in Unit 2 is generally to the south. The flow direction varies seasonally from southwest to southeast. Nine groundwater monitoring wells screened in Unit 2 had enough water during the Fall 2018 monitoring and sampling event to develop a potentiometric surface. The potentiometric surface for Unit 2 provided as Figure C.2-2 (Appendix C2).

4.2.5 Unit 3 – Middle Sandy Silt

The groundwater flow direction in Unit 3 is consistently to the southeast (Figure C.2-3, Appendix C2). Thirty-seven groundwater monitoring wells were used to develop the potentiometric surface for Unit 3 following the Fall 2018 monitoring and sampling event.

4.2.6 Unit 4 – Lower Clayey Silt

The interpreted groundwater flow direction for Unit 4 is generally to the south (Figure C.2-4, Appendix C2). All six groundwater monitoring wells in Unit 4 had enough water during the Fall 2018 monitoring and sampling event to

develop a potentiometric surface. This is consistent with previous investigations, which indicated that the groundwater flow direction was south-southeast.

5.0 Contaminant Characterization

To characterize the substances on-Site, laboratory analyses have included benzene, toluene, ethylbenzene, total xylenes (BTEX), PHC fractions F1 to F4, polycyclic aromatic hydrocarbons (PAHs), and volatile organic compounds (VOCs). Out of these analyses, the contaminants of potential concern (CoPCs) that are focussed on for the purposes of contaminant characterization include benzene, naphthalene, and 1,2-dichloroethane (1,2-DCA) representing each analytical suite. The rationale for concentrating on these three constituents is based on the following observations:

- They were the most frequently detected and most commonly exceeded the AEP 2019 Tier 1 Guidelines within their contaminant categories; and
- With few exceptions, the remainder of the constituents detected were associated with a detection of their representative constituent, benzene, naphthalene, or 1,2-DCA, depending on the contaminant category.
  Since submission of the Remediation Plan, Clifton has reassessed the application of the AEP Tier 1 Guidelines and has eliminated the freshwater aquatic life exposure pathway which has resulted in a revision of the PAH guidelines. This elimination is because the nearest surface water body downstream of the plume extent is approximately 1.4 km away. The nearest surface waterbody upstream of the Site is approximately 1.1 km.

5.1 Soil

Based on historic investigations, the original contamination source was leaking USTs associated with the former Sears Service Centre in the Mall Area. Between 2006 and 2007, a remedial excavation to remove the impacted soils beneath the parking lot of the Mall Area was completed. A total of approximately 69,000 m^3 of PHC impacted soil and approximately 12,000 m^3 of clean overburden were excavated from the parking lot area. An approximate maximum depth ranging between 10 to 13 m bgs was achieved. Soil treatment was done using Allu buckets to volatize PHC constituents. The excavation was subsequently backfilled with the remediated soil. The excavation was completed under the 2001 Petroleum Storage Tank Guidelines and as a result, backfilled soil which met the then current guidelines in some instances, exceeds the now current AEP Tier 1 Guidelines. The extent of the completed excavation is depicted in Figure 5 of the attachments.

Soil contamination has been noted throughout not only the Mall Area, but also the Hounsfield Heights Area. There are no known historic spills in the Hounsfield Heights Area that would contribute to soil contamination; the contamination in this area is believed to be the result of migration of the CoPCs in groundwater from the Mall Area.

The following discussion of soil chemistry is based on laboratory analytical results compiled from the 2015 Subsurface Investigation (Clifton, 2016), the 2016 Supplementary Drilling Report (Clifton, 2016), the Supplemental Phase II ESA (Clifton, 2018) as well as the most recent subsurface investigation completed within the Mall Area in June 2019. Where available, these results have been supplemented by results for soil samples collected prior to 2015.

The lateral distribution of the soil contamination is depicted in Figures D.1-1 to D.1-2 (Appendix D1). A figure for the Naphthalene was not created as there are no exceedances for this parameter as described in Section 5.1.2. The

vertical distribution of the soil contamination is depicted on six representative cross-sections, presented as Figures D.2-1 through D.2-6 (Appendix D2).

5.1.1 Benzene and PHC Fractions F1 to F4

Of the BTEX and PHC Fractions F1 to F4 analytical suite, benzene was the most frequently detected and most commonly exceeded the AEP Alberta Tier 1 Guidelines. Also, with few exceptions, the remainder of the TEX and PHC F1 and F4 compounds detected were associated with a detection or exceedance of benzene. For these reasons, benzene is considered representative of the BTEX and PHC Fractions F1 and F4 throughout this discussion. For the BTEX and PHC F1 and F4 constituents, the plume margin is defined by the AEP Alberta Tier 1 Guidelines for benzene in fine-grained soil, 0.046 mg/kg.

Benzene has been detected in concentrations above the AEP Alberta Tier 1 Guidelines in all six Units (Figure D.1-1; Appendix D1). Concentrations ranged from below the laboratory detection limit to 10.40 mg/kg (BH1956, Unit 3). Guideline exceedances were limited to the northern portion of the Site for Units 1, 2 and 6. Elevated benzene concentrations in Unit 3 are located centrally on-Site, which is consistent with the current Conceptual Site Model (CSM; Section 6.0). Benzene exceedances in Units 4 and 5 are limited to the southern portion of the Site, where boreholes were advanced deep enough to intersect these units downgradient of the source. The soil benzene plume on-Site has been laterally delineated in Units 1 through 5(Figure D.1-1; Appendix D1). It should be noted that although BH4002, the furthest west borehole within the Mall Area did not have a benzene or 1,2 – DCA exceedance, an exceedance for the parameter xylene(s) was observed. The lateral delineation of these impacts to the west is achieved in borehole BH2012. Selected cross-sections showing the vertical distribution of soil benzene exceedances on-Site are provided in Appendix D2.

Lateral delineation of benzene has been achieved. Vertical delineation has been achieved within the source area (Mall Area) and throughout most of the Site. Remedial efforts within the Hounsfield Heights Area is focussed on the groundwater and to a lesser extent soil vapour using the DPVE system. In areas where the deepest soil sample exceeds the applicable guidelines it is anticipated that the treatment of the groundwater within these areas will aid in the natural attenuation of the soil impacts.

5.1.2 PAHs

Naphthalene was the most frequently detected PAH, and with few exceptions, the remainder of the PAH compounds detected were associated with a detection of naphthalene. For these reasons, naphthalene is considered representative of the PAHs throughout this discussion.

Naphthalene has historically been detected at concentrations above the AEP Alberta Tier 1 Guidelines with consideration of the freshwater aquatic life pathway. However, with the removal of this pathway, none of the detections of Naphthalene actually exceed the next most stringent guideline value for this parameter. The vertical distribution of naphthalene is provided in Appendix D2.

5.1.3 VOCs

1,2-DCA was the most frequently detected VOC, and most commonly exceeded the AEP Alberta Tier 1 Guidelines. Also, with few exceptions, the remainder of the VOC compounds detected were associated with a detection or exceedance of 1,2-DCA. For these reasons, 1,2-DCA is considered representative of the VOCs throughout this

discussion. The plume margin is defined as the AEP Alberta Tier 1 Guideline for 1,2-DCA in fine-grained soils of 0.025 mg/kg.

1,2-DCA has been detected in concentrations in excess of the AEP Alberta Tier 1 Guidelines in BH1904 (Unit 2),BH1921 (Unit 3) as well as all boreholes (BH4003B to BH4007) completed within the former excavation boundary. Concentrations were below the guidelines in all other boreholes. The lateral distribution of 1,2-DCA is shown on Figure D.1-2 for each stratigraphic unit mapped in the study area, and select cross-sections showing the vertical distribution of 1,2-DCA are provided in Appendix D2.

Lateral delineation of 1,2 – DCA has been achieved. Vertical delineation has been achieved within the source area (Mall Area) and throughout most of the Site. Remedial efforts within the Hounsfield Heights Area is focussed on the groundwater and to a lesser extent soil vapour using the DPVE system. In areas where the deepest soil sample exceeds the applicable guidelines it is anticipated that the treatment of the groundwater within these areas will aid in the natural attenuation of the soil impacts.

5.2 Liquid Petroleum Hydrocarbon

LPH has been intermittently present on-Site since 1998, when it was first documented. Between 1998 and 2012, LPH was encountered in twelve groundwater monitoring wells within the Hounsfield Heights Area (Figure D.3). These monitoring wells were screened primarily across Unit 3, or Unit 2 and Unit 3. As part of the Updated SMP, a dual-phase vapour extraction (DPVE) system was installed north of 13th Avenue NW, with seven extraction wells screened through Unit 3 to the south, to capture and treat LPH. All infrastructure and extraction wells were installed on City of Calgary property for ease of access and regular maintenance.

Following completion of the 2015 Subsurface Investigation (Clifton, 2016), there was no LPH observed in the newly-installed groundwater monitoring wells, or the historic wells that were left in-place. LPH was encountered for the first time in BH1704 in September 2015 (Figure D.3). Between 04 September 2015 and 27 May 2016, approximately 4.2 L of LPH was extracted from BH1704.

In October 2018, LPH was once again encountered in BH1704. The DPVE was intermittently operational in July and August 2018 due to pump repairs; this may be the cause for LPH recurrence. Since the 2015 Subsurface Investigation (Clifton, 2016), LPH has not been encountered in any other groundwater monitoring wells.

Current and historical information related to the presence of LPH can be obtained in the following reports:

- Updated Site Management Plan (2014), Final Version, Hounsfield Heights – Briar Hill Community, Calgary, Alberta (Clifton, July 2014); and
- 2018 Fourth Quarter Groundwater Monitoring and Sampling Report, Hounsfield Heights – Briar Hill Community, Calgary, Alberta (Clifton, January 2019)

This information can also be obtained in the AEP Response dated 17 June 2019.
The extent of the current LPH plume is difficult to approximate, as subsurface investigations are restricted to publicly owned property, such as a right-of-way. The groundwater flow direction in Unit 3 is directly to the south; therefore, it is currently not possible to delineate the LPH plume in the direction of groundwater flow north of 11th Avenue NW.

5.3 Groundwater

The following discussion of groundwater chemistry on-Site is based on the laboratory analytical results from the Fall 2018 monitoring and sampling event as well as the data from the June 2019 Mall Area Investigation The work which was completed in June 2019 provided additional data within Unit 3. Groundwater monitoring wells were not screened within Unit 6 – Excavation Fill as the wells would have likely been dry as a result of the depth of excavation not significantly exceeding the groundwater table. Both lateral distributions (Appendix D4) and vertical cross-sections (Appendix D5) have been provided. It should be noted that the trend analysis discussion presented below is based on data available up to the Spring of 2018. The data set is relatively small, consisting of 4 to 9 data points, which also includes seasonality. As more data becomes available through the on-going monitoring and sampling program more consistent and meaningful trends are expected.

5.3.1 Benzene and PHC Fractions F1 and F2

Benzene was the most frequently detected and most commonly exceeded the AEP Alberta Tier 1 Guidelines of the BTEX and PHC Fractions F1 and F2 analytical suite. Also, with few exceptions, the remainder of the TEX and PHC F1 and F2 compounds detected were associated with a detection or exceedance of benzene. For these reasons, benzene is considered representative of the BTEX and PHC Fractions F1 and F2 throughout this discussion. For the BTEX and PHC F1 and F2 constituents, the plume margin is defined by the AEP Alberta Tier 1 Guideline for benzene, 0.005 mg/L.

Benzene has been detected in concentrations in excess of the AEP Alberta Tier 1 Guidelines in Units1, 2, 3, and 4. Concentrations of benzene ranged from below detection (<0.00040 mg/L) to a maximum of 3.2 mg/L in BH1982 (Unit 3). The lateral distribution of benzene in groundwater is shown in Figure D.4-1 for each stratigraphic unit mapped in the study area.

The Middle Sandy Silt (Unit 3) shows the most extensive distribution of benzene, and the lateral extent of the benzene plume is largely defined in this Unit. The benzene concentrations in BH1928 (2.5 mg/L) and in BH1944 (0.016 mg/L) were above the AEP Alberta Tier 1 Guidelines. These wells represent the southernmost exceedances in Unit 3. Monitoring wells BH1954, BH1981, and BH2003 had benzene concentrations that were below the reportable detection limit or the AEP Alberta Tier 1 Guidelines near the downgradient plume margin in Unit 3. Based on previously completed Mann-Kendall Plume Stability Analyses, the benzene plume is either stable or declining at the southern plume margin in Unit 3.

Benzene has been detected at concentrations above the AEP Alberta Tier 1 Guidelines in the underlying lower clayey silt (Unit 4) in the southern portion of the Site. BH1939 represents the southernmost exceedance in Unit 4. Monitoring wells BH1964, BH1980, and BH2002 currently serve as the southernmost downgradient indicators of the plume extent in Unit 4 with concentrations below the reportable detection limit or the AEP Alberta Tier 1 Guidelines.

Mann-Kendall analyses for BH1937 and BH1939 indicate the plume is declining. The PlumeStop™ pilot study application, implemented 03 August 2016, is within 5 meters of BH1939. The pilot study is discussed in greater detail in Section 8.0 of this report.

Benzene concentrations have been laterally delineated throughout the Site. Although some wells at the extents of each mapped unit show exceedances, these exceedances could not be further delineated to the south because the unit truncates.

5.3.2 PAHs

Naphthalene was the most frequently detected PAH, and with few exceptions, the remainder of the PAH compounds detected were associated with a detection of naphthalene. For these reasons, naphthalene is considered representative of the PAHs throughout this discussion.

Naphthalene has historically been detected at concentrations above the AEP Alberta Tier 1 Guidelines with consideration of the freshwater aquatic life pathway. However, with the removal of this pathway there are no exceedances of the next most stringent exposure pathway guideline.

5.3.3 VOCs

1,2-DCA was the most frequently detected VOC, and most commonly exceeded the AEP Alberta Tier 1 Guidelines. Also, with few exceptions, the remainder of the VOC compounds detected were associated with a detection or exceedance of 1,2-DCA. For these reasons, 1,2-DCA is considered representative of the VOCs throughout this discussion. The plume margin is defined by the AEP Alberta Tier 1 Guideline for 1,2-DCA of 0.005 mg/L.

1,2-DCA has been detected at concentrations more than the AEP Alberta Tier 1 Guidelines in Units 1, 2, 3 and . Concentrations were below the analytical detection limits in Unit 5 except for BH2001, which had a detectable concentration of 0.0017 mg/L, below the AEP Alberta Tier 1 Guidelines. Concentrations of 1,2-DCA on-Site ranged from below detection (<0.001 mg/L) to 0.37 mg/L (BH1928). The lateral distribution of 1,2-DCA is shown on Figure D.4-3 for each stratigraphic unit mapped in the study area.

Monitoring wells BH1928, BH1954, BH1981, and BH2003 serve as useful indicators of the 1,2-DCA concentrations near the downgradient VOC plume margin. A Mann-Kendall analysis of the plume based on historic 1,2-DCA concentrations in BH1928 indicated that the plume has been expanding since Spring 2017; it was stable in the fourth quarter of 2016. Concentrations of 1,2-DCA in BH1954 and BH1981 indicate that the plume is expanding at these locations. The plume was stable at BH1954 in the Spring 2017 sampling event. BH1981 represents the southernmost exceedance in Unit 3. Further analysis will be required to determine if the plume will continue to grow at these locations, which represent the south-southwest plume margins.

There was an exceedance of 1,2-DCA in monitoring well BH1939 installed in Unit 4, the lower clayey silt. A Mann-Kendall analysis of the 1,2-DCA plume in BH1939 indicated that the plume is stable at this point. The Mann-Kendall analysis on the adjacent well, BH1937, indicated a fluctuating trend that was generally declining. The downgradient lateral extent of 1,2-DCA in Unit 4 may be delineated by wells BH1980 and BH2002, which have both been non-detect for 1,2-DCA in all monitoring and sampling events. There is some uncertainty as to the extents of the 1,2-DCA plume immediately south and southwest of BH1939.

1,2- DCA concentrations have been laterally delineated throughout the Site. Although some wells at the extents of each mapped unit show exceedances, these exceedances could not be further delineated to the south because the unit truncates.

5.4 Soil Vapour

The DQHHERA completed by Intrinsik following the 2015 Subsurface Investigation (Clifton, 2016) included a detailed investigation of the vapour inhalation pathway for human receptors in both soil and groundwater. This was completed

in response to the communication provided by AEP (Appendix B), requesting a soil vapour monitoring program be established.

In 2016, Clifton prepared and implemented a Soil Vapour Monitoring Program for the Site. The program included the advancement of forty soil vapour monitoring points to assess the soil vapour concentrations across the Site. Three of these points included nested soil vapour points, with one point just above the water table, one between 2 and 3 m below ground surface (m bgs), and a third spaced evenly between the upper and lower two. Additionally, indoor air quality and sub-slab vapour samples are consistently collected from some private residences. The location of the soil vapour monitoring points is provided in Appendix D6.

Site-specific soil vapour quality guidelines (SVQG) were developed by Intrinsik for comparison of the soil vapour and sub-slab soil vapour samples. The guidelines were developed based on the 2014 CCME *A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours*.

To date, there has been one exceedance of the SVQG in the sub-soil which resulted in the implementation of the Contingency Plan. The information related to this exceedance is documented in the report titled *Supplemental Soil Vapour Monitoring Points Installation and Monitoring Report, Hounsfield Heights and North Hill Mall, Calgary, Alberta* (20 June 2019).

6.0 Conceptual Site Model

A Conceptual Site Model (CSM) is a visual representation and narrative description of the physical, chemical, and biological processes occurring, or that have occurred, at a site as related to the CoPC and their migration. The CSM for the Site is presented in Appendix E. The CSM is based on a representative cross section of the Site and captures all significant infrastructure and remedial measures that have been applied.

7.0 Regulatory Framework for Remediation Plan

The regulatory framework through which this Revised Remediation Plan will be administered is based off the AEP 2019 Alberta Tier 1 and 2 Guidelines. Through the guidance provided within these documents and the work completed by Intrinsik, the Revised Remediation Plan is governed by two sets of regulatory criteria. To achieve unconditional Site closure, the AEP 2019 Alberta Tier 1 Guidelines for soil and groundwater apply. A second set of guidance values for soil, groundwater and soil vapour were also calculated by Intrinsik for application during Site remediation for the protection of human health.

These guidelines include:

- AEP Alberta Tier 2 Guidelines, Groundwater Remediation Guidelines for the Protection of Vapour Inhalation during Site Management and Remediation (18 April 2019);
- Calculated Residential and Commercial Soil-gas Remediation Guidelines (13 April 2017); and
- AEP Alberta Tier 2 Guidelines, Soil Guidelines for the Protection of Vapour Inhalation in the Mall Area (13 April 2017).

It should be noted that since the development of the Soil Guidelines for the Protection of Vapour Inhalation in the Mall Area additional data within the Mall Area has been obtained which may influence these guidelines. As a result, the AEP Tier 1 Guidelines, Vapour Inhalation Pathway, have been applied for the protection of Human Health within the Mall Area.

Further information regarding the application of this regulatory framework is provided in Section 8.3 and Section 8.4 of this report.

8.0 Remediation Plan

As mentioned within the introduction section of this report, the Revised Remediation Plan being proposed is risk management focused, with active remediation as means of source removal and plume expansion control. In addition to active remediation, part of this Revised Remediation Plan includes details on obtaining evidence that natural attenuation is occurring within certain parts of the groundwater plume that are not being affected by the residual LPH within the Hounsfield Heights Area, particularly within the Mall Area.

The EPO specifically states the Remediation Plan shall include a detailed plan to address the following:

- Remediation and/or risk management plan for all substances in, or under the Site, including all soil, subsoil and groundwater; and
- A detailed description of the work that will be undertaken for both the Site to meet the Soil Vapour guidelines as per the Soil Vapour Quality Guidelines for Hounsfield Height and Mall Areas and the AEP Alberta Tier 1 Guidelines, as applicable for all other media.

With respect to the first requirement of the EPO, the Revised Remediation Plan will address through either risk management and remediation all substances in, or under, the Site, in all applicable media, including the soil, subsoil, and groundwater. With respect to the second requirement, the Revised Remediation Plan will also include detailed plans on the work required to ensure the soil vapour at the Site meets the SVQG and that remediation to the AEP Alberta Tier 1 Guidelines is achieved, where practicable, as described below.

The requirement to meet the AEP Alberta Tier 1 Guidelines for all substances, in all media, across the entire Site should be applied under the assumption that all areas of the Site can be accessed for investigative and remedial purposes. This assumption does not hold true for the Site, particularly for the portions occupied by private residences. In addition to this, as it pertains to the substances of concern at the Site, the AEP Alberta Tier 1 Guidelines are governed by the Domestic Use Aquifer (DUA) pathway. Although this pathway cannot be eliminated based on the protocol provided within the guidelines, this pathway should be considered incomplete based on the following rationale:

- According to the AEP Alberta Water Well Information Database, there are no wells listed within the NE ¼ - 20 - 024 – 01 W5M which covers the extent of the delineated groundwater plume; and
- It is assumed that all residences within the affected area are supplied water for domestic use from the City of Calgary water utility network. This is further supported by City of Calgary Bylaw 40M2006 which states, all

residential dwellings within the City of Calgary must be metered, precluding the use of a water well within the City for domestic purposes.

It is understood that currently an administrative removal of this pathway will not be granted but may be revisited by AEP in the future.

A Remediation Plan that is implemented for the purposes of achieving the AEP Alberta Tier 1 Guidelines, with consideration of the DUA pathway, would require full access to all areas of the Site, including commercial, public, and private properties. Currently, access is restricted to only allow investigative and remedial activities within commercial and public properties. Soil and groundwater contamination, and the potential presence of LPH beneath the private residences of the Hounsfield Heights Area, has not yet, and may never be, fully characterized. Although remediation and confirmation of remediation within commercial and public properties is possible, any plan implemented to treat these unknown, privately-owned areas and more importantly confirm that the AEP Alberta Tier 1 Guidelines have been achieved, would be limited.

Based on this rationale, a Revised Remediation Plan consisting of the following four primary components has been proposed:

1. Source Removal: Delineating the extent of any residual LPH, if practicable, and active LPH removal using a DPVE.
2. Plume Expansion Control: Controlling the plume from expanding further to the south by reducing groundwater concentrations using a permeable reactive barrier (PRB) along 11th Avenue NW.
3. Plume Monitoring: Continuing with routine groundwater monitoring and sampling and determining if natural attenuation is occurring within certain portions of the Site.
4. Risk Management: Continued source removal and plume expansion control with routine soil vapour monitoring and sampling program to ensure risks to human health are not present through the soil vapour inhalation pathway.

The Revised Remediation Plan is presented for the whole Site. It should be noted that different approaches will be applied within different areas of the Site. The rationale provided for a selected approach within a given area is provided in the following sections. In addition to this, the pertinent background information, objectives, and scope of work for each component of the Revised Remediation Plan is also provided.

A summary of the remedial targets, timelines to achieve the remedial targets as well as the proposed remedial strategy by area has also been presented within Section 8.5 as part of this Revised Remediation Plan.

8.1 Source Removal

8.1.1 Source Removal Background Information

The original source of the subsurface PHC contamination across the Site is believed to be a leak from the USTs associated with the former service station and automotive center operated within the Mall Area parking lot between 1958 and 1995. During this time, the original USTs were replaced in 1984, the new USTs were then removed in 1995 during the decommissioning of the service station. Removal of the USTs represented the original source removal from the Site; LPH on-Site is considered a secondary source. Through the processes of volatization and solubilization, portions of the LPH will partition into the soil vapour as well as the groundwater. As a result, any treatment that only addresses the soil vapour or dissolved phase components of the plume will fail to address their source. Theoretically, the LPH would continue to partition into the soil vapour and groundwater until the entire mass has been distributed. A more effective means of treatment would be to remove the source and then address the residual PHCs within the soil vapour and groundwater.

Historically, LPH was identified in two monitoring wells within the Mall Area; subsequently, two remedial excavations were completed to address these “hot spots”. In addition to these two smaller excavations, a larger remedial excavation was completed between 2006 and 2007 within the Mall Area to remove PHC impacted soil and any residual LPH that may not have been detected in the monitoring well network. Since the completion of the remedial excavation in 2006 and 2007, LPH has not been encountered within the Mall Area.

Between 1998 and 2012, LPH was encountered in the following twelve groundwater monitoring wells within the Hounsfield Heights Area (Figure D.3):

- BH209, BH213, BH214, BH702 and BH1703 - located on 13th Avenue near 16th Street NW;
- BH509, BH705 and BH706 – located on 16th Street NW near 13th Avenue NW;
- BH510, BH510A and BH725 – located in the laneway between 15th Street NW and 16th Street NW; and,
- BH1105 (sheen only) – located in Lions Park.

Each of the wells historically containing LPH were either screened in stratigraphic Unit 2 or Unit 3 or were screened across both Unit 2 and Unit 3. The historical and current LPH data is presented in the AEP Response dated 17 June 2019.

In October 2010, as part of the original SMP created in 2006 for the Site, a DPVE system was installed north of 13th Avenue NW, with seven extraction wells to the south, to capture and treat LPH and dissolved phase PHCs.

The extent of the LPH within the Hounsfield Heights Area is currently not well understood due to the location of private residences and the inability to access these properties for additional investigation. Figure D.3 (Appendix D) shows the historical and current locations of LPH within the groundwater at the Site. As evident from the Figure, a large area beneath the private residences remains unknown. It should be noted that the DPVE was designed with a radius of influence that would overlap these residences, capturing the entire area of potential concern. However, the potential for LPH to have migrated beyond the extent of the DPVE influence, beneath the private residences to the south, exists. Without access to these properties to confirm the extent of LPH, it will remain undefined. It is also possible that the LPH extent has been significantly reduced through the operation of the DPVE and is bound to areas immediately surrounding monitoring well BH1704. Currently the DPVE is operating on extraction wells EX-4, EX-5, EX-6 and EX-7 as they are closest in proximity to monitoring well BH1704 which contains the LPH.

On-going removal of LPH is a critical component for the success of this Revised Remediation Plan.

8.1.2 Source Removal Objectives

The primary objectives of the Source Removal component of this Revised Remediation Plan are:

- Confirm the extent of the residual LPH within the Hounsfield Heights Area; and
- Continue to remove residual LPH to the extent practicable from the groundwater within the Hounsfield Heights Area.

The recommended scope of work to meet the above objectives is presented in the following section.

8.1.3 Source Removal Scope of Work

Currently, the extent of the LPH within the Hounsfield Heights Area is undefined and is limited to one monitoring well, BH1704. The LPH on-Site may extend beneath the residences located adjacent to this monitoring well or it may be confined to the immediate area surrounding this well. The potential for additional pockets of LPH that have not been previously been identified may also exist beneath the private residences within Hounsfield Heights Area.

The first component of the Source Removal portion of this Revised Remediation Plan is to delineate the LPH, to the extent practicable. This will involve trying to obtain access to private residences for the purposes of delineation drilling. If access is not granted, Additional delineation will be limited to the area surrounding BH1704, to the north, east and west. If access is granted, the delineation program will also involve private residences to the south of monitoring well BH1704.

A defined extent of LPH will allow for the creation of a source removal plan that the can be designed to specifically address the entire area of concern. Once additional delineation is achieved to the extent practicable, an assessment of the current extraction well configuration will be completed to determine if it needs to be adjusted. If the extraction well network does need to be adjusted, it will be completed as part of this Revised Remediation Plan.

8.1.3.1 Assessment and Continued Operation of the DPVE

The DPVE is currently housed in Lions Park and consists of an extraction well network of seven wells situated around the residences located between 16th Street NW and the laneway separating 15th and 16th Street NW. Figure F.1 of Appendix F shows the location of the extraction well network.

The DPVE has been in operation since 2010, and continued operation will require an upgrade to several of the pumps and motors to ensure that it can continue to run until the removal of LPH is confirmed. As part of continued use of the DPVE, it was recently retrofitted to achieve an additional 10 year operational life cycle, if required. If the system continues to operate beyond an additional 10 years another assessment will be completed to ensure that the system is mechanically fit to continue operating.

In addition to the electrical and mechanical component upgrades recently completed, an assessment of the current extraction well network will be completed upon further delineation of the LPH. This may involve the decommissioning and installation of new extraction wells.

Upon completion of this work, the DPVE will remain operational until it is determined that the LPH has been removed, to the extent practicable. Source removal also provides risk management associated with the presence of LPH and the dissolved phase PHCs.

As part of this Source Removal program, a summary of the LPH volumes removed through the continued operation of the DPVE will be presented within the semi-annual groundwater monitoring and sampling reports.

In addition to removal of the LPH using the DPVE, it is also recommended that LPH be removed from any wells through passive bailing when the DPVE is shut-down during the semi-annual groundwater monitoring and sampling events.

8.2 Plume Expansion Control

8.2.1 Plume Expansion Control Background Information

Plume expansion control is being proposed as part of this Revised Remediation Plan along 11th Avenue NW. Plume expansion control will be achieved through the installation of a PRB that transects the primary units through which groundwater CoPC are laterally migrating. The location of the PRB along 11th Avenue NW has been selected for the following three reasons:

- This is the first area, south of Lions Park, that completely transects the groundwater plume and is fully accessible for remedial and investigative purposes;
- This area of the Site, between 10th and 11th Avenue NW, represents the extents of where horizontal delineation of the groundwater plume has been achieved; and
- The clay layer between the groundwater table and the surface in this area reduces in thickness and as a result the Tier 2 Risk Based Guidelines calculated for these areas are more stringent, supporting the need for a reduction in contaminant mass passing through this area to ensure risk thresholds are not exceeded.

The plume expansion control portion of this Revised Remediation Plan is essential in limiting the plume from expanding further down-gradient and helping to mitigate the risk to residents south of 11th Avenue. This area represents the southernmost limit of the plume which has been shown to have a higher water table and a reduction in the thickness of the clay layer. As a result of this, managing the concentrations of the CoPCs to levels below the risk-based guidelines within the groundwater of this area is of significant importance. A significant effort has been invested into ensuring the design and implementation of the PRB will be effective in mitigating the risks associated with the groundwater PHC plume south of 11th Avenue NW. Two pilot studies and a passive flux meter program, as presented below, were conducted between 2016 and 2019 to help to ensure the most effective design possible given the unique Site conditions and requirements.

The specific trademarked name of the PRB and oxygen release products applied at the Site as part of the pilot studies were PlumeStop™ and ORC-A, respectively. PlumeStop™ is a colloidal activated carbon reagent. The activated carbon particles in PlumeStop™ have a diameter of 1 – 2 µm, which allows it to suspend in liquid form. As a result, PlumeStop™ can achieve wide spread, low pressure distribution through the soil matrix to provide a long-term barrier.

The activated carbon forms a colloidal biomatrix which is favorable for microbial colonization and growth. The CoPCs sorb to the activated carbon, and microbes are drawn to this as a source of nutrition. Digestion of the CoPCs by microbial activity reopens sorption sites on the activated carbon. The application of ORC-A further promotes biodegradation of the CoPCs that have been sorbed to the activated carbon matrix.

The first pilot study was implemented along 11th Avenue NW in an area with some of the highest reported benzene concentrations across the Site. Nine injection points were advanced, spaced over 21 metres along 11th Avenue NW, based on the estimated radius of influence of 2.4 m determined in the design verification test. In total, 13,720 litres of PlumeStop ™ solution and 540 litres of ORC-A were injected into the subsurface. The injections were made at a depth range of 6.1 m to 8.8 m below ground surface (bgs), which intersected Unit 3 and the upper portion of Unit 4.

Three down-gradient groundwater monitoring wells screened across three Units (BH1982 - Unit 3, BH1939 - Unit 4, and BH1937- Unit 5) were used to assess remedial progress during the pilot study performance monitoring program.

Details of the down-gradient monitoring wells are provided below:

- Monitoring well BH1982 is screened in a sand layer (Unit 3) from a depth of 1.6 to 7.8 m bgs;
- Monitoring well BH1939 is screened in a clay layer (Unit 4) from a depth of 8.2 m to 8.6 m bgs; and
- Monitoring well BH1937 is screened across an alternating silt and clay layer with a sand lens (Unit 5) from a depth of 8.8 m to 13.7 m bgs.

All three monitoring wells are located approximately 3.5 m down-gradient of where the barrier was installed.

Monitoring wells BH1937, BH1939, and BH1982 were sampled prior to application and on a bi-weekly basis for three months following installation of the PRB to assess remedial progress. Following three months of bi-weekly sampling, performance sampling was then conducted on a monthly-basis for an additional three months. These wells were subsequently sampled two more times as part of the routine semi-annual groundwater monitoring and sampling program. It should be noted that monitoring well BH1937 was removed from the performance sampling program after the bi-weekly events as this well is screened below the injection zone and therefore contaminant reductions resulting from the PRB were not expected.

Benzene and 1,2-DCA concentrations were used as the primary indicators for contaminant reduction based on their prevalence throughout the Site. The results from the initial pilot study performance monitoring program showed a decrease in concentrations of benzene and 1,2-DCA of 60% and 48%, respectively. Results obtained from the most recent sampling event carried out in these wells shows benzene concentration reductions of 69% and 99.7% for monitoring wells BH1982 and BH1939, respectively. During this same sampling event, 1,2-DCA concentration reductions of 99.5% and 48% were also observed for monitoring wells BH1982 and BH1939, respectively.

A second pilot study was conducted on the western portion of 11th Avenue near monitoring well BH1929 to assess the ability of PlumeStop™ to reduce concentrations to the AEP Alberta Tier 1 Guidelines. Between 10 and 13 September 2018, a total of three injection points, spaced approximately 2.4 m apart, were used to inject a total mass of 2,173 kg of PlumeStop™ into the subsurface between depths of 7.6 m to 14.9 m bgs. This depth range of injection was almost entirely within stratigraphic Unit 3. Due to the lower concentrations of the CoPC in monitoring well BH1929, ORC-A was not recommended for application.

Current performance monitoring results show a reduction of 93% and 72% for benzene and 1,2-DCA, respectively, within monitoring well BH1929. Performance monitoring is recommended to continue for a minimum of one year to determine if the PRB was successful in achieving the AEP Alberta Tier 1 Guidelines.

Pre-application and post application sampling results for both pilot studies are provided in Tables G1 and G2 of Appendix G. These tables have been updated to include the most recent data obtained in Spring 2019.

The results from both pilot studies suggest that the application of a PRB can reduce CoPC concentrations down-gradient through sorption and biodegradation of the sorbed contaminants within the barrier. This method of remediation will help to reduce the contaminant mass moving south of 11th Avenue NW, providing a method of plume expansion control and risk management.

In addition to the two pilot studies completed, in the Spring of 2019 passive flux meters (PFMs) were installed within three monitoring wells along 11th Avenue NW, BH1928, BH1936 and BH1937. The PFMs were hung in the monitoring wells for approximately 1 month prior to removal and sampling. The resulting data provided insight into the darcy velocity and contaminant flux throughout the entire screened unit within each well allowing for a refinement of the PlumeStop design.

Based on the results of the two pilot studies and the PFM program, the final PlumeStop design for full scale implementation was prepared in July 2019.

8.2.2 Plume Expansion Control Objectives

The primary objective of the installation of the PRB portion of this Revised Remediation Plan is to achieve plume expansion control south of 11th Avenue NW, by reducing CoPC concentrations as they migrate to an area of higher potential risk.

Currently, one of the wells (BH1982) used in the pilot study has reached a level below the AEP Tier 1 Guidelines during the most recent sampling in Spring 2019 for the parameter 1,2-DCA.

8.2.3 Plume Expansion Control Scope of work

The following scope of work is recommended for the application of a PRB at the Site.

8.2.3.1 Design Verification Testing

Prior to the installation of a PRB, it is recommended that additional design verification testing be completed along 11th Avenue NW. This design verification testing will include completing the following activities:

- Verifying the radius of influence;
- Determining the volume of PlumeStop™ required;
- Determining the volume and frequency of ORC-A injections, if required; and
- Determining the injection zone thickness by location along 11th Avenue NW.

Since the submission of the original Remediation Plan the design of the PRB has been finalized and is ready for implementation which is scheduled for late summer/early fall 2019. The installation of the barrier is expected to take approximately 90 days.

8.2.3.2 Performance Monitoring

Following the installation of the PRB, a performance monitoring plan including down-gradient well sampling should be completed. The sampling will be conducted on a bi-weekly basis for the first three months following application, followed by monthly sampling for an additional 3 months and then quarterly for the remainder of the first year. The performance monitoring program will include Mann-Kendall Plume Stability Analyses of down-gradient monitoring wells to determine if concentrations are statistically decreasing. Results may suggest that additional amendments, such as oxygen release compound may need to be injected. Select down-gradient monitoring wells will also be used to assess geo-chemical parameters indicative of biodegradation.

The results of the performance monitoring program will be submitted to AEP on a quarterly basis.

8.3.1 Plume Monitoring Background Information

In the absence of risk to human health and the environment related to the CoPCs, along with active source removal and the application of a PRB as a means of plume expansion control, plume monitoring and obtaining evidence to determine if natural attenuation is occurring in portions of the Site, is recommended as part of this Revised Remediation Plan.

Currently, delineation of the CoPCs has been achieved within the soil and groundwater at the Site. To develop a greater understanding of how the groundwater PHC plume is changing, it is recommended that the data obtained from the monitoring wells at the margins of the plume be continued to be used for Mann-Kendall Plume Stability Analyses. The interpretation of this analysis will be refined with additional datasets as well as considering seasonality of the data.

The second component of the Plume Monitoring portion of this Remediation Plan will be to obtain data to determine if natural attenuation of the CoPCs within the groundwater is occurring within certain areas of Site. While monitored natural attenuation (MNA) may not be applicable at the Site in the area being impacted by LPH, there may be evidence to suggest the LPH is not affecting all areas of the Site and that MNA is applicable in those areas. By assessing certain areas of the Site for specific geochemical parameters indicative of biodegradation an assessment on the application of MNA can be made. These areas may include areas up-gradient of the LPH, within the Mall Areas as well as areas cross-gradient to the currently known extent of LPH, along the plume margins.

The objectives and scope of work as they pertain to the Plume Monitoring component of this Remediation Plan are presented in the following sections.

8.3.2 Plume Monitoring Objectives

The primary objectives of the Plume Monitoring component of this Remediation Plan are:

- Develop an understanding of how the plume is changing over time (increasing, decreasing and/or stable); and
- Determine if MNA is applicable in certain portions of the Site not impacted by LPH.

An assessment of the above objectives will be completed as part of the semi-annual groundwater monitoring and sampling events conducted at the Site.

8.3.3 Plume Monitoring Scope of work

The following scope of work is recommended for the Plume Monitoring component of this Remediation Plan.

8.3.3.1 Semi-annual Groundwater Monitoring and Sampling for Plume Stability Analysis

As part of the Plume Monitoring approach for the Site, it is recommended that semi-annual monitoring and sampling of the groundwater at the Site be completed. A routine groundwater monitoring and sampling program has been implemented at the Site since 2015, when quarterly events were completed. In 2016, the program included quarterly monitoring and semi-annual sampling events. In 2017, quarterly monitoring was completed for Q1, Q2, and Q3; one semi-annual sampling event was completed in Q2. In 2018, semi-annual groundwater monitoring and sampling was completed in Q2 and Q4.

It is recommended that this frequency of sampling be maintained for an additional three years. Upon completion of the three-year time-period, an evaluation of the groundwater monitoring and sampling results should be completed to determine if the same frequency and extent of sampling is required.

The scope of work for the proposed semi-annual groundwater monitoring and sampling program includes:

- Measure organic vapour concentrations in all monitoring wells;
- Measure LPH thickness (if present) and depth of groundwater in all monitoring wells;
- Collect groundwater samples using the bailer method from 40 monitoring wells on-Site;
- Collect one discrete sample using the HYDRASleeve^{TM} method from 51 monitoring wells on-Site;
- Collect a quality assurance/quality control (QA/QC) sample for every ten samples taken;
- Submit groundwater samples from 86 monitoring wells for laboratory analysis of BTEX, PHC Fractions F1 and F2, and VOCs;
- Submit groundwater samples from 48 monitoring wells for laboratory analysis of PAHs;
- Compare the results to the AEP 2016 Tier 1 Guidelines and the Risk Based Guidelines developed by Intrinsik (Section 8.4); and
- Prepare a report documenting the results of the groundwater monitoring and sampling events which includes groundwater plume modelling and plume stability analyses and discussion.

Any changes to monitoring well network in the future should be reflected in the on-going groundwater monitoring and sampling program.

8.3.3.2 Natural Attenuation Assessment

Prior to MNA being selected as a viable and effective component of this Revised Remediation Plan for specific areas of the Site, it must first be proven. A method of showing that natural attenuation is occurring at the Site includes the analysis of geochemical parameters indicative of the biodegradation process. As part of the semi-annual groundwater monitoring and sampling program, it is recommended that monitoring wells, up-gradient of the LPH as well as cross-gradient, at the margin of the plume extents, be selected for analysis of dissolved oxygen (DO), nitrate, iron, manganese, sulfate, methane, and total alkalinity ($CaCO_3$). Upon receipt of the laboratory analysis, an assessment of whether the concentrations of these parameters suggest that biodegradation is occurring will be made and presented in the semi-annual groundwater monitoring and sampling reports.

Natural attenuation, if proven, will be targeted for the Mall Area. This area has already undergone significant remedial efforts including an in-situ injection program as well as a large-scale remedial excavation. The recent investigation completed in the Mall Area in June 2019 has shown concentrations of the COPCs at levels which do not exceed the soil vapour inhalation exposure pathway guideline. This, along with the on-going soil vapour sampling program continue to show no risk to human health within this area.

When comparing data from the original confirmatory drilling program completed in 2008 following completion of the excavation to the new data set from the June 2019 investigation, concentrations of the COPCs do appear lower. Maximum benzene concentrations in the soil and groundwater in 2008 and 2019 within this area were 5.45 mg/kg and 7.37 mg/L and 0.90 mg/kg and 0.76 mg/L, respectively. While these samples were not taken from the exact same locations the observed difference in maximum concentrations could suggest that natural attenuation of the residual PHCs within this area is occurring.

8.4 Risk Management

8.4.1 Risk Management Background Information

Risk management is the basis of this proposed Remediation Plan. As part of the Risk Management component of this Remediation Plan, an assessment of the actual potential risks associated with the CoPC was completed. Once the risks at the Site were understood, implementation of remedial measures to reduce the potential risks and a system for on-going monitoring of risk is recommended for implementation.

To establish actual potential risks at the Site, Intrinsik finalized an updated DQHHERA for the Site in April 2017. The objectives of the updated DQHHERA were as follows:

- To assess risks to human and ecological receptors based on the 2014 and 2015 subsurface investigation;
- To update the previous DQHHERA (2006) based on the most recent guidance provided by the Government of Alberta and Canadian Council of Ministers of the Environment (CCME);
- To develop Tier 2 risk management guidelines that are required to address immediate risks and would be in effect during the remediation; and
- To develop Tier 2 guidelines that are required to achieve unconditional Site closure.

The 2014 and 2015 subsurface investigations were used to identify the primary CoPCs through a risk-based screening process. Through the screening process, benzene, xylene(s), PHC Fraction F1, and 1,2- DCA were identified as the primary CoPCs within the Hounsfield Heights Area for the vapour inhalation pathway. Within the Mall Area, benzene and 1,2-DCA were identified as the CoPCs for the vapour inhalation pathway. While other CoPCs were identified within the soil and groundwater across the Site, the DQHHERA determined that a human health risk is not posed by their presence, and risk-based guidelines did not need to be calculated for them.

The primary pathway of concern with respect to the protection of human health was determined to be the vapour inhalation pathway. The following pathways for the protection of human health were eliminated based on Site-specific conditions: drinking water pathway; and direct soil contact. With respect to ecological health, no receptors were identified to be at risk and therefore risk-based guidelines were not calculated.

Risk-based guidelines within the Hounsfield Heights Area were calculated for the groundwater as the soil contamination within this area was primarily confined to the saturated zone. Through the guidance provided by the

Government of Alberta (GoA) and the CCME, the Hounsfield Heights Area was subdivided into four risk zones, based on local topography, groundwater elevation, and geology. Figure H.1 of Appendix H shows the locations of the zones identified by Intrinsik. Zone-specific guidelines for each of the CoPCs were then calculated by Intrinsik. The zone-specific guidelines are presented in the table below. These guidelines have been revised following the initial submission of the Remediation Plan as AEP did not accept some of the parameter adjustments which were made in the original submission, particularly the Henry's Constant adjustment.

Table 8.1 – Risk Based Groundwater Guidelines for Site Management during Risk Management and Remediation for the Hounsfield Heights Area (mg/L)

Input Variable	North of 11th Avenue NW (N1)	North of 11th Avenue NW (N2)	South of 11th Avenue NW (S1)	South of 11th Avenue NW (S2)
Benzene	4.6	4.4	3.2	2.8
Toluene	NGR	NGR	NGR	NGR
Ethylbenzene	NGR	NGR	NGR	NGR
Xylenes	134	130	94	80
F1 – BTEX	32	31	29	19
F2	NGR	NGR	NGR	NGR
1,2 – DCA	0.29	0.28	.0.20	0.17

Notes:
NGR indicates no guideline required because calculated value exceeds solubility limits.

Only one monitoring well exceeded the Risk Based Groundwater Guidelines during the Spring 2019 groundwater monitoring and sampling event for the parameter benzene. This monitoring well is located right along 11th Avenue in Zone S1. This area is also immediately adjacent to where the PRB will be installed which is expected to lower concentrations in this area below the Risk Based Groundwater Guidelines.

Within the Mall Area, risk-based guidelines were calculated based on soil concentrations as these impacts were present above the groundwater table and pose a more significant risk to human health through the vapour inhalation pathway due to their closer proximity to the surface. The following table presents the Tier 2 risk-based guidelines for the Mall Area, within the soil, for risk management purposes.

Table 8.2 – Risk Based Soil Guidelines for Site Management during Risk Management and Remediation of

These guidelines were generated based on a limited dataset at the time of creation. Since then, additional soil data has been obtained from the Mall Area parking lot. Since this data was not incorporated into these Tier 2 Guidelines, the default AEP Tier 1 Guidelines for the protection of vapour inhalation will be used for Site Management during Risk Management and Remediation of the Mall Area. The Risk Based Soil Guidelines are presented in the table below.

Table 8.3 – Risk Based Soil Guidelines for Site Management during Risk Management and Remediation of the Mall Area (mg/kg)

Chemical	AEP Default Tier 1 Guidelines – Vapour Inhalation Pathway
Benzene	11
Toluene	13,000
Ethylbenzene	6,500
Xylenes	1,700
1,2 – DCA	0.37

None of the soil samples from the recent (June 2019) investigation within the Mall Area exceeded these guidelines. Since soil concentrations cannot be monitored on a routine basis, the SVQG (presented below) calculated for the Site will be used as the basis for on-going risk management assessment.

The final set of risk-based guidelines created by Intrinsik is the Tier 2 SVQG for the protection of human health through the vapour inhalation pathway. These guidelines consider the risks posed by any soil vapour generated from the dissolved phase CoPCs within the Hounsfield Heights Area and the residual soil contamination present within the Mall Area. The following table presents the risk-based SVQG for the Hounsfield Heights and Mall Areas for implementation during risk management and remediation of the Site.

Table 8.4 – Calculated Risk Based Residential and Commercial Soil-gas Guidelines during Risk Management and Remediation (µg/m^3)

Chemical	Residential Tier 2 Guidelines	Commercial Tier 2 Guidelines
Benzene	303	1,122
Toluene	187,790	695,519
Ethylbenzene	49,625	183,796
Xylene(s)	8,909	32,996
Aliphatic C6 - C8	915,445	3,390,537
Aliphatic >C8 - C10	48,060	178,000
Aromatic >C8 - C10	8,125	30,093
Aliphatic >C10 - C12	50,000	185,185
Aliphatic >C12 - C16	50,000	185,185
Aromatic >C10 - C12	10,000	37,037
Aromatic >C12 - C16	10,000	37,037
1,2 – DCA	38	142

To date, five soil vapour sampling events have been conducted at the Site. One exceedance of these guidelines has occurred in a single vapour probe, SV32. This exceedance occurred in the Winter 2019 sampling event. The exceedance also resulted in the implementation of the Contingency Plan component of the Soil Vapour Quality Monitoring Program accepted by AEP. The most recent sampling event which was completed as part of the Contingency Plan resulted in a concentration below the Soil Vapour Quality Guidelines.

The final aspect of the work completed by Intrinsik was to develop Tier 2 guidelines to achieve unconditional Site closure. Based on the guidance documents available through AEP, the DUA pathway cannot be eliminated through the protocol provided. This pathway governs the most stringent allowable concentrations for the CoPCs in the soil and groundwater across the Site, except for the polycyclic aromatic hydrocarbons. Therefore, the Tier 2 guidelines required to achieve unconditional Site closure are in fact the Alberta Tier 1 Soil and Groundwater Remediation Guidelines. It should be noted that although the DUA pathway cannot be eliminated based on the protocol provided in the Alberta Tier 2 Soil and Groundwater Remediation Guidelines, this pathway should be considered incomplete as described in Section 8.0. It is understood that currently an administrative removal of this pathway cannot be granted. The work completed by Intrinsik developed an understanding of the actual risks presented by the CoPCs at the Site in addition to developing a set of guidelines to assess risk. Currently, results do not show risks to human health through the vapour inhalation pathway; however, reducing concentrations of the CoPCs through active source removal and the application of the PRB still serve as mitigative measures with respect to risk. Both remedial measures are intended to reduce groundwater concentrations of the CoPCs within the Hounsfield Heights Area. The groundwater in this area is the primary source of the soil vapour PHCs. By reducing the concentrations in the groundwater, soil

vapour concentrations are also expected to be reduced, therefore lowering the risks associated with soil vapour through the vapour inhalation pathway.

It should be noted, that to date, based on the most current datasets, there has been no exceedances within the soil of the Risk Based Soil Guidelines, currently only one exceedance of the Risk Based Groundwater Guidelines and finally, only one exceedance of the Soil Vapour Quality Guidelines which further sampling resulted in concentrations below these guidelines.

The remainder of the Risk Management section of this Remediation Plan will focus on the efforts surrounding on-going assessment of risk as well as the potential application of contingency measures, should they be required.

8.4.2 Risk Management Objectives

The objectives of the Risk Management component of this Remediation Plan are:

- Continued source removal and installation of a PRB to reduce groundwater concentrations of CoPCs that may pose a risk through the vapour inhalation pathway;
- Assess and report potential risk to human health by comparing results of the CoPCs in the groundwater, soil, and soil vapour to the calculated Tier 2 Guidelines until unconditional Site closure is achieved; and
- Implement contingency measures, should results from the groundwater and soil vapour sampling programs suggest an actual risk is present.

The recommended scope of work and contingency plan to be implemented as part of the Risk Management component of this Remediation Plan are presented below.

8.4.3 Risk Management Scope of Work

The following scope of work is recommended as part of the Risk Management component of this Remediation Plan. It is important to note that the following section discusses the risk monitoring component of this remediation plan. Actual risk reduction by reducing CoPC concentrations in the groundwater is discussed in the Source Removal and Plume Expansion Control sections of this report.

8.4.3.1 Semi-annual groundwater monitoring and sampling

As part of the Risk Management approach for the Site, it is recommended that semi-annual monitoring and sampling of the groundwater at the Site be completed. The proposed groundwater monitoring and sampling program will follow the protocol outlined in the Plume Monitoring component of this Remediation Plan. In the context of Risk Management, groundwater concentrations will be assessed against the Tier 2 Risk Based Guidelines calculated by Intrinsik for purposes of assessing risk to human health through the vapour inhalation pathway.

8.4.3.2 Semi-annual Soil Vapour Monitoring and Sampling

The continuance of the semi-annual soil vapour monitoring and sampling program will form the basis of the risk monitoring portion of this Remediation Plan. The soil vapour sampling program was first implemented in June 2016, when the first event was completed. Since that time, subsequent soil vapour sampling events have been conducted in January 2017, July 2017 and April 2018.

As part of this Remediation Plan, it is recommended that semi-annual soil vapour sampling be completed. It is recommended that this frequency of sampling be completed for an additional three years and that events are conducted in the Winter and Summer, capturing any potential effects related to seasonal weather extremes. Upon completion of the three-year time-period, an evaluation of the soil vapour sampling results should be completed to determine if the same frequency and extent of sampling is required.

The primary objectives of the soil vapour sampling program are to:

- Assess and report soil vapour concentrations with respect to the Tier 2 SVQG created for the Site for the protection of human health within the Hounsfield Heights and Mall Areas; and
- Trigger the implementation of a contingency plan if the soil vapour quality guidelines are exceeded.

The scope of work for the proposed semi-annual soil vapour sampling program includes:

- Collecting representative soil vapour samples from areas identified by the 2016 subsurface investigations as having CoPC concentrations in groundwater or soil exceeding the AEP Alberta Tier 1 Guidelines for the vapour inhalation exposure pathway;
- Sampling nested soil vapour monitoring points at locations representing changing stratigraphy on-Site to provide representative data for evaluation of the Site-specific vertical soil vapour migration and biodegradation;
- Sampling soil vapour monitoring locations constituting lateral transects to facilitate lateral delineation of the soil vapour plume extent at the Site;
- Conducting sub-slab soil vapour sampling and indoor air quality monitoring at one residential property within the Hounsfield Heights Area;
- Forwarding collected soil vapour and air samples to certified lab under Chain-of -Custody protocols for laboratory analyses of CoPCs;
- Implementing QA/QC procedures to assure quality and defensibility of the collected data;
- Comparing CoPC concentrations in soil vapour from soil vapour monitoring points against the Site-specific SVQG developed based on the 2014 CCME Protocol by Intrinsik; and
- Comparing CoPC concentrations in soil vapour from soil vapour monitoring points against trigger threshold values for additional investigation set as 90% of guidelines.

A figure showing the locations of the current soil vapour probes is presented in Figure D.6-1 of Appendix D. Any changes to soil vapour monitoring network in the future should be reflected in the proposed soil vapour monitoring and sampling program.

8.4.3.3 Contingency Plan

As part of the assessment of the results obtained from the semi-annual groundwater and soil vapour sampling programs, a determination of risk to human health will be considered based on the risk-based guidelines generated by Intrinsik. Should the results of these programs reveal a potential risk to human health, additional investigation as part of a contingency plan shall be implemented.

Implementation of the contingency plan will be focussed on the areas of concern as identified from the groundwater and soil vapour sampling program. Upon confirmation of the areas of concern the following protocol will be implemented:

- Immediate re-sampling of any areas of concern (may include groundwater and soil vapour sampling);
- Upon confirmation of exceedance of risk-based guidelines, approach potentially impacted residents to discuss the results and obtain approval for additional assessment within the property;
- If access is provided, perform an indoor air quality and sub-slab soil vapour assessment in the potentially impacted dwellings;
- Should results from these assessments reveal evidence to suggest there is a direct risk to the occupants of the dwelling through the vapour inhalation pathway, the recommendation for the installation of a sub-slab devaporization system (SSDS) should be made;
- Upon approval to install to the SSDS, installation should occur, and the system shall be initiated; and
- Adjust the semi-annual soil vapour sampling program to include an indoor air quality and sub-slab soil vapour assessments of the affected dwelling.

During this process residents should be offered temporary relocation assistance from the time of confirmation of risk to when the SSDS system has been installed and initiated. Should the owner of the dwelling not agree to the installation of an SSDS system, alternate agreements may be required between the owner the Site and the property.

If at any time during the contingency program additionally obtained data suggests that actual risks are not present, the program will be halted, and the potentially impacted property will be added to the on-going soil vapour sampling program, including an indoor air quality and sub-slab soil vapour assessment of the home.

8.5 Remedial Targets, Timeline and Remediation Strategy Summary

8.5.1 Remedial Targets

The Revised Remediation Plan has been based off two Remedial Targets for both the Soil and Groundwater. The first set of Remedial Targets is based on the Risk Management Based Guidelines for the Protection of Human Health as described in Section 8.4 of this document. These are the guidelines which will be used to help assess the risk to human health through the duration of the remediation of the Site.

The second set of Remedial Targets is the application of the AEP 2019 Tier 1 Guidelines for both soil and groundwater. These are the Remedial Targets which must be achieved to obtain unconditional Site closure.

Based on the feedback provided by AEP following submission of the original Remediation Plan, more work has been done to characterize and delineate contaminants within the Mall Area. While the additional diligence and investigation were beneficial in further characterizing the residual PHCs within the soil and groundwater of this area, the approach to the Revised Remediation Plan is still risk management focused with source removal and plume expansion control in support of monitoring natural attenuation. This approach, through a remedial options analysis, has been determined to be appropriate for meeting the objectives laid out by AEP given our current understanding of the risks and inherent constraints associated with the remediation of the residual PHCs at the Site.

8.5.2 Timeline to Achieve Remedial Targets

With respect to Remedial Target Timelines, three time-ranges have been proposed for application within this Revised Remediation Plan.

The timeframes are based on years to achieve the Remedial Targets and are as follows:

- Short – Term: Less than 5 years;
- Medium – Term: Greater than 5 years, less than 15 years; and
- Long-Term: Greater than 15 years.

The Revised Remediation Plan goal is to achieve the Site-Specific Tier 2 Guidelines within a short-term time-frame, while the time-frame associated with meeting the AEP 2019 Tier 1 Guidelines has been classified as long-term. Placing a definitive time frame on achieving these remedial targets is challenging due to restricted Site access, particularly within Hounsfield Heights, resulting in data gaps associated with the LPH, the dissolved phase plume as well as the application of remedial technologies.

8.5.3 Summary of Remedial Approach

A summary of the Remedial Approach by area is presented below.

Mall Area and Lion's Park

The proposed remedial approach for the Mall Area and Lion's Park is natural attenuation once proven viable. Current data suggests that there is no presence of LPH or additional source material within these areas. Through the on-going monitoring and sampling program additional parameters will be assessed to confirm natural attenuation is occurring within these areas. Significant remedial efforts have already been completed within the Mall property, eliminating the source material and reducing concentrations within the soil. A portion of Lions Park, particularly the areas just north of 13th Avenue NW will also be influenced through the continued operation of the DPVE system. It is anticipated that achieving unconditional closure within this area of the Site will be a long-term objective of the Revised Remediation Plan. A long-term remedial objective is a practical approach provided on-going data supports a low risk to human health at the Site.

Hounsfield Heights

The proposed remedial approach Hounsfield Heights includes the continued operation of the DPVE system as well as the installation of a PRB along 11th Avenue NW. The application of these remedial methods is intended to provide source removal and plume expansion control. The application of both remedial technologies will facilitate achieving the remedial targets in an expedited manner. Given current access limitations within this portion of the Site it is anticipated that unconditional closure will be achieved within the long-term. A long-term remedial objective is a practical approach provided on-going data supports a low risk to human health at the Site.

9.0 Remediation Plan Schedule for Implementation

As per the requirements of the EPO, a schedule for implementation of this Revised Remediation Plan has been provided in the table below. Since submission of the original Remediation Plan some of the components of the plan

have already been completed. The schedule presented below has been updated since the submission of the original Remediation Plan.

Table 9.1 – Proposed Remediation Schedule

Activity	Description	Schedule
Source Removal	LPH extent assessment; working with AEP and land-owners to discuss and acquire access to private property to complete an LPH delineation program*	August to September 2019
	DPVE assessment of mechanical and electrical components and repairs*	June 2019 (completed)
	DPVE extraction well assessment*	August to September 2019
	Continued operation of DPVE	July 2019 – Until LPH removal confirmed to extent practicable
Permeable Reactive Barrier	Barrier installation preliminary design	April to June 2019
	Design Finalization	July 2019
	Barrier installation	September to November 2019
	Barrier performance monitoring	November 2019- On-going
Plume Monitoring	Semi – annual groundwater monitoring and sampling	April and October of each year program continued semi-annually
	Plume stability analysis	
	Natural attenuation assessment	
Risk Management	Source removal and PRB installation	See above for schedule
	Groundwater monitoring and sampling program	April and October of each year program continued semi-annually
	Soil vapour sampling program	January and August of each year program continued semi-annually
	Risk assessment summary	

*The DPVE will continue to operate in its current configuration during this time-period.

10.0 Closure

This report was prepared by Clifton Associates Ltd. for the account of Sears Canada Inc. The material in it reflects Clifton Associates Ltd. best judgment available to it at the time of preparation. Any use that a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Clifton Associates Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This report has been prepared in accordance with generally accepted engineering practice common to the local area. No other warranty, expressed or implied is made.

No conclusions should be made based on this report regarding any concentrations of substances in other areas of the Site. Other Contaminants of Concern may be present at the Site in areas that were not investigated. Clifton Associates Ltd. accepts no responsibility for any deficiencies or inaccuracies in the information provided in this report that are the direct result of intentional or unintentional misrepresentations, errors or omissions of the persons interviewed, or information reviewed.

No environmental site investigation or remediation can wholly eliminate uncertainty regarding environmental conditions in connection with a property. This investigation is intended to reduce, but not eliminate the uncertainty regarding environmental conditions. Conclusions regarding the condition of the Site do not represent a warranty that all areas within the site and beneath structures are of the same quality as those sampled. Further, contamination could also exist in forms not indicated by the investigation.

The work was based in part upon the environmental quality guidelines and regulations in effect when the work was begun. Future regulatory changes may require reassessment of the findings of this investigation.

Clifton Associates Ltd.

Stephen d'Abadie, MEng
Environmental Scientist

PROFESSIONAL GEOLOGIST ALBERTA
DAVID G. PRITCHARD

David Pritchard, PGeol
Senior Environmental Geoscientist

Association of Professional Engineers
and Geoscientists of Alberta
Permit to Practice P4823

Reference List

Alberta Environment and Parks. (2016). *Alberta Tier 1 Soil and Groundwater Remediation Guidelines*

Alberta Environment and Parks. (2016). *Alberta Tier 2 Soil and Groundwater Remediation Guidelines*

British Columbia Ministry of Environment: *Technical Guidance on Contaminated Sites 4,* version 1, September 2010

Canadian Council of Ministers of the Environment: *A Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours*, 2014

Clifton Associates Ltd.: *Updated Site Management Plan (2014), Hounsfield Heights-Briar Hill Community, Calgary, Alberta,* April 2014

Clifton Associates Ltd.: *Subsurface Investigation-Mall Area and Hounsfield Heights,* 22 January 2016

Clifton Associates Ltd.: *Sears Canada Inc., Revised Soil Vapour Monitoring Program (Update Fall 2016), Hounsfield Heights and North Hill Mall, Calgary, Alberta*, 20 October 2016.

Clifton Associates Ltd.: *Sears Canada Inc., Soil Vapour Monitoring Points Installation Report, Hounsfield Heights and North Hill Mall, Calgary, Alberta*, 20 October 2016.

Health Canada: *Federal Contaminated Site Risk Assessment in Canada, Part VII: Guidance for Soil Vapour Intrusion Assessment at Contaminated Sites*, September 2010

Intrinsik Environmental Sciences Inc.: *Draft Report*, *Human Health and Ecological Risk Assessment for the Hounsfield Heights Community and North Hill Mall, Calgary, Alberta,* December 2015

Johnson, P.C., & R. Ettinger: *Heuristic Model for predicting the Intrusion Rate of Contaminant Vapours into Buildings*, 1991

Pennsylvania Department of Environmental Protection: *Land Recycling Program Technical Guidance for Vapour Intrusion into Buildings from Groundwater and Soil under Act 2,* 2015.

United States Environmental Protection Agency. *Compendium of Methods for the Determination of Compounds in Ambient Air, Second Edition, Compendium Method TO-15, Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GCMS).* EPA/625/R96/01b, 1999.

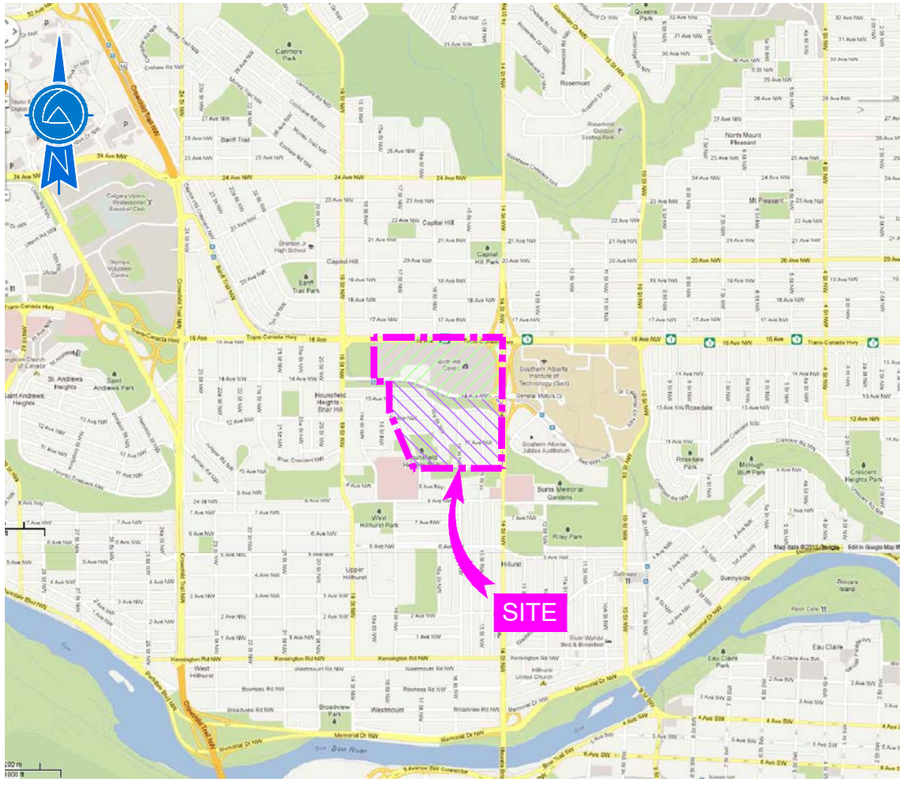
United States Environmental Protection Agency. *Background Indoor Air Concentrations of Volatile Organic Compounds in North American Residences (1990-2005): A Compilation of Statistics for Assessing Vapour Intrusion.* Office of Solid Waste and Emergency Response. EPAé530éR10/001, 2011.

Zhu, J., Wong, S.L., and Cakmak, S. *Selected volatile organic compounds in residential air in the city of Ottawa, Canada*. Environ Sci Technol. 39(11): 3964-3971. 2005.

Zhu, J., Wong, S.L., and Cakmak, S. *Nationally representative levels of selected volatile organic compounds in Canadian residential indoor air: population based survey.* Environ Sci Technol. 2013;47(23):13276-83.

Figures

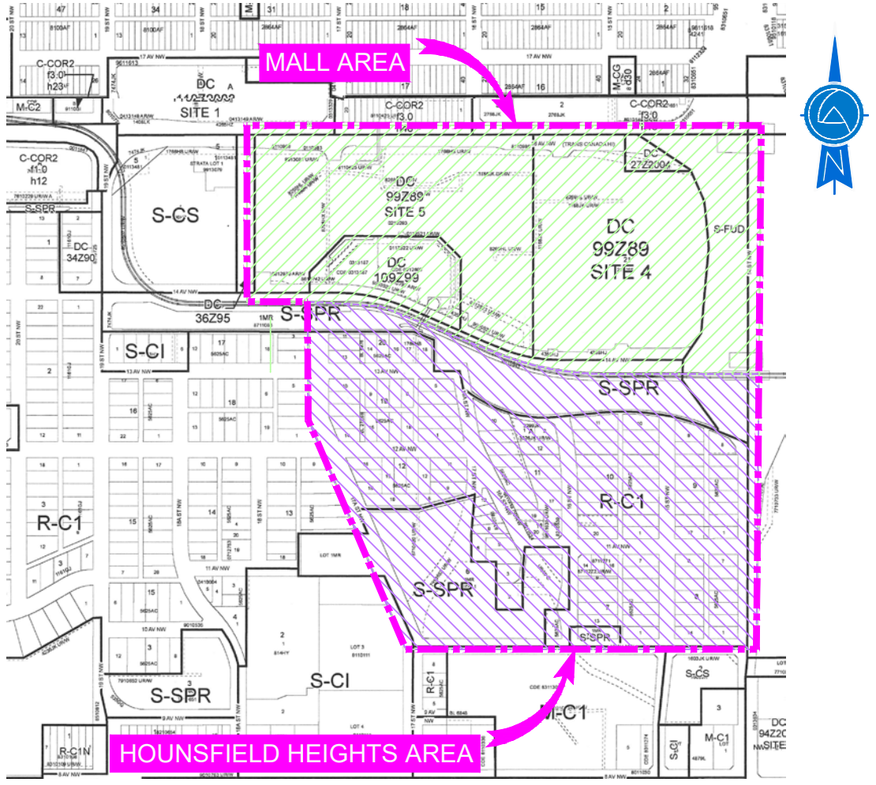
Clifton



GENERAL SITE LOCATION

SCALE 1:30,000

0 0.5 1.0 1.5 km



SURROUNDING LAND USE

SCALE 1:7,500

0 100 200 300 m

LEGEND:

- SITE BOUNDARY
- MALL AREA
- HOUNSFIELD HEIGHTS AREA
- CITY OF CALGARY BY-LAW ZONING

LAND USE DISTRICTS:

RESIDENTIAL - CONTEXTUAL ONE DWELLING DISTRICT	R-C1
MULTI-RESIDENTIAL - CONTEXTUAL LOW-PROFILE DISTRICT	MC-1
MULTI-RESIDENTIAL - CONTEXTUAL GRADE-ORIENTED DISTRICT	MC-G
COMMERCIAL - CORRIDOR 2 DISTRICT	C-COR2
SPECIAL PURPOSE - SCHOOL, PARK, AND COMMUNITY RESERVE DISTRICT	S-SPR
SPECIAL PURPOSE - COMMUNITY INSTITUTION DISTRICT	S-CI
SPECIAL PURPOSE - COMMUNITY SERVICE DISTRICT	S-CS
SPECIAL PURPOSE - FUTURE URBAN DEVELOPMENT DISTRICT	S-FUD
DIRECT CONTROL DISTRICT	DC

NOTES:

1. CITY OF CALGARY ROAD MAP PROVIDED BY CANADIAN CARTOGRAPHICS CORPORATION, 2012.
2. LAND USE MAP PROVIDED BY THE CITY OF CALGARY.

ENGINEER: Clifton Associates

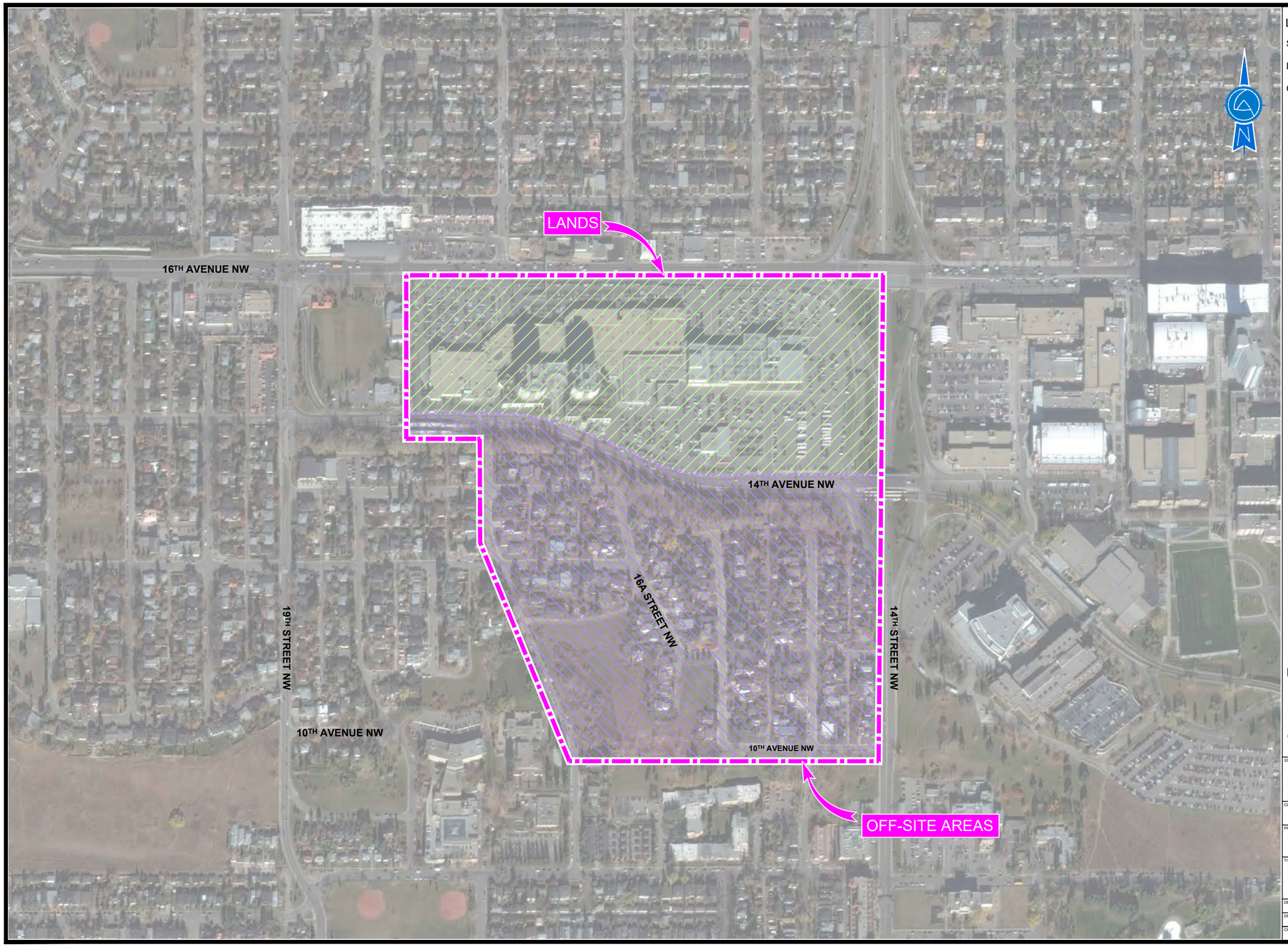
CLIENT: SEARS

PROJECT: REVISED REMEDIATION PLAN
HOUNSFIELD HEIGHTS AND MALL AREAS
CALGARY, ALBERTA

TITLE: SITE LOCATION AND SURROUNDING LAND USE

DESIGNED		SCALE: AS SHOWN	DATE: 2019-08-06
DRAWN: RD		PROJECT NO.: CG2430.1 E33	FIG.: 1
CHECKED: TK		FILE NO.: CG2430.1-E33-01	

W:\CG2430.1 SEARS\CURRENT\E33\CG2430.1-E33-01.dwg, 08/06/2019 1:26:19 PM



LEGEND:

- SITE BOUNDARY
- LANDS
- OFF-SITE AREAS

NOTES:

1. AERIAL PHOTOGRAPH PROVIDED BY GOOGLE EARTH PRO. AIR PHOTO DATE: OCT 23, 2015.

0 50 100 150 200 250m

ENGINEER: Clifton Associates

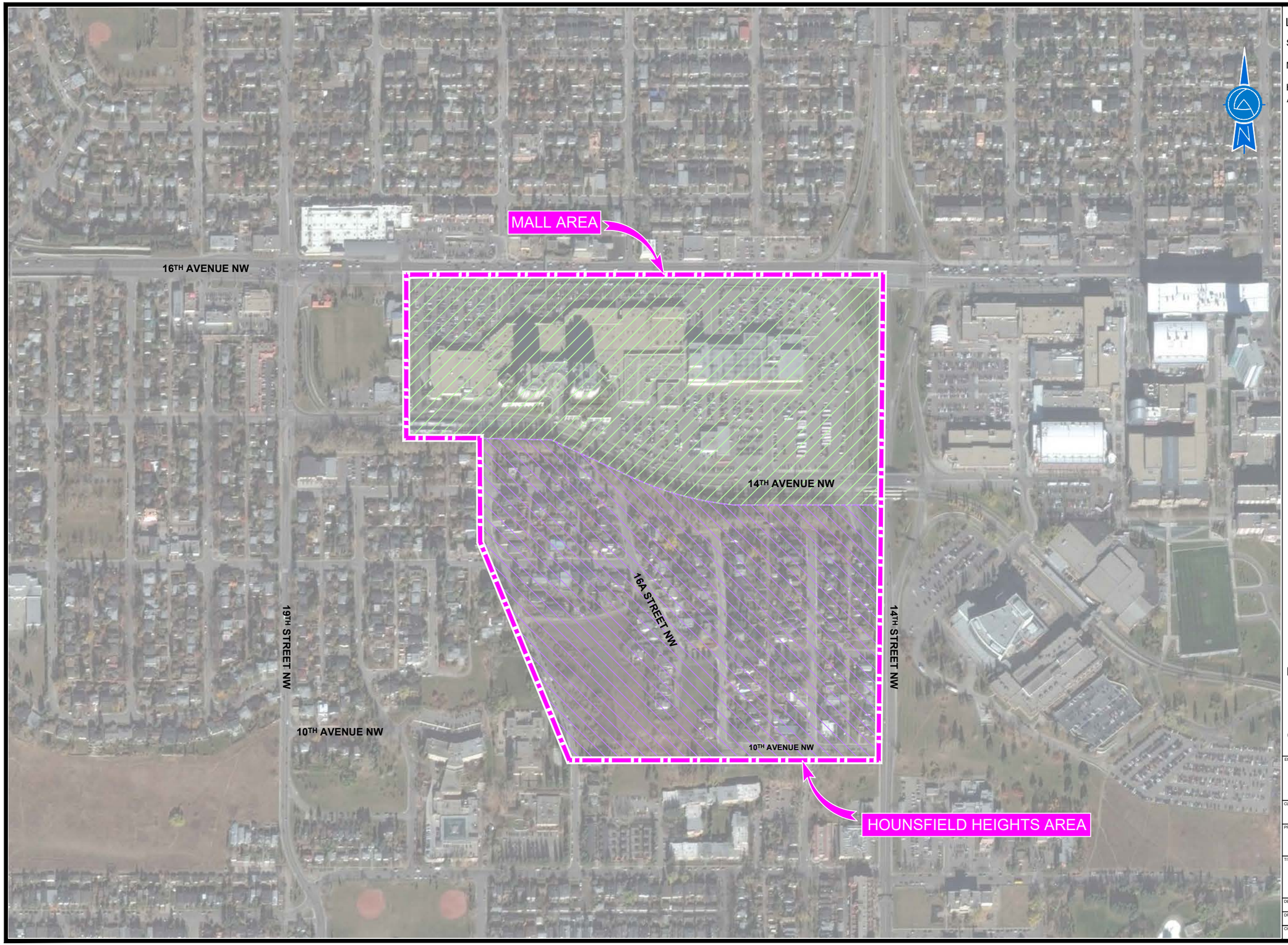
CLIENT: SEARS

PROJECT: REVISED REMEDIATION PLAN
HOUNSFIELD HEIGHTS AND MALL AREAS
CALGARY, ALBERTA

TITLE: LANDS AND OFF-SITE AREAS

DESIGNED	SCALE: 1:5000	DATE: 2019-08-06
DRAWN: RD	PROJECT NO.: CG2430.1 E33	FIG.: 2
CHECKED: TK	FILE NO.: CG2430.1-E33-02	

W:\CG2430.1 SEARS\CURRENT\E33\CG2430.1-E33-02.mxd, 09/06/2019 1:28:03 PM



LEGEND:

- SITE BOUNDARY
- MALL AREA
- HOUNSFIELD HEIGHTS AREA

NOTES:

1. AERIAL PHOTOGRAPH PROVIDED BY GOOGLE EARTH PRO. AIR PHOTO DATE: OCT 23, 2015.

0 50 100 150 200 250m

ENGINEER: Clifton Associates

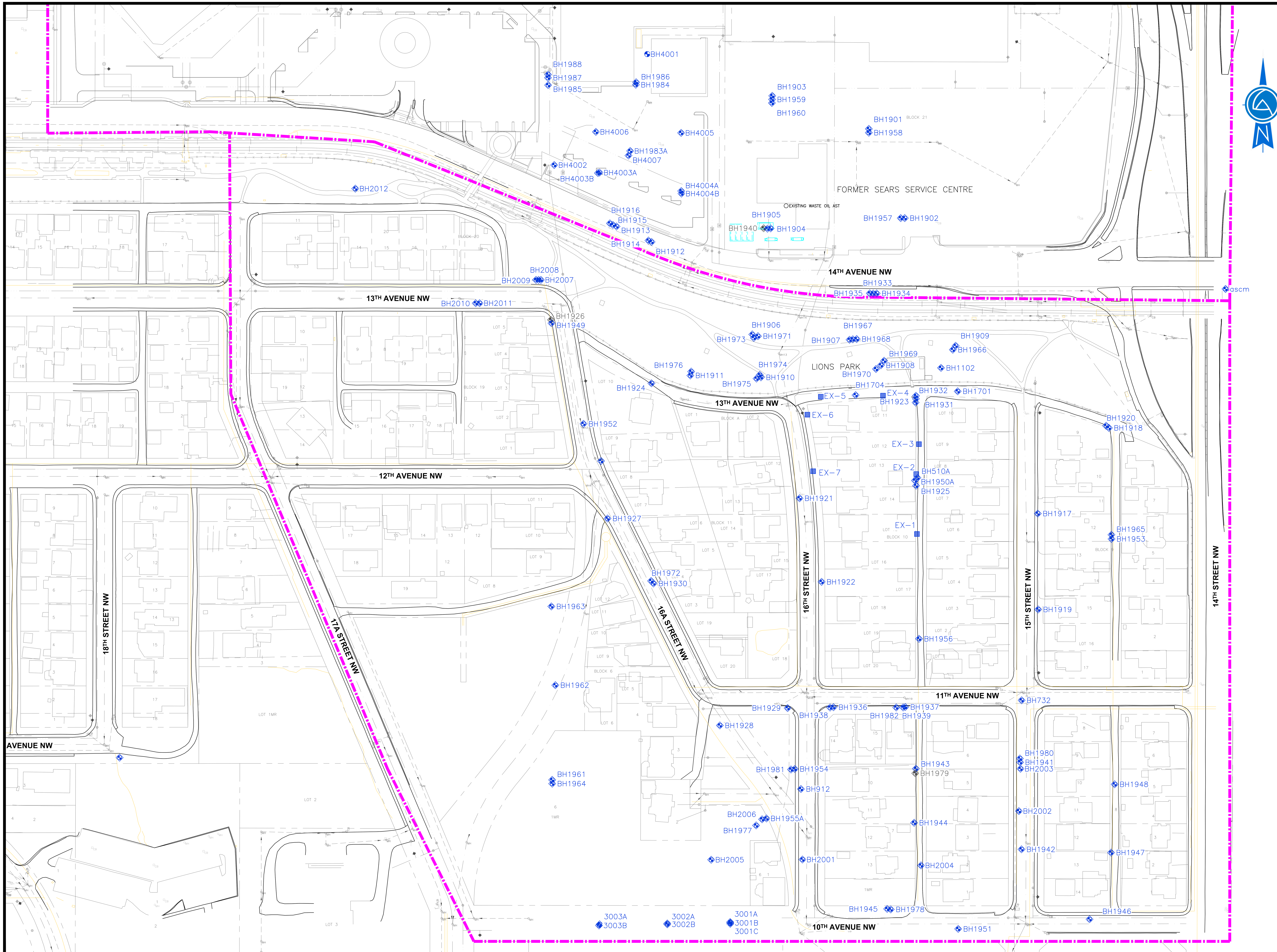
CLIENT: SEARS

PROJECT: REVISED REMEDIATION PLAN
HOUNSFIELD HEIGHTS AND MALL AREAS
CALGARY, ALBERTA

TITLE: SITE AND SURROUNDING PROPERTIES

DESIGNED	SCALE	DATE
	1:5000	2019-08-06
DRAWN: RD	PROJECT NO.: CG2430.1 E33	FIG. 3
CHECKED: TK	FILE NO.: CG2430.1-E33-03	

W:\CG2430.1 SEARS\CURRENT\E33\CG2430.1-E33-03.dwg, 08/06/2019 1:29:08 PM



LEGEND

SITE BOUNDARY	
EXTRACTION WELL	
LRT TRACKS	
FENCE LINE	
LEGAL LINE	
FORMER FACILITY/FEATURE	
BUILDING	
GROUNDWATER MONITORING WELL	
BOREHOLE	

UTILITY LINES & SYMBOLS

NATURAL GAS LINE	
SANITARY SEWER	
STORM SEWER	
WATER	
CATCH BASIN	
FIRE HYDRANT	
LIGHT STANDARD	
MANHOLE	
UTILITY POLE	

NOTES:

1 DRAWING COMPILED FROM PLANIMETRIC FILES SUPPLIED BY THE CITY OF CALGARY (INCLUDING U/G UTILITIES) & FROM SITE ASSESSMENT INFORMATION. ADDITIONAL REFERENCES FROM SEACOR ENVIRONMENTAL ENGINEERING INC., DRAWINGS 149-5A11.DWG, 149-5A6.DWG.

0 10 20 30 40 50 m

PLOT SIZE 22x34

ENGINEER: Clifton Associates

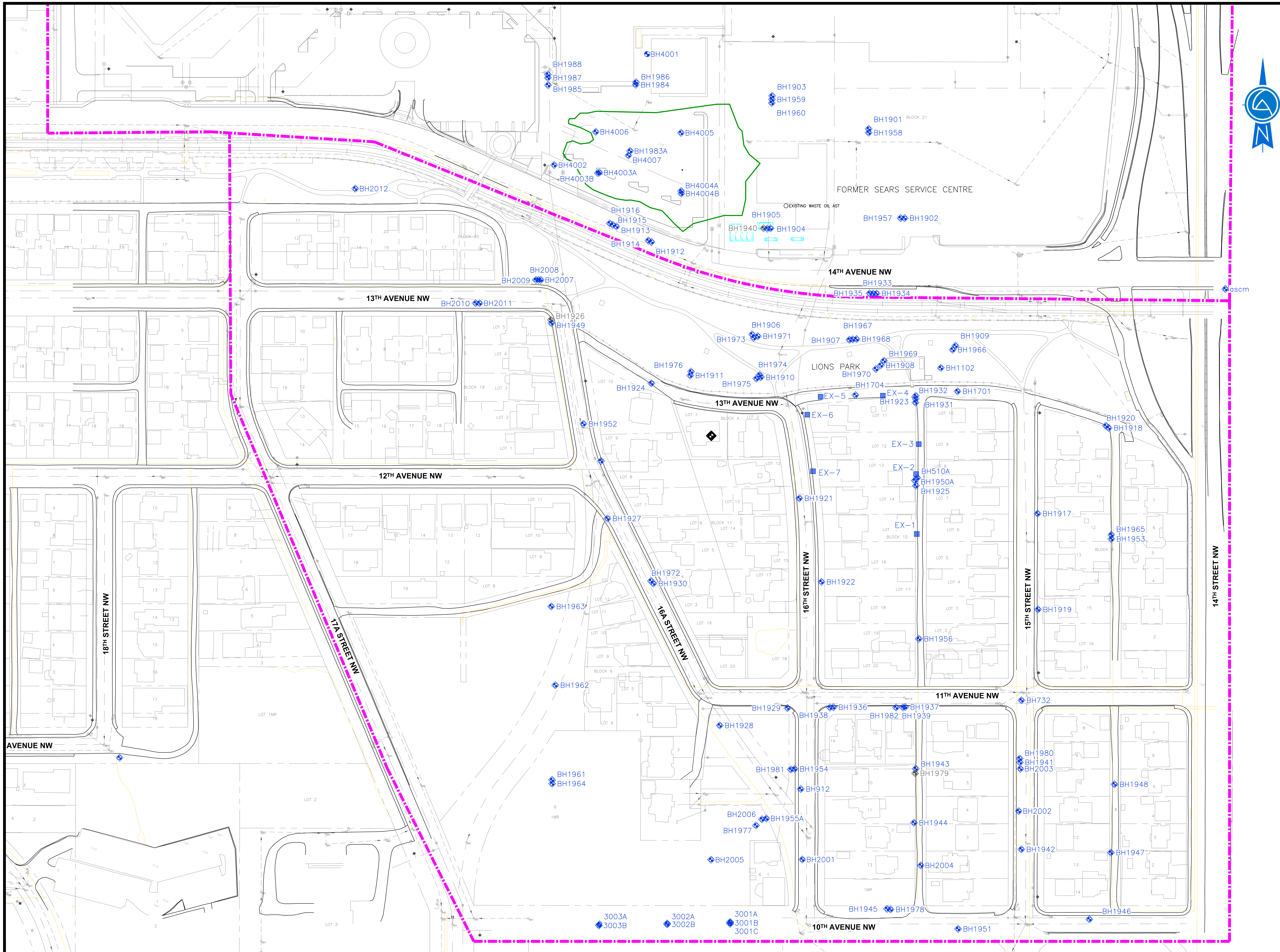
CLIENT: SEARS

PROJECT: REVISED REMEDIATION PLAN
HOUNSFIELD HEIGHTS AND MALL AREAS
CALGARY, ALBERTA

TITLE: MONITORING WELL LOCATION PLAN

DESIGNED	SCALE	DATE
	1:1000	2019-08-06
DRAWN: RD	PROJECT NO.: CG2430.1 E32	FIG. 4
CHECKED: TK	FILE NO.: CG2430.1-E32-04	

W:\CG2430.1 SEARS\CURRENT\E32\REMEDIATION PLAN\CG2430.1-E32-04.dwg, 08/06/2019 1:23:00 PM



LEGEND

SITE BOUNDARY
EXTRACTION WELL
LRT TRACKS
FENCE LINE
LEGAL LINE
FORMER FACILITY/FEATURE
BUILDING
GROUNDWATER MONITORING WELL
BOREHOLE
EXCAVATION EXTENT

UTILITY LINES & SYMBOLS

NATURAL GAS LINE
SANITARY SEWER
STORM SEWER
WATER
CATCH BASIN
FIRE HYDRANT
LIGHT STANDARD
MANHOLE
UTILITY POLE

NOTES:

1 DRAWING COMPILED FROM PLANIMETRIC FILES SUPPLIED BY THE CITY OF CALGARY (INCLUDING U/G UTILITIES) & FROM SITE ASSESSMENT INFORMATION. ADDITIONAL REFERENCES FROM SEACOR ENVIRONMENTAL ENGINEERING INC., DRAWINGS 149-5A11.DWG, 149-5A6.DWG.

0 10 20 30 40 50 m

PLOT SIZE 22x34

ENGINEER

Clifton Associates

CLIENT

SEARS

PROJECT

REVISED REMEDIATION PLAN
HOUNSFIELD HEIGHTS AND MALL AREAS
CALGARY, ALBERTA

TITLE

MONITORING WELL LOCATION PLAN
AND EXCAVATION EXTENT

DESIGNED	SCALE 1:1000	DATE 2019-08-06
DRAWN RD	PROJECT NO. CG2430.1 E32	FIG. 5
CHECKED TK	FILE NO. CG2430.1-E32-05	

W:\CG2430.1 SEARS\CURRENT\E32\REMEDIATION PLAN\CG2430.1-E32-05.dwg, 08/06/2019 1:26:50 PM

Appendix A
Environmental Protection Order and Alberta Environment and Parks Communication

Clifton

Alberta Environment and Parks

ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT

BEING CHAPTER E-12 R.S.A. 2000 (the "Act")

ENVIRONMENTAL PROTECTION ORDER NO. EPO-2018/01-SSR

Sears Canada Inc. [Sears]
C/O
Lloyd McLellan
FTI Consulting Canada Inc.
1900, 520 – 3rd Avenue SW,
Calgary, Alberta T2P 0R3

And

Concord North Hill GP Ltd. [Concord]
4000, 421 – 7 Avenue SW
Calgary, Alberta T2P 4K9

[Collectively the "Parties"]

WHEREAS Sears or one of its predecessor companies (Contill Realty Ltd.), was the registered owner of the lands legally described as Plan 8210266, Block 21 [the "Lands"] located in the City of Calgary, Alberta from October 31, 1958 until June 18, 2015;

WHEREAS Sears operated both a retail clothing store and an automotive repair/Gas Bar [the "Service Station"], which were located in two separate buildings on the Lands;

WHEREAS Sears owned and/or operated the Service Station from 1958 until the decommissioning in 1995;

WHEREAS in a SEACOR Environmental Engineering Inc. ("SEACOR") report titled "Environmental Activities Synthesis Report – October 1995 To August 1997 – North Hill Sears Gas Bar", dated August 1997 [the "SEACOR August 1997 Report"], the Service Station was identified as commencing operation in 1958 and ceasing operation in 1995;

WHEREAS the SEACOR August 1997 Report identified that an underground storage tank at the Service Station leaked gasoline sometime between the late 1970's to early 1980's;

WHEREAS the SEACOR August 1997 Report identified exceedances of then applicable provincial guidelines of that time (Alberta Environmental Protection (AEP) Risk Management Criteria (RMC) Level II and Level III course grained soil (CGS) criteria) for both the Lands and the adjacent/downgradient properties (the "Off-Site") n both soil and groundwater for hydrocarbon residuals and benzene (the "Substances");

WHEREAS the Lands were purchased by Concord on June 18, 2015 and Concord is the current registered owner of the Lands;

WHEREAS on March 29, 2016, the environmental consultant, Clifton Associates Ltd, ("Clifton") on behalf of Sears, submitted a reported titled "Remedial Action Plan for Mall and Hounsfield Heights Areas Calgary, Alberta" [the "RAP"], which identified in section 4.1 of the RAP, that the Alberta Tier 1 Soil and Groundwater Remediation Guidelines [the "Tier 1 Guidelines'] would be used as remediation targets;

WHEREAS on August 31, 2016, another consultant, Intrinsik Corp. on behalf of Sears, submitted a reported titled "Soil Vapour Quality Guidelines for Hounsfield Heights and Mall Areas" [the "Soil Vapour Guidelines"] to Alberta Environment & Parks ("AEP"), which were accepted by AEP as identified in a letter to Mr. Greg Paliouras of Sears, dated January 27, 2017;

WHEREAS Clifton Associates on behalf of Sears, submitted a report to AEP titled, "Revised Soil Vapour Monitoring Program (Update Fall 2016)", dated October 20, 2016 [the "Soil Vapour Monitoring Program"]. The Soil Vapour Monitoring Program was approved by AEP by letter dated January 27, 2017;

WHEREAS, numerous delineation and sampling events have been undertaken since the SEACOR August 1997 Report. The most recent Annual Summary Report completed by Clifton and dated May 19, 2017 (Annual summary report Hounsfield Heights – Briar Hill Community Calgary Alberta) identified that Substances are still present above the current Alberta Tier 1 Criteria;

WHEREAS there are several data gaps in the information regarding contamination both on the Lands and Off-Site which required additional work including:

- Completion of additional groundwater monitoring wells to characterize benzene and 1,2-DCA in groundwater in the southern extent of the plume in the Off-Site;
- Continue to conduct semi-annual groundwater sampling events to characterize the groundwater plume on the Lands and Off-Site;
- Continue to conduct semi-annual soil vapour sampling events as per the approved Soil Vapour Monitoring Program to characterize soil vapour; and
- Continued operation and maintenance of the DPVE system.

WHEREAS Craig Knaus, Compliance Manager, South Saskatchewan Region, has been appointed a Director for the purposes of issuing environmental protection orders under the Act (the "Director");

WHEREAS the Director is of the opinion that a release of a Substance has occurred, and that the Substance has caused, is causing or may cause an adverse effect on the environment;

WHEREAS the Director is of the opinion that the remedial actions taken to date by the Parties are not sufficient to confine, manage or remediate the Substances and that further work to delineate remediate and/or manage the Substances is required;

WHEREAS the Parties are a "person responsible" for the Substance, as defined in section 1(tt) of the Act;

THEREFORE, I, Craig Knaus, the Director, pursuant to section 113 of the *Environmental Protection and Enhancement Act*, DO HEREBY ORDER:

1. The Parties shall immediately re-commence the semi-annual soil vapour monitoring (high and low water table events) as described in the Soil Vapour Monitoring Program, including a sampling event prior to March 30, 2018);

2. Immediately recommence the Groundwater sampling and monitoring program as described in most recent program demonstrated in 2017 Second Quarter Groundwater Monitoring and Sampling Report, July 14, 2017.

3. By **July 1, 2018**, complete delineation activities to fully delineate the dissolved gasoline plume based on the data gaps identified in the Clifton Associates report July 2016 titled, "2016 Supplemental Drilling Report Hounsfield Heights-Briar Hill Community, Calgary, AB";

4. The Parties shall by **December 15, 2018**, submit a written plan to the Director to remediate the Substances on the Lands or any of the Substances from the Lands that have migrated to the Off-Site areas (the "Remediation Plan").

5. The Remediation Plan shall be prepared by a qualified environmental professional that meets the requirements for professional sign criteria as established by Remediation and Reclamation Sign Off Advisory Committee.

6. The Remediation Plan shall include, at a minimum, the following:

    a. A proposal outlining:

        i. the remediation and/or Risk Management Plan for all Substances in, on or under the Lands including all soil, subsoil and groundwater; and

        ii. the remediation and/or Risk Management Plan for all Substances in, on or under all Offsite areas, including to the North, South, East and West to which the Substances may have migrated including all soil, subsoil and groundwater.

    b. A detailed description of the work that will be undertaken for both the Lands and the Off-Site areas to meet the Soil Vapour guidelines as per Soil Vapour Quality Guidelines for Hounsfield Heights and Mall Areas August 31, 2016 and Alberta Tier 1 Soil and Groundwater Remediation Guidelines, as applicable [the "Criteria"] for all other media; and

    c. A schedule of implementation to implement the

Remediation Plan, with a completion date of no later than **March 4, 2019**, or as otherwise approved by the Director.

7. The Company shall implement the work set out in the Remediation Plan in accordance with the schedule of implementation that is approved by the Director.

8. The Parties shall submit written status reports to the Director as follows:

    a. Final, stamped versions of sampling and monitoring reports (for any media – soil, vapour, ground water) are to be submitted to the Director by the end of the 2nd month following the month the sampling and/or monitoring event occurred.

    b. Annual Report are required to be submitted to the Director by **March 31 of each year** for the previous January 1st to December 31st time period, with the first submission due March 31, 2019.

        i) At a minimum, each Annual Report all of the following:
        - Summary of the communications with the affect landowners that occurred during the year;
        - List of any concerns that arose from other parties;
        - An explanation of how these concerns were addressed;
        - Any recommended changes to improve communication;
        - A summary description of all assessment, remediation and monitoring work undertaken;
        - A summary of the results obtained within the year;
        - Details on the operation of the Soil Vapour Extraction system and an evaluation of the effectiveness of the system;
        - Identification of data gaps with recommendations to address them, and;
        - Recommendations and commitments for future assessment, monitoring and remediation work.

9. The Parties shall respond to inquiries from Off-Site landowners affected by the release within 3 business days of the inquiry being sent to the Parties individually or collectively.

10. The Parties shall within 30 days of the date of this Order, create, publish and activate a communications website.

11. Within 5 business days of the communications website being activated, the Parties shall provide the web address for the website to the Off-Site landowners affected by the release.

12. The Parties shall post on the communications website:

    a. regular status updates
    b. copies of all finalized and stamped sampling and monitoring reports.
    c. A summary of the results of the posted finalized and stamped reports

DATED at the City of Calgary in the Province of Alberta, this 28 day of February, 2018.

Craig Knaus
Compliance Manager (the Director)
South Saskatchewan Region

Section 91 of the *Environmental Protection and Enhancement Act* may provide a right of appeal against this decision to the Alberta Environmental Appeals Board. There may be a strict time limit for filing such an appeal. A copy of section 91 is enclosed. For further information, please contact the Board Secretary at #306 Peace Hills Trust Tower, 10011 - 109 Street, Edmonton, Alberta, T5J 3S8; telephone (780) 427-6207; fax (780) 427-4693.

Notwithstanding the above requirements, the Parties shall obtain all necessary approvals in complying with this order.

Take notice that this environmental protection order is a remedial tool only, and in no way precludes any enforcement proceedings being taken regarding this matter under this Act or any other legislation.

Alberta Environment and Sustainable Resource Development

Environmental Operations
Southern Region
2nd Floor, 2938 – 11 Street NE
Calgary, AB T2E 7L7
Telephone: 403-297-7605
Fax: 403-297-2749
www.environment.alberta.ca

July 20, 2012

File No.: 00141934

Mr. Greg Paliouras
Associate VP Construction, Energy and Maintenance
Sears Canada Inc.
Dept 702CE, Suite 700
290 Yonge Street
Toronto, Ontario M5B 2C3

Dear Mr. Paliouras:

Subject: Sears North Hill - Hounsfield Heights Briar Hill Remediation and Monitoring NW Calgary, Alberta

Environment and Sustainable Resource Development (ESRD) has reviewed the following Clifton Associates Ltd. reports regarding remediation and monitoring activities in the area including Hounsfield Heights Briar Hill community and City of Calgary property:
Pre-Commissioning Monitoring Report. January 17, 2011.
First Quarter Site Monitoring Report. July 11, 2011.
Status Update of Activities Site Management Plan. July 18, 2011.
Second Quarter Site Monitoring Report. October 5, 2011.
Third Quarter Site Monitoring Report. March 2012.

ESRD met with Clifton Associates (Clifton) on June 20, 2012; and with Clifton, Alberta Health Services, and representatives from the Hounsfield Heights Briar Hill community association (HHBHCA) on June 28, 2012. The following comments are based on our review of the above captioned reports and the discussions at the June 20th and 28th meetings.

ESRD principles of contaminated sites management require that sources be removed or controlled as soon as practicable. There is a concern that source material may remain on the Sears site to the north and that it could continue to affect the Hounsfield Heights Briar Hill community located downgradient. ESRD requests the Sears provide information on whether areas remain on the Sears site that may need further assessment. We acknowledge that Sears undertook significant remedial activities on an area of the Sears North Hill property. Confirmation is needed for other areas to ensure source removal has been completed to the extent possible.

A dual phase vapour extraction system (DPVES) was commissioned in February 2011 to remove liquid phase petroleum hydrocarbons (LPHC) from the northern area of 13 Avenue between 16 and 15 Streets NW in the Hounsfield Heights Briar Hill community. The extent of LPHC plume appears to have reduced in the area where the DPVES has been operating although LPHC remain in the area of BH1703. Removal of LPHC needs to continue and we understand that the DPVES may be adjusted to focus on the area where LPHC remain.

Results from the groundwater monitoring and sampling program show that the dissolved phase plume is expanding to the south/southwest. Groundwater analytical results from selected monitoring wells located south of 11 Avenue NW exceeded the Alberta Tier 1 groundwater

remediation guidelines. In particular, Benzene exceeded the vapour inhalation guideline for residential land use in fine grained soil at monitoring well BH1303 in 2011.

Site conditions and the requirements under the Alberta Tier 1 and Tier 2 guidelines have changed since the acceptance of the May 31, 2006 Site Management Plan, therefore ESRD requires that the following actions be undertaken by Sears Canada Inc. (Sears) including:

- Fully delineate the dissolved plume south of 11th Avenue;
- Sample the groundwater adjacent to where it discharges to the surface in the south portion of zone 3 and evaluate it for risk to ecological receptors. There would be no risk from petroleum hydrocarbons to humans having direct contact with the surface water from these seepages;
- Delineate the soil gas/vapour plume in Zones 1, 2 and 3;
- Assess potential risks from ingress of petroleum hydrocarbon vapours to indoor air in areas where the guidelines are exceeded for the vapour inhalation pathway, and in areas where it has been determined that elevated soil gas/vapours are present;
- Establish a soil gas monitoring program on properties that may be at risk from vapour ingress to indoor air. Compare current needs with those previously identified in the Clifton April 5, 2007 response to Alberta Environment regarding the soil vapour monitoring;
- Implement additional remediation techniques to deal with the expanding dissolved phase plume. As discussed, this could include enhanced bioremediation. Monitored natural attenuation is not appropriate while LPHC are being removed and when the dissolved plume is not stable. Multiple remediation approaches are needed to address the petroleum hydrocarbon impacts;
- Review the groundwater monitoring and sampling program to ensure adequate coverage based on current conditions and trends; and,
- Apply the Tier 1 guidelines to monitoring well locations along 11th Avenue NW and include these wells in the groundwater monitoring and sampling program.

At the June 28 meeting, all parties agreed that there could be improvements in communication between Sears and community representatives: as activities are to be implemented at the site; for interpretation of the technical information by enhancing the presentation of information to improve the communication of the results; and, for evaluation of remediation progress. Therefore ESRD requires that Sears establish a communication protocol and schedule that will meet the needs of all parties.

A time line for remediation needs to be established which could identify key milestones along the time line and evaluate progress. We understand that these would be estimates and that plans change over time, but it is important to manage the site activities within a timeframe for reaching the remediation objectives.

As part of the ongoing management of risks at the site while remediation is undertaken, ESRD requests a commitment letter from Sears to undertake remediation and management of the site

over the long term. This is a standard requirement of the Department when risk management is undertaken.

Sears shall incorporate all of the above into a new Site Management Plan for the Hounsfield Heights Briar Hill area going forward. Parts of the original Site Management Plan from 2006 are outdated, and the July 18, 2011 Status Update of Activities Site Management Plan does not address the changes at the site and the need for additional assessment, monitoring and remediation activities. ESRD suggests that the SMP for the Hounsfield Heights Briar Hill area be a separate document from the SMP for the North Hill shopping area as separate approaches are needed for each area.

ESRD requests that Sears submit a new Site Management Plan to our office by December 2012 which shall contain a plan to address all of the points identified in this letter. Without delay, Sears should proceed with further assessment work at the site in conjunction with developing the new Site Management Plan.

Please contact me at 403-297-8270 if you wish to discuss the contents of this letter further.

Sincerely,

Kim Kirillo
Contaminated Sites Coordinator

cc: Stephen d'Abadie, Clifton Associates
Emmanuel Malterre, Sears Gas Plume Committee
David Crowe, Alberta Health Services

Appendix B
Alberta Environment and Parks Communication and Responses

Clifton

10 April 2019

Attention:	Craig Knaus - Compliance Manager
Company:	Alberta Environment and Parks, Operations – South Saskatchewan Region
Address:	2nd Floor, 2938-11th Avenue Calgary, Alberta T2E 2L7

Response to Remediation Plan Hounsfield Heights and Mall Areas Comments **File CG2430.1**
Calgary, Alberta

Clifton Associates Ltd. (Clifton) is pleased to respond to Alberta Environment and Parks (AEP), on behalf of Sears Canada Inc. (Sears), regarding the comments pertaining to the *Remediation Plan, Hounsfield Heights and Mall Areas* submitted in December 2018.

The comments provided by AEP have been attached in Appendix A of this response in the document entitled *Subject: Remediation Plan Hounsfield Heights and Mall Areas, Calgary, Alberta* (AEP Remediation Plan Comments) dated 20 February 2019. Following a review of these comments and an in-person meeting between AEP, Clifton, Intrinsik Environmental Services Inc. (Intrinsik) and Sears on 19 March 2019, Clifton has prepared the following response which has been structured to address all nine comments in the order they were presented within the AEP Remediation Plan Comments document.

Response to Remediation Plan Comments

Comment 1
Sears acknowledges that the Remediation Plan is to address all areas of the site, including the Hounsfield Heights and Mall Areas. While no active remedial measures have been proposed for the Mall Area within this Remediation Plan, this area will continue to be included in the groundwater and soil vapour monitoring and sampling program. Between 2006 and 2007 Sears completed a remedial excavation, to the extent practicable, of the western portion of the Mall Area parking lot. Since completion of the excavation, the entire Mall Area has been continued to be included in the groundwater and more recent soil vapour monitoring and sampling programs. Residual impacts within the Mall Area will be included as part of the monitoring natural attenuation (MNA) approach as presented within the Remediation Plan. This approach has been selected based on the fact that source removal within the Mall Area has been achieved, residual soil and groundwater petroleum hydrocarbons (PHC) have been largely delineated, there are currently no known health risks associated with the residual impacts within the Mall Area, and significant remedial efforts have already been completed on a portion of the Mall Area lands.

Comment 1 A

Soil delineation of residual PHCs within the Mall Area has been achieved primarily along the western, eastern and northern boundaries. Delineation of these residual PHCs has been completed to the Alberta Tier 1 Soil and Groundwater Remediation Guidelines, 10 January 2019 (2019 AEP Tier 1 Guidelines). An area along the northern extent of the parking lot at borehole location BH1984 showed an exceedance for benzene. Sears is proposing an additional borehole be completed to the north of this area, within the corridor between the two existing structures. Additional delineation will also be completed to the west of the previously identified soil impacts within borehole BH1983A. This borehole will be advanced south of borehole BH1985. Advancement of additional boreholes within this portion of the Mall Area will require approval from the current property owners.

Figure 1 of Appendix B shows the potential locations for the additional delineation drilling and the current soil delineation which has been achieved.

Delineation of impacts within the groundwater in the Mall Area has been achieved to the 2019 AEP Tier 1 Guidelines. During the most recent groundwater monitoring and sampling event, only one monitoring well (MW1904) exceeded the applicable guidelines. If additional drilling is completed to achieve greater soil delineation, it is anticipated that additional monitoring wells will be added which can further delineate the residual impacts within the groundwater.

Figure 2 of Appendix B shows the current groundwater delineation within the Mall Area.

Clifton is also aware that the owners of a portion of the Mall Area recently submitted a response to the Remediation Plan as it relates to their property. A review of this response will be completed to determine if it will result in additional investigative requirements at the site.

Comment 1 B

The remedial excavation of a portion of the Mall Area completed in 2006 and 2007 included on-site soil treatment through allu-bucket technology. At the time of the excavation, the soil was treated to the guidelines of the time which were the AEP *Risk Management Guidelines for Petroleum Storage Tank Sites* (October 2001), commercial land use, coarse-grained soil for protection of vapour inhalation. The excavation report was completed in 2008 and submitted to AEP for public access through the Environmental Site Assessment Repository (ESAR) database.

Comment 1 C

Communication between Sears, Clifton and the owner of the Mall Areas has been on-going, related to obtaining site access for investigative purposes and providing relevant reports.

Comment 2

Delineation of the 1,2 – DCA within the groundwater has been achieved. Figure 3 of Appendix B shows the most recent exceedances of this parameter with respect to the 2019 AEP Tier 1 Guidelines. Statistical analysis has been completed on the 1,2 – DCA results from seven monitoring wells at the periphery of the groundwater plume. Of these seven wells, six show a deceasing and/or stable trend for this parameter. Only one well, MW1954 shows a statistical trend of increasing concentrations. This well is located in the southwest portion of the Hounsfield Heights Area and is down-gradient from where the liquid activated carbon barrier application is being proposed. The liquid activated carbon barrier is intended to control the expansion of the groundwater plume within this area. It should also be noted that the concentration of 1,2-DCA within this well is below the 2019 AEP Tier 1 Guidelines.

Comment 3
The trigger and contingency plan for 1,2-DCA exceedances within the groundwater would be based on the site-specific risk-based Tier 2 Guideline created by Intrinsik. If exceedances of this guideline do occur, the already implemented soil vapour monitoring program would be used as a second line of evidence to determine if a potential health risk exists. It should be noted that during our most recent groundwater monitoring and sampling event, no wells throughout the entire Mall or Hounsfield Heights Areas exceeded the site-specific risk-based Tier 2 Guideline value for 1-2 - DCA. In addition to this, the implementation of the liquid activated carbon barrier along 11th Avenue NW is intended to control the groundwater plume from expanding further to the south. Based on this information, the Remediation Plan, as presented, addresses the concerns associated within the potential expansion of the 1,2-DCA plume within the groundwater.

Comment 4
Sears acknowledges that currently AEP is not in a position to allow for an administrative removal of the domestic use aquifer pathway and that this exclusion may be re-visited in the future. It is important to note that the removal of this pathway would result, according to our most recent groundwater monitoring and sampling data, in only one well exceeding the next most stringent guidance pathway, for one parameter, across the entire site. This pathway, which is incomplete, is directing the majority of the Remediation Plan. Future consideration into the removal of this pathway can have a significant impact to the Remediation Plan that has been prepared for the both the Mall and Hounsfield Heights Areas.

Comment 5
Sears acknowledges that AEP continues to support the site-specific Soil Vapour Quality Guidelines created by Intrinsik.

Comment 6 a to d, inclusive
Sears acknowledges that AEP has not yet accepted the previously submitted site-specific risk-based Tier 2 Guidelines for groundwater. To derive guidelines which will be acceptable to AEP, it has been requested that the previously submitted guidelines be adjusted to reflect the following changes:

- Use of a larger groundwater data set as the previous guidelines were calculated based on data up to 2016;
- Use of default Henry's Constant;
- Use of default soil moisture content; and,
- Zone specific guidelines protective of all geological units.

Based on a preliminary revision of the site-specific risk-based Tier 2 Guidelines generated by Intrinsik and using our most current groundwater sampling results, there are no new groundwater monitoring wells which exceed the revised guidelines as compared to the previously proposed guidelines. Intrinsik is currently in the process of finalizing the revised site-specific risk-based Tier 2 Guidelines for groundwater. The revised Tier 2 Guidelines will be submitted as an amendment letter to the previously submitted Human Health and Ecological Risk Assessment completed for the site. It is anticipated that the revised Tier 2 Guidelines will be submitted by 15 April 2019.

Comment 7
Sears acknowledges that the named parties of the EPO are responsible for obtaining access to private properties. If access cannot be granted, AEP is to be advised.

Comment 8 and 9
Sears acknowledge that comments 8 and 9 reflect a timeline request to meet the Alberta Tier 1 Guidelines, not the revised Tier 2 guidelines as stated within the AEP Remediation Plan Comments document. To address this, Clifton will revise their remedial options analysis to reflect a shorter time-frame to determine if this is feasible. Comments 8 and 9 of the AEP Remediation Plan Comments document will be addressed in a revised Remediation Plan. It is anticipated that the revised Remediation Plan will be submitted by 30 April 2019. It should be noted that if our further analysis of potential remedial options does not reveal a reduction in total estimated remediation time, the Remediation Plan will still be revised, providing more rationale behind the recommended approach and time-frame.

Closure

We trust our proposed changes and acknowledgement of your comments within the AEP Remediation Plan Comments document addresses each item such that upon submission of the revised documents (Tier 2 Guidelines and Remediation Plan) AEP will be in a position of accepting our proposed approach.

Yours truly,
Clifton Associates Ltd.

Stephen d'Abadie, M.Eng. PBiol
Project Manager

Attachments
Appendix A: AEP Remediation Plan Comments
Appendix B: Figures

Appendix A

Clifton

Alberta Environment and Parks

Operations
South Saskatchewan Region
2nd Floor, 2938 – 11 Street NE
Calgary, AB T2E 7L7
Telephone: 403-297-7605
Fax: 403-297-2749
www.aep.alberta.ca

February 20, 2019

File No.: 00141934

Mr. Greg Paliouras
Divisional Vice-President
Construction, Energy and Maintenance
Sears Canada Inc.
700 - 290 Yonge Street
Toronto, ON M5B 2C3

Dear Mr. Paliouras:

Subject: Remediation Plan Hounsfield Heights and Mall Areas, Calgary Alberta

Alberta Environment and Parks (AEP) has reviewed the Remediation Plan, Hounsfield Heights and Mall Areas, (December 2018) prepared by Clifton Associates for Sears Canada Inc. Our comments are provided below.

1) The Environmental Protection Order EPO-2018/01-SSR (EPO) specified that the remediation plan should encompass both the Lands and any impacted off-site areas. While AEP recognizes the priority and importance of work in the community, the remediation plan must be revised to encompass any additional work, if required, for the mall area (including both the Lands as defined in the EPO and the adjacent mall property owned by other parties). Some concerns to address include, but are not limited to, the following:

    a) Are impacts in the mall area (the Lands and adjacent mall property) sufficiently delineated, and if so, to what guidelines?

    b) What were the concentrations of petroleum hydrocarbons in the treated soil used as backfill?

    c) What communication has there been with the current owners of the adjacent mall property and have their concerns regarding impacts in the mall area been addressed?

2) Please note that as 1,2 DCA in groundwater is not completely delineated, and concentrations have not yet been shown to be stable or decreasing, the proposed groundwater and soil vapour monitoring, along with the accompanying contingency plan, are key components for AEP's acceptance of a final remediation plan.

3) The contingency plan must be revised to include a trigger and contingency in the event that the 1,2 DCA plume shows signs of expansion, or there are other indicators that natural attenuation of the dissolved phase plume is not occurring.

4) As noted in the remediation report, the domestic use aquifer pathway is not eligible for exclusion on the basis of bylaws that prohibit the installation of water wells. The pathway

being inoperable relies on an administrative control to ensure use of groundwater is restricted and as this is considered exposure control, the site is not eligible for regulatory closure. AEP is open to revisiting this option in future.

5) AEP continues to support the use of the site-specific soil vapour quality guidelines developed by Intrinsik and accepted by the Department.

6) Tier 2 soil and groundwater guidelines proposed in the April 2017 Human Health and Ecological Risk Assessment report have not been accepted by the Department. Prior to acceptance, the Tier 2 guidelines must be revised to limit adjustments to parameters that are measurable and stable as per the Alberta Tier 2 Soil and Groundwater Remediation Guidelines. It must be made clear that sufficient site-specific data is available to support parameter adjustments and that there is sufficient conservatism to ensure the same high level of protection across this large, geologically variable area. Revisions must include but are not limited to the following:

   a) Tier 2 groundwater guidelines for the protection of the vapour inhalation pathway were derived from maximum groundwater concentrations collected between February and September 2015. Justification is required to demonstrate that these concentrations are adequately conservative to encompass groundwater monitoring data collected since that time, including in other seasons.

   b) Tier 2 guidelines must be revised to use the default Henry's constant. AEP does not accept adjustments to the Henry's Law constant.

   c) Tier 2 guidelines must be revised to use the default soil moisture content. AEP does not recommend the use of site-specific soil moisture values as, in practice, this measurement is difficult to assess and must reflect both spatial and temporal variability for the site.

   d) Site-specific inputs were used for each geologic unit, calculating guidelines for each geologic unit in a designated sub area. Due to the size and variability of the site, as well as the uncertainty around the site-specific data and geologic units, the Tier 2 guidelines should be revised to a single guideline that is protective of all geologic units for a described area.

7) The named parties of the EPO are responsible to contact and negotiate access agreements with respective land owners. If access agreements cannot be reached please advise AEP.

8) A timeline must be provided for the the dissolved phase plume to achieve revised Tier 2 guidelines.

9) What active remedial measures will be employed to expedite achieving revised Tier 2 guidelines for the dissolved phase plume, and in particular, for 1,2 DCA (roughly 3-5 year time frame)?

Required revisions to the remediation plan are expected to occur concommitantly with the activities in the proposed remediation schedule.

The information presented in this letter is based upon applicable environmental legislation and guidelines for the assessment, remediation, and management of contaminated sites in consideration of the information provided. This letter is not intended to exempt any party from future liability where either the land use may change, or additional concerns arise from any contamination remaining on or off the site.

If you have any questions or concerns regarding this correspondence, please contact Barbara McEwen at (403) 297-3591.

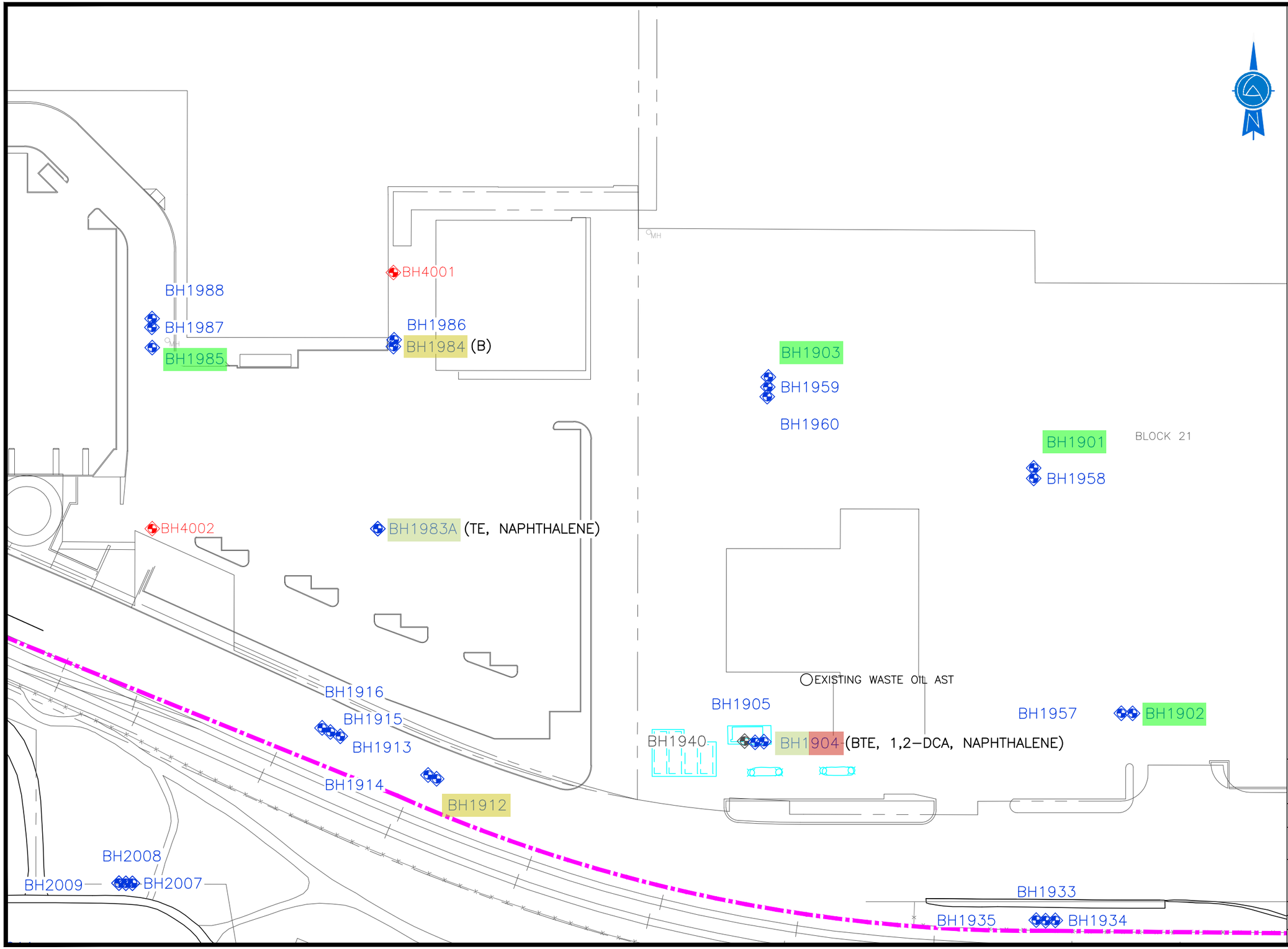
Sincerely,

Craig Knaus
Compliance Manager (the Director)

cc: Calvin Chan, Concord North Hill GP Ltd.
Paul Gordon, Suncor Energy Products Partnership
Stephen d'Abadie, Clifton Associates
Barbara McEwen, AEP
Rick McClelland, AEP

Appendix B

Clifton



LEGEND:

- SITE BOUNDARY
- LRT TRACKS
- LEGAL LINE
- FORMER FACILITY/FEATURE
- EXISTING GROUNDWATER MONITORING WELL
- PROPOSED BOREHOLE LOCATION
- MEETS AEP 2019 TIER 1 GUIDELINES
- EXCEEDS AEP 2019 TIER 1 GUIDELINES (UNIT 1)
- EXCEEDS AEP 2019 TIER 1 GUIDELINES (UNIT 2)
- EXCEEDS AEP 2019 TIER 1 GUIDELINES (UNIT 3)
- EXCEEDS AEP 2019 TIER 1 GUIDELINES (UNIT 4)
- EXCEEDS AEP 2019 TIER 1 GUIDELINES (UNIT 5)

NOTES:

1. DRAWING COMPILED FROM PLANIMETRIC FILES SUPPLIED BY THE CITY OF CALGARY (INCLUDING U/G UTILITIES) & FROM SITE ASSESSMENT INFORMATION. ADDITIONAL REFERENCES FROM SEACOR ENVIRONMENTAL ENGINEERING INC., DRAWINGS 149-5A11.DWG, 149-5A6.DWG.

0 10 20 30 m

SCALE 1:750 PLOT SIZE 11x17

ENGINEER: Clifton Associates

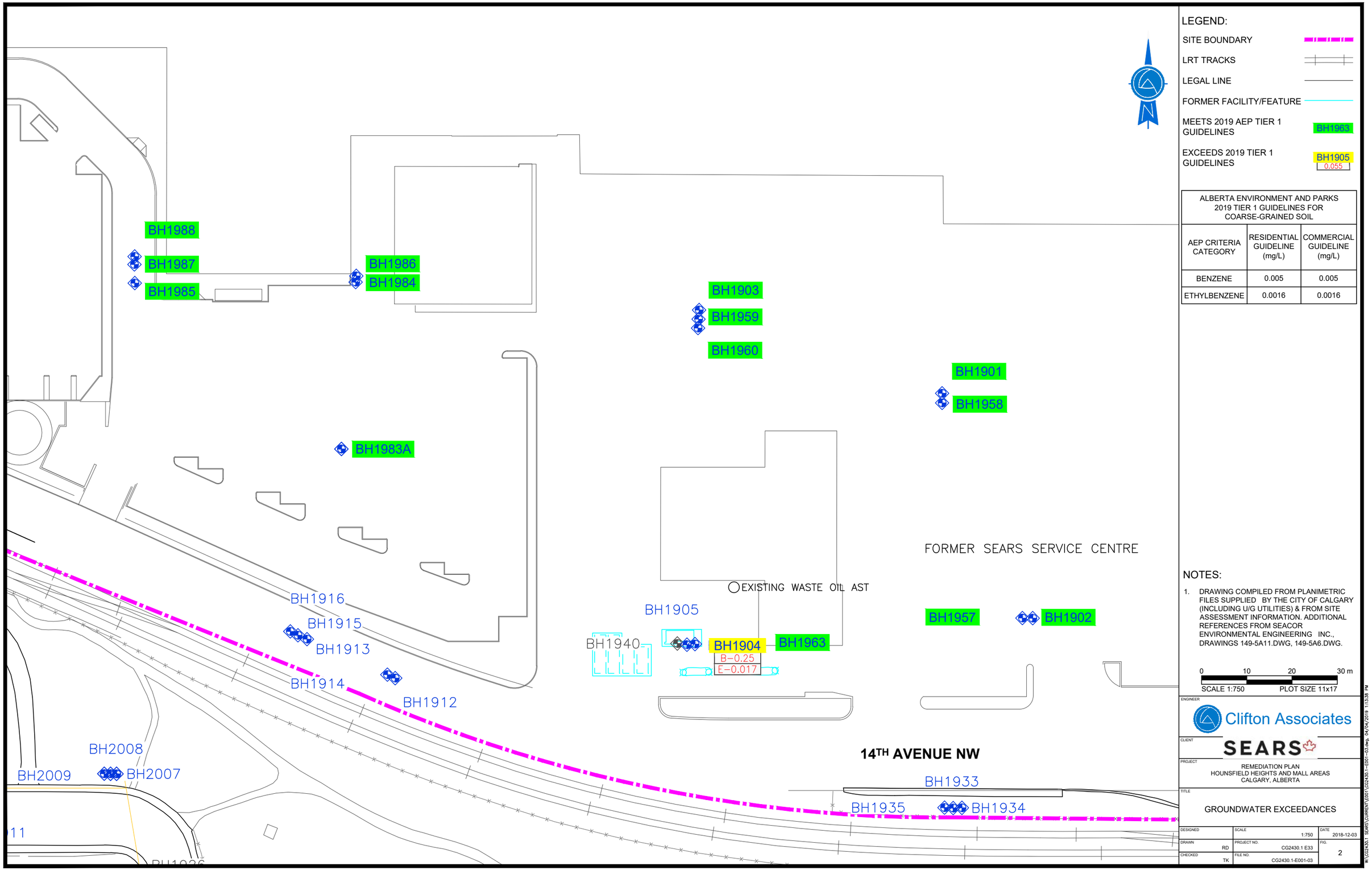
CLIENT: SEARS

PROJECT: REMEDIATION PLAN
HOUNSFIELD HEIGHTS AND MALL AREAS
CALGARY, ALBERTA

TITLE: SOIL EXCEEDANCES AND PROPOSED DRILLING LOCATIONS

DESIGNED	SCALE	DATE
	1:750	2018-12-03
DRAWN: RD	PROJECT NO. CG2430.1 E33	FIG. 1
CHECKED: TK	FILE NO. CG2430.1-E001-05	

M:\CG2430.1 SEARS\CURRENT\E001\CG2430.1-E001-05.dwg, 04/04/2019 1:13:53 PM



LEGEND:

SITE BOUNDARY

LRT TRACKS

LEGAL LINE

FORMER FACILITY/FEATURE

MEETS 2019 AEP TIER 1 GUIDELINES — BH1963

EXCEEDS 2019 TIER 1 GUIDELINES — BH1905 (0.055)

ALBERTA ENVIRONMENT AND PARKS 2019 TIER 1 GUIDELINES FOR COARSE-GRAINED SOIL		
AEP CRITERIA CATEGORY	RESIDENTIAL GUIDELINE (mg/L)	COMMERCIAL GUIDELINE (mg/L)
BENZENE	0.005	0.005
ETHYLBENZENE	0.0016	0.0016

NOTES:

1. DRAWING COMPILED FROM PLANIMETRIC FILES SUPPLIED BY THE CITY OF CALGARY (INCLUDING U/G UTILITIES) & FROM SITE ASSESSMENT INFORMATION. ADDITIONAL REFERENCES FROM SEACOR ENVIRONMENTAL ENGINEERING INC., DRAWINGS 149-5A11.DWG, 149-5A6.DWG.

0 10 20 30 m

SCALE 1:750 PLOT SIZE 11x17

ENGINEER: Clifton Associates

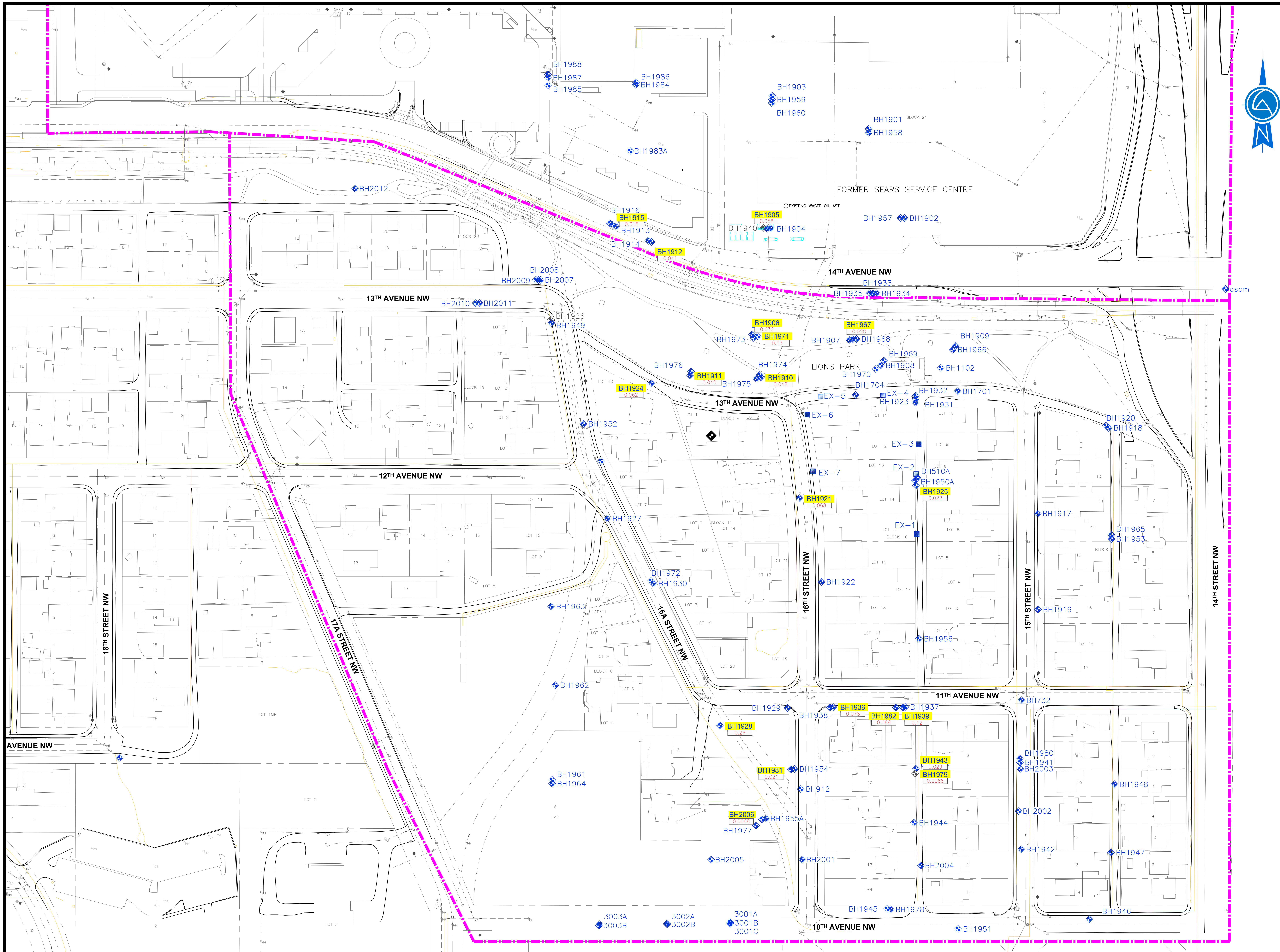
CLIENT: SEARS

PROJECT: REMEDIATION PLAN
HOUNSFIELD HEIGHTS AND MALL AREAS
CALGARY, ALBERTA

TITLE: GROUNDWATER EXCEEDANCES

DESIGNED		SCALE 1:750	DATE 2018-12-03
DRAWN	RD	PROJECT NO. CG2430.1 E33	FIG. 2
CHECKED	TK	FILE NO. CG2430.1-E001-03	

M:\CG2430\1 SEARS\DRAWN\E001\CG2430.1-E001-03.dwg, 04/04/2019 11:33:38 PM



LEGEND

- SITE BOUNDARY
- EXTRACTION WELL
- LRT TRACKS
- FENCE LINE
- LEGAL LINE
- FORMER FACILITY/FEATURE
- BUILDING
- EXISTING GROUNDWATER MONITORING WELL
- EXCEEDS AEP 2016 TIER 1 GUIDELINES — BH1905 0.055

UTILITY LINES & SYMBOLS

- NATURAL GAS LINE
- SANITARY SEWER
- STORM SEWER
- WATER
- CATCH BASIN — CB
- FIRE HYDRANT
- LIGHT STANDARD
- MANHOLE — MH
- UTILITY POLE

ALBERTA ENVIRONMENT AND PARKS 2016 TIER 1 GUIDELINES FOR COARSE-GRAINED SOIL		
AEP CRITERIA CATEGORY	RESIDENTIAL GUIDELINE (mg/L)	COMMERCIAL GUIDELINE (mg/L)
1,2 - DCA	0.005	0.005

NOTES:

1 DRAWING COMPILED FROM PLANIMETRIC FILES SUPPLIED BY THE CITY OF CALGARY (INCLUDING U/G UTILITIES) & FROM SITE ASSESSMENT INFORMATION. ADDITIONAL REFERENCES FROM SEACOR ENVIRONMENTAL ENGINEERING INC., DRAWINGS 149-5A11.DWG, 149-5A6.DWG.

0 10 20 30 40 50 m

PLOT SIZE 22x34

ENGINEER: Clifton Associates

CLIENT: SEARS

PROJECT: 2018 FALL MONITORING AND SAMPLING EVENT HOUNSFIELD HEIGHTS AND MALL AREAS CALGARY, ALBERTA

TITLE: 1,2 - DCA GROUNDWATER EXTENTS

DESIGNED	SCALE 1:1000	DATE 2018-11-27
DRAWN RD	PROJECT NO. CG2430.1 E32	FIG. 3
CHECKED TK	FILE NO. CG2430.1-E001-04	

W:\CG2430.1 SEARS\CURRENT\E001\CG2430.1-E001-04.dwg, 03/14/2019 12:56:56 PM

01 May 2019

Attention:	Craig Knaus - Compliance Manager
Company:	Alberta Environment and Parks, Operations – South Saskatchewan Region
Address:	2nd Floor, 2938-11th Avenue Calgary, Alberta T2E 2L7

Response to Comments on the Remediation Plan **File CG2430.1**
Hounsfield Heights and Mall Areas
Calgary, Alberta

Clifton Associates Ltd. (Clifton) is pleased to respond to Alberta Environment and Parks (AEP), on behalf of Sears Canada Inc. (Sears), regarding specific comments pertaining to the document titled *Remediation Plan, Hounsfield Heights and Mall Areas* (Remediation Plan) submitted in December 2018.

The comments provided by AEP have been attached in Appendix A of this response in the letter entitled *Subject: Remediation Plan Hounsfield Heights and Mall Areas, Calgary, Alberta* (AEP Response) dated 20 February 2019.

Our response specifically addresses Comments 8 and 9 of the AEP Response. Clifton, on behalf of Sears, previously responded to Comments 1 to 7 on 10 April 2019.

AEP Remediation Plan Comments

AEP Comments 8 and 9 specifically relate to the remediation of the entire North Hill Mall and Hounsfield Heights Areas (the Site). It should be noted that although the AEP Response, specifically Comments 8 and 9, refer to the Site-specific Tier 2 Guidelines, it was clarified during an in-person meeting held on 19 March 2019 that the response should have stated the AEP Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AEP Tier 1 Guidelines, January 2019).

Based on this information, the revised comments should state:

- Comment 8: A timeline must be provided for the dissolved phase plume to achieve AEP Tier 1 Guidelines; and
- Comment 9: What active remedial measures will be employed to expedite achieving the AEP Tier 1 Guidelines for the dissolved phase plume, and in particular, for 1,2 – dichloroethane (DCA) (roughly 3-5-year time frame)?

It is understood that for unconditional Site closure to be obtained, all lands and media must be remediated to the AEP Tier 1 Guidelines. The Site-specific Tier 2 Guidelines are risk-management based guidelines for application during Site management.

Remediation Plan

To address AEP Comments 8 and 9, the framework of the Remediation Plan, as currently presented, is summarized below.

The Remediation Plan is a risk management-based approach, with active remediation for the removal of residual liquid petroleum hydrocarbon (LPH) in the northern portion of Hounsfield Heights and plume expansion control using a permeable reactive barrier along 11th Avenue NW. The short-term goal of the Remediation Plan is to achieve the Site-specific Tier 2 Guidelines across the entire Site, with a long-term goal of achieving the AEP Tier 1 Guidelines. Achieving the AEP Tier 1 Guidelines across the entire Site would require complete LPH removal and dissolved phase petroleum hydrocarbon (PHC) remediation through the permeable reactive barrier and natural attenuation.

In developing the Remediation Plan, Clifton identified the challenges associated with Site remediation, particularly within the Hounsfield Heights Area where access is limited. The majority of this area is occupied by private residences. Of the total area within the residential community, there is approximately 40% which can be accessed without consent from private landowners, 30% of which comprises Lion's Park and the green space within the southwestern portion of the Site. Due to these limitations, placing a timeframe on the complete remediation of this portion of the Site is challenging. In addition, showing that this entire area has been remediated to AEP Tier 1 Guidelines may not be feasible without full access.

Comment 8

Comment 8 of the AEP Response states that a timeline must be provided for the dissolved phase plume to achieve the AEP Tier 1 Guidelines.

To address this comment, Clifton has considered three time ranges with respect to achieving the remedial targets:

- Short Term: Less than 5 years;
- Medium Term: Less than 15 years; and
- Long Term: > 15 years.

These timeframes can be applied to the current Remediation Plan with respect to achieving the revised Site-specific Tier 2 Guidelines as well as the AEP Tier 1 Guidelines. The goal of the current Remediation Plan is to achieve the revised Site-specific Tier 2 Guidelines in the short-term (<5 years) and the AEP Tier 1 Guidelines in the long-term goal (>15 years).

Placing a definitive time frame on achieving the AEP Tier 1 Guidelines across the entire Site is extremely challenging. These challenges primarily revolve around the fact that the limitation to access all areas of the Site produces data gaps in the LPH and dissolved phase plume characterization as well the ability to apply remedial technologies that can address the entire Site area.

These data gaps result in uncertainty as to the full extent and composition of the LPH and dissolved phase plume. Not knowing the concentrations or even being able to confirm the presence of the contaminants of concern (COCs) in large portions of the Site, particularly in Hounsfield Heights, makes it extremely difficult to determine how long it will take to remediate these areas. In terms of remediation, these access restrictions also limit the effectiveness of a variety of potential remedial options.

As a result of these challenges, placing a definitive timeframe on achieving the AEP Tier 1 Guidelines across the entire Site is not realistic. Therefore, it is our professional opinion that achieving the AEP Tier 1 Guidelines across the entire Site will be a long-term objective.

During our assessment of defining a time-frame for achieving the AEP Tier 1 Guidelines across the entire Site we did consider the application of additional remedial options targeting specific portions of the Site. In particular, Lion's Park and the North Hill Mall Area both represent two portions of the Site where access is not as restricted as it is within the community. The application of specific remedial approaches for either of these two areas could feasibly achieve the AEP Tier 1 Guidelines within a defined time-frame. However, due to the uncertainty in the remedial timeframe for the community itself and the fact that remediating these areas will not alleviate this uncertainty, investing additional resources into areas of the Site where risk to human health has been determined as low is not recommended.

Comment 9

Comment 9 of the AEP Response requests a description of what active remedial measures will be employed to expedite achieving the AEP Tier 1 Guidelines for the dissolved phase plume, and in particular, for 1,2 – DCA.

The current Remediation Plan employs two active remedial measures: the continued operation of the dual phase vapour extraction (DPVE) system; and the proposed implementation of a permeable reactive barrier along 11th Avenue NW.

The DPVE will continue to actively remove PHC impacted groundwater and residual LPH from the subsurface within its radius of influence. This system, as currently operating, will help to move the Site towards the AEP Tier 1 Guidelines in the long-term.

The permeable reactive barrier is an active system in the sense that it will continually adsorb and promote the biodegradation of PHCs within the groundwater as it migrates through the barrier. By reducing concentrations of the dissolved phase plume the down gradient areas will achieve the AEP Tier 1 Guidelines sooner than relying solely on natural attenuation.

As the above information was presented within the Remediation Plan that was reviewed by AEP, it is our understanding that they are seeking additional remedial measures which can expedite achieving the AEP Tier 1 Guidelines within the dissolved phase plume across the entire Site.

To address this request, Clifton has considered additional measures and options for remediation of the Site on an accelerated basis taking into account Site-specific limitations. These options are presented below based on two applicable Site areas:

- Hounsfield Heights (excluding Lion's Park); and

- Lions Park and the North Hill Mall Area.

The primary difference between these two areas is the ability/ease of access. Hounsfield Heights primarily consists of residential properties, transected by roadways and laneways and includes a green space in the southwestern corner. Access within this portion of the Site is extremely limited which has a significant effect on the type of remedial option available for application. The Lion's Park and North Hill Mall Area generally consist of open spaces, except for the Light Rail Transit system south of 14th Avenue NW. Access in this area is restricted to approval from the landowners; however, based on past experience access has been granted through the appropriate access agreement avenues.

The following factors have been considered in assessing the application of additional remedial measures to accelerate achieving the AEP Tier 1 Guidelines for the dissolved phase plume throughout the Site:

- Contaminants of Concern (COCs; What contaminants exist at the Site?);
- Remediation Technology Feasibility (Is this technology applicable given Site characteristics?);
- Technology effectiveness (Can the technology effectively reduce concentrations to the applicable criteria?);
- Cost (What are the initial and recurring costs associated with a specific technology?);
- Disruption to local area (what are the perceived impacts to the surrounding lands?); and
- Duration (How long will the remediation take?).

Any one of these factors can wholly eliminate a potential remedial option and are often used in consideration of one another to identify the most appropriate approach. A summary has been provided at the end of this section referencing each specific remedial approach and our recommendation for application.

Contaminants of Concern

The dissolved phase COCs throughout the Hounsfield Heights and Lion's Park/North Hill Mall Area have been well documented through several subsurface investigations conducted on-Site since the late 1990's. Three broad PHC contaminant groups have been identified:

- Benzene, toluene, ethylbenzene, xylenes (BTEX) and PHC fractions F1 to F4;
- Volatile Organic Compounds (VOCs); and
- Polycyclic Aromatic Hydrocarbons (PAHs).

Within each of the above categories, the following parameters have specifically been identified as the most prevalent within their contaminant group:

- BTEX and PHC fractions F1 to F4 – Benzene;
- VOCs – 1,2 -DCA; and
- PAHs – Naphthalene.

Delineation of each of these parameters has been achieved within the dissolved phase plume across the entire Site. Benzene and 1,2 – DCA are the two most prevalent parameters throughout the entire Site, being observed at the margins of the dissolved phase plume. Naphthalene distribution within the groundwater is limited from the source area to the northern extent of the Hounsfield Heights community.

It should also be noted that consideration of any additional remedial effort to accelerate achieving the AEP Tier 1 Guidelines across the entire Site needs to consider the uncertainty surrounding the presence of LPH. Obtaining delineation of the LPH was presented within the Remediation Plan. Currently, the full extents of the LPH remain unknown and until delineation and remediation of this is achieved, accelerating the remediation of the dissolved phase plume will be challenging.

Remedial Technology Feasibility

Remedial technology can be presented in two broad categories, in-situ and ex-situ treatment. In-situ treatment involves the remediation of the COCs within the media they reside and includes chemical, biological and physical remedial approaches. Ex-situ treatment involves the remediation of the COCs by physically removing the contaminated media and either treating it and returning it to the subsurface or removing it off-Site for appropriate disposal. Ex-situ remedial approaches have been determined not to be feasible based on their associated costs and disruption to the Site.

With respect to the dissolved phase plume, all remedial approaches considered will be in-situ. In the case of a groundwater extraction system, although the media is extracted from the subsurface, treated aboveground and discharged this will still be considered in-situ for the purposes of this response.

From a technology perspective in-situ chemical, biological and physical remedial methods are all feasible at the Site.

Remedial Technology Effectiveness

Once a remedial approach has been identified as technologically feasible, an assessment into the effectiveness of employing that specific approach must be completed. For the purposes of this response, the effectiveness of the various approaches presented below have been assessed using a desktop approach, opposed to field level and pilot scale testing which provides more accurate data related to remedial technology effectiveness. In terms of effectiveness, with respect to Comment 9 of the AEP Response, we have assessed a variety of remedial options and their ability to accelerate achieving the AEP Tier 1 Guidelines within the dissolved phase plume across the entire Site.

When considering in-situ remedial technology effectiveness a primary concern is the estimated radius of influence a specific technology can achieve. This is a critical factor in determining the most effective approach for a site. In-situ applications such as groundwater/vapour extraction systems are ideal for areas where access is limited as they can provide continuous treatment over a larger area that may not be accessed otherwise. In contrast, in-situ injections are often limited by the radius of influence they can achieve, have a finite lifetime in terms of effectiveness and often result in multiple applications being required to achieve the remedial targets.

Remedial technology effectiveness is addressed below, separately, for the Hounsfield Heights and Lion's Park/North Hill Mall Areas.

Remedial Technology Effectiveness – Hounsfield Heights (excluding Lion's Park)

The community of Hounsfield Heights is a densely populated residential community consisting of single-family dwellings, transected by roadways and laneways as well as a green space in the southwestern margin of this area. The groundwater within this area of the Site ranges between 10 m below ground surface (bgs) in the northern portion

of the community to less than 2 m bgs in the southern extent of the community. The PHC impacts within the community consist primarily of dissolved phase BTEX and PHC fractions F1 to F4 as well as VOCs. The most prevalent components of each of these contaminant categories are benzene and 1,2 - DCA, respectively. It should also be noted that LPH is present within one well located in the northern portion of the Hounsfield Heights community within the laneway adjacent to the intersection at 13th Avenue and 16th Street NW.

Access for remediation purposes within Hounsfield Heights is limited to public lands including roadways, laneways and the green space in the southwestern corner. On-going and proposed remedial approaches for this portion of the community currently include the continued operation of the DPVE as well as the future implementation of a permeable reactive barrier along 11th Avenue NW.

The dissolved phase PHCs within the community extend approximately 200 m to the south and approximately 200 m east to west. At the surface, much of this area is covered by privately owned residential properties and as a result access for remedial purposes is limited. Remedial applications that can achieve a larger radius of influence would be ideal given these unique characteristics. Point source treatment using chemical oxidants or bio-additives are limited in their ability to treat large areas, due to their smaller radius of influence. These types of remedial applications cannot access a large enough portion of the Site to have a significant effect on accelerating remediation to the AEP Tier 1 Guidelines. As a result, injection based remedial efforts, using chemical oxidants or bio-additives within Hounsfield Heights, have been ruled out as being an effective approach.

There are two primary remedial approaches which have been identified as the most practicable and effective for Hounsfield Heights:

1. Physical extraction systems (vapour and/or groundwater)
2. Reactive barriers

As a reactive barrier has already been proposed for this area of the Site, this has not been considered in additional detail within this response.

Currently, there is one operating extraction system which is housed within Lion's Park and consists of a seven well extraction network within the northern portion of the community. The primary purpose of this DPVE is to remove the LPH, with a secondary objective of removing dissolved phase PHC impacted groundwater. Expansion of the current well network to cover a larger area of the Site has been considered. However, there are challenges associated with the physical capacity of the unit as it relates to the actual areas from which it can extract vapour and groundwater. The current system alone will not be able to provide treatment for the entire Hounsfield Heights area. As a result, the installation of a second unit housed within Lion's Park has been considered. The extraction well networks of both systems would have to be balanced to achieve the largest possible extraction zone. This will likely still result in areas which cannot effectively be treated based on the extent of the plume within this area. Furthermore, two operational units housed within Lion's Park will not be able to adequately achieve a radius of influence that addresses the dissolved phase plume in areas immediately north and to the south of 11th Avenue NW. To address these areas, a third extraction system, housed in the greenspace south of 11th Avenue, would be required.

Due to the limitations on where the extraction units can be housed and where the extraction wells can be installed, preliminary discussions with a local contractor have determined that there would be significant challenges associated

with achieving a vacuum strong enough to extract vapour and groundwater from all areas of the community using this approach.

As a summary, physical extraction systems within the community of Hounsfield Heights will have a limited effectiveness on accelerating remediation to the AEP Tier 1 Guidelines.

Remedial Technology Effectiveness – Lion's Park and North Hill Mall Area

The Lion's Park and North Hill Mall Area lie directly to the north of the Hounsfield Heights community. Between Lion's Park and the North Hill Mall is 14th Avenue NW and the LRT line. This area is more easily accessed for the purposes of remediation as compared to the Hounsfield Heights area. The dissolved phase plume within this area is largely delineated to the east, west and north. The depth to the groundwater within this area of the Site is approximately 10 m bgs. The PHC impacts within Lion's Park and the North Hill Mall consist primarily of dissolved phase BTEX and PHC fractions F1 to F4, VOCs and PAHs. The most prevalent components of each of these contaminant categories are benzene, 1,2 – DCA and naphthalene, respectively. There is no LPH present within any of the groundwater monitoring wells within these areas.

The Remediation Plan currently does not have any active remedial measures proposed for this portion of the Site. It should also be noted that the extraction well network, as currently configured, does address portions of the groundwater at the southern edge of Lion's Park. Due to the layout of this area, in-situ remedial efforts in the form of injections or the installation of a new, or an upgrade to the existing, extraction system would be appropriate. Any remedial efforts applied within Lion's Park should consider the up-gradient presence of the dissolved phase plume within the North Hill Mall Area.

Remedial technologies which would be effective in accelerating remediation of the dissolved phase plume to the AEP Tier 1 Guidelines within the Lion's Park and North Hill Mall areas include:

- Installation of a vapour/groundwater extraction system;
- Installation of a permeable reactive barrier;
- Chemical oxidation; and
- Bio-injection program (nutrients and/or oxygen additives).

Cost

The cost associated within any proposed remedial option much be taken into consideration and can be a key factor in determining the most appropriate approach for a given site. Often cost plays an important role when considering the actual potential risk associated the COCs. If the actual risk associated with the COCs is low, a balance between a more aggressive higher cost approach needs to be carefully weighed against a less aggressive lower cost approach. Consideration must also be given to determining whether or not a more aggressive, higher cost approach, will achieve the remedial targets any sooner.

There are two primary components to consider when factoring in the cost of a remediation program. These are the capital cost and on-going operational and maintenance costs.

The following remedial technologies which have been identified as feasible and effective (with some limitations) for addressing the COCs at the Site:

- Groundwater/vapour extraction systems (Hounsfield Heights and Lion's Park / North Hill Mall);
- Permeable reactive barriers (Hounsfield Heights and Lion's Park / North Hill Mall);
- Chemical oxidation (Lion's Park / North Hill Mall); and
- Bio-injection (Lion's Park / North Hill Mall).

With respect to cost, the groundwater/vapour extraction systems would have the highest combined capital/operational costs as compared to the other options. Permeable reactive barriers would have the second highest cost related to initial capital costs with no assumed operational and maintenance costs. A chemical oxidation or bio-injection program would have the lowest costs as compared to the other two options. However, there must be cost consideration with respect to having to complete multiple injections within a given location.

Disruption

Disruption to the local environment can have a significant effect on whether a remedial approach is appropriate for a specific site. From the options which have been proposed in the previous sections the installation of additional groundwater/vapour extraction systems would have the most significant disruption to the community. These units are housed aboveground and require an appropriate amount of space. The only areas where these can be positioned is within the green space in the southwest corner of the Site, as well as in Lion's Park. These units also require on-going operational and maintenance visits which brings additional traffic into the community. They also will have a significant visual impact to these limited green spaces. In addition, noise is also a potential impact when operating these systems.

The disruption associated with a reactive barrier or a chemical/bio injection program is much lower. The application of these approaches is event based and do not include on-going operations or the requirement of an aboveground structure with a visual and noise impact.

Duration

In the context of the AEP Response, duration of remediation will be considered as the time to achieve the AEP Tier 1 Guidelines across the entire Site. Unfortunately, there is no single remedial strategy that will accelerate achieving the AEP Tier 1 Guidelines within the dissolved phase plume across the entire Site. Each area of the Site has its own unique characteristics which puts forth limitations with respect to the most appropriate remedial strategy.

The biggest challenge in achieving the AEP Tier 1 Guidelines within the dissolved phase plume across the entire Site lies within the Hounsfield Heights community. As described in the previous sections, the applicable remedial options are restricted within this area due to Site access. The only potentially practicable approach to address the entire dissolved phase plume within this area is the use of additional extraction systems. However, limitations on where these units can be housed and creating an extraction well network that can encompass the entire Site area is not practicable. This approach will result in untreated areas that rely on the natural attenuation of the COCs within the dissolved phase plume to achieve the AEP Tier 1 Guidelines. This uncertainty is why a providing a definitive timeframe, beyond long-term, is not realistic.

The AEP Tier 1 Guidelines can be achieved for the dissolved phase plume within the Lion's Park and North Hill Mall area within the short or medium term through the application of a variety of options, including a groundwater/vapour extraction system, a permeable reactive barrier, or a chemical or biological injection program. However, accelerating achieving the AEP Tier 1 Guidelines within this portion of the Site will not alleviate the uncertainty associated with the ability to achieve these targets throughout the remainder of the Site.

Summary

A summary and recommendation of each available remedial option that is feasible and has the potential to be effective in accelerating remediation to the AEP Tier 1 Guidelines within the dissolved phase plume is provided below:

1. Physical Extraction Systems: As discussed in the previous sections, the addition of new, and the upgrade to the existing, extraction system has been considered for application as an approach for accelerating remediation to the AEP Tier 1 Guidelines across the entire Site. The effectiveness of applying these types of systems throughout the Site will likely result in areas that are still beyond the extraction capacity of the units. These areas, left untreated, will result in a level of uncertainty as to when the AEP Tier 1 Guidelines can be achieved across the entire Site. In addition to this, the relatively higher cost and disruption to the community that additional systems can have do not make them ideal for this Site. We do not recommend the addition of new extraction systems as a viable option for accelerating achieving the AEP Tier 1 Guidelines across the entire Site for the dissolved phase plume.
2. Permeable Reactive Barriers: The addition of a second permeable reactive barrier within Lion's Park and the North Hill Mall areas has been considered for application as an approach for accelerating achieving the AEP Tier 1 Guidelines across the entire Site. Injecting a permeable reactive barrier within these portions of the Site will not reduce the uncertainty associated with the dissolved phase plume and LPH beneath the residences of Hounsfield Heights. Based on preliminary pilot studies, this technology has shown to be effective in reducing contaminant mass, however, reduction to a level below the AEP Tier 1 Guidelines has yet to be shown. The residual mass would still rely on the processes of natural attenuation to reduce concentrations across the entire Site to the AEP Tier 1 Guidelines. Furthermore, even if portions of the Site immediately down-gradient of the barrier meet the AEP Tier 1 Guidelines, there is still a large down gradient area of mass which will not be treated by this barrier. This leaves uncertainty as to when the AEP Tier 1 Guidelines can be achieved across the entire Site. Based on this information, and in light of the significant costs associated with this option, we do not recommend the addition of a second barrier in the Lion's Park / North Hill Mall area.
3. Chemical Oxidation/Bio-Injection: The application of chemical oxidation or a bio-injection program within Lion's Park and the North Hill Mall areas has been considered for application as an approach for accelerating remediation to the AEP Tier 1 Guidelines across the entire Site. The application of both of these methods can reduce the concentrations of the dissolved phase plume to levels below the AEP Tier 1 Guidelines within a short to medium term timeframe. However, the effectiveness of these applications is limited to the areas where they can be applied. Achieving the AEP Tier 1 Guidelines within Lion's Park and the North Hill Mall areas will not alleviate the uncertainty associated with the remediation of the areas to the south. Investing additional resources into these areas without certainty that unconditional Site closure will be achieved any sooner is not, in our view, an economically feasibly approach. Based on this information, we do not recommend the application of a chemical or bio injection program within Lion's Park or the North Hill Mall area.

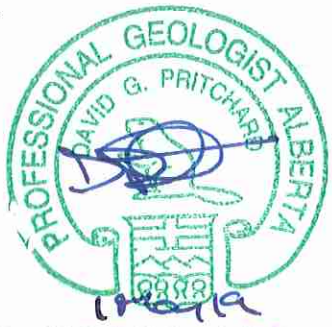
In summary, significant consideration has been placed into identifying feasible and effective remedial strategies which can be employed to help accelerate achieving the AEP Tier 1 Guidelines within the dissolved phase plume across the entire Site. When factoring in the limitations related to Site access, the uncertainty surrounding the dissolved phase plume and LPH within Hounsfield Heights as well as the cost and disruption associated with specific remedial approaches, we do not think it is realistic to place a definitive timeframe on achieving the AEP Tier 1 Guidelines across the entire Site beyond long-term. Based on our current understanding of the identified potential risks associated with the COCs at the Site (i.ie no risk to human health and safety), combined with the limitations and costs associated with the alternative approaches presented above, has led to our recommendations that no additional remedial measures should be employed at this time for the purposes of accelerating remediation of the dissolved phase plume to the AEP Tier 1 Guidelines.

Finally, the current approach as presented within our Remediation Plan balances managing the risks associated with the dissolved phase plume as well as achieving the AEP Tier 1 Guidelines over a long-term timeframe.

Closure

Should you have any additional questions or comments please contact Stephen d'Abadie at Stephen_dabadie@clifton.ca or via telephone at 403-263-2556 ext. 4139.

Yours truly,
Clifton Associates Ltd.



Stephen d'Abadie, M.Eng. PBiol
Project Manager

David G. Pritchard, P.Geo
Director, Environmental Services

Attachments
Appendix A: AEP Response

Appendix A

Clifton

Alberta Environment and Parks

Operations
South Saskatchewan Region
2nd Floor, 2938 – 11 Street NE
Calgary, AB T2E 7L7
Telephone: 403-297-7605
Fax: 403-297-2749
www.aep.alberta.ca

February 20, 2019

File No.: 00141934

Mr. Greg Paliouras
Divisional Vice-President
Construction, Energy and Maintenance
Sears Canada Inc.
700 - 290 Yonge Street
Toronto, ON M5B 2C3

Dear Mr. Paliouras:

Subject: Remediation Plan Hounsfield Heights and Mall Areas, Calgary Alberta

Alberta Environment and Parks (AEP) has reviewed the Remediation Plan, Hounsfield Heights and Mall Areas, (December 2018) prepared by Clifton Associates for Sears Canada Inc. Our comments are provided below.

1) The Environmental Protection Order EPO-2018/01-SSR (EPO) specified that the remediation plan should encompass both the Lands and any impacted off-site areas. While AEP recognizes the priority and importance of work in the community, the remediation plan must be revised to encompass any additional work, if required, for the mall area (including both the Lands as defined in the EPO and the adjacent mall property owned by other parties). Some concerns to address include, but are not limited to, the following:

    a) Are impacts in the mall area (the Lands and adjacent mall property) sufficiently delineated, and if so, to what guidelines?

    b) What were the concentrations of petroleum hydrocarbons in the treated soil used as backfill?

    c) What communication has there been with the current owners of the adjacent mall property and have their concerns regarding impacts in the mall area been addressed?

2) Please note that as 1,2 DCA in groundwater is not completely delineated, and concentrations have not yet been shown to be stable or decreasing, the proposed groundwater and soil vapour monitoring, along with the accompanying contingency plan, are key components for AEP's acceptance of a final remediation plan.

3) The contingency plan must be revised to include a trigger and contingency in the event that the 1,2 DCA plume shows signs of expansion, or there are other indicators that natural attenuation of the dissolved phase plume is not occurring.

4) As noted in the remediation report, the domestic use aquifer pathway is not eligible for exclusion on the basis of bylaws that prohibit the installation of water wells. The pathway

being inoperable relies on an administrative control to ensure use of groundwater is restricted and as this is considered exposure control, the site is not eligible for regulatory closure. AEP is open to revisiting this option in future.

5) AEP continues to support the use of the site-specific soil vapour quality guidelines developed by Intrinsik and accepted by the Department.

6) Tier 2 soil and groundwater guidelines proposed in the April 2017 Human Health and Ecological Risk Assessment report have not been accepted by the Department. Prior to acceptance, the Tier 2 guidelines must be revised to limit adjustments to parameters that are measurable and stable as per the Alberta Tier 2 Soil and Groundwater Remediation Guidelines. It must be made clear that sufficient site-specific data is available to support parameter adjustments and that there is sufficient conservatism to ensure the same high level of protection across this large, geologically variable area. Revisions must include but are not limited to the following:

   a) Tier 2 groundwater guidelines for the protection of the vapour inhalation pathway were derived from maximum groundwater concentrations collected between February and September 2015. Justification is required to demonstrate that these concentrations are adequately conservative to encompass groundwater monitoring data collected since that time, including in other seasons.

   b) Tier 2 guidelines must be revised to use the default Henry's constant. AEP does not accept adjustments to the Henry's Law constant.

   c) Tier 2 guidelines must be revised to use the default soil moisture content. AEP does not recommend the use of site-specific soil moisture values as, in practice, this measurement is difficult to assess and must reflect both spatial and temporal variability for the site.

   d) Site-specific inputs were used for each geologic unit, calculating guidelines for each geologic unit in a designated sub area. Due to the size and variability of the site, as well as the uncertainty around the site-specific data and geologic units, the Tier 2 guidelines should be revised to a single guideline that is protective of all geologic units for a described area.

7) The named parties of the EPO are responsible to contact and negotiate access agreements with respective land owners. If access agreements cannot be reached please advise AEP.

8) A timeline must be provided for the the dissolved phase plume to achieve revised Tier 2 guidelines.

9) What active remedial measures will be employed to expedite achieving revised Tier 2 guidelines for the dissolved phase plume, and in particular, for 1,2 DCA (roughly 3-5 year time frame)?

Required revisions to the remediation plan are expected to occur concommitantly with the activities in the proposed remediation schedule.

The information presented in this letter is based upon applicable environmental legislation and guidelines for the assessment, remediation, and management of contaminated sites in consideration of the information provided. This letter is not intended to exempt any party from future liability where either the land use may change, or additional concerns arise from any contamination remaining on or off the site.

If you have any questions or concerns regarding this correspondence, please contact Barbara McEwen at (403) 297-3591.

Sincerely,

Craig Knaus
Compliance Manager (the Director)

cc: Calvin Chan, Concord North Hill GP Ltd.
Paul Gordon, Suncor Energy Products Partnership
Stephen d'Abadie, Clifton Associates
Barbara McEwen, AEP
Rick McClelland, AEP

17 June 2019

Attention:	Craig Knaus - Compliance Manager
Company:	Alberta Environment and Parks, Operations – South Saskatchewan Region
Address:	2nd Floor, 2938-11th Avenue Calgary, Alberta T2E 2L7

Response to Remediation Plan Hounsfield Heights and Mall Areas Comments **File CG2430.1**
Calgary, Alberta

Clifton Associates Ltd. (Clifton) is pleased to respond to Alberta Environment and Parks (AEP), on behalf of Sears Canada Inc. (Sears), regarding the comments pertaining to the *Remediation Plan, Hounsfield Heights and Mall Areas* submitted in December 2018.

The comments provided by AEP have been attached in Appendix A of this response in the document entitled *Subject: Remediation Plan Hounsfield Heights and Mall Areas, Calgary, Alberta* (AEP Remediation Plan Comments) dated 31 May 2019. AEP previously provided additional comments in a letter dated 20 February 2019.

Response to Remediation Plan Comments

Comment 1
A review of the sampling program in the mall area has revealed inadequate groundwater characterization. Groundwater exceedances identified in 2013 were not further investigated as the wells with exceedances were decommissioned. The replacement groundwater monitoring wells present the following concerns:

a) *Replacement wells were not installed in locations with previously noted exceedances.*
b) *Some wells were screened above the water table.*
c) *Some wells have inappropriately long well screens.*

AEP requires hydrogeological characterization of the mall area. This would include the installation of groundwater monitoring wells in individual hydrostratigraphic units. For further information on groundwater monitoring well installation requirements please refer to the Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment (CCME 2016).

Clifton has prepared a work plan to complete additional hydrogeological characterization of the mall area property. The program includes the advancement of additional soil borings completed as monitoring wells within the extents of the former excavation as well as the boundaries of the plume extent. The program has been designed to characterize the following information:

- Confirmation of geological units within the Mall Area;
- Soil contamination characterization and delineation within the Mall Area;
- Hydrostratigraphic characterization within the Mall Area; and
- Groundwater contamination characterization and delineation within the Mall Area.

This program will take into account the concerns raised by AEP related to the depth of the groundwater monitoring wells as well as the length of screen within each well. The outcome of this investigation will provide a more detailed characterization of the soil and groundwater within the Mall Area which can be incorporated into the Remediation Plan.

This program is scheduled to take place within the last week of June 2019 pending approval from the landowner. The proposed borehole and monitoring well location plan is provided in Appendix B.

Comment 1 A
AEP agrees that additional boreholes are needed and would provide a more complete picture of soil concentrations in the mall area.

This comment will be addressed as part of the work plan summarized in the response to Comment 1.

Comment 1 B
The Remediation Plan should be revised to be clear that soil contamination within the mall area has been vertically as well as horizontally delineated.

Currently, delineation of soil impacts within the mall area has been completed, with the exception of one location, BH1984. As part of the proposed work plan summarized in the response to Comment 1, achieving further delineation of the entire mall area will be targeted. In addition to targeting further delineation within the Mall Area, additional characterization of residual petroleum hydrocarbons (PHCs) within the former excavation footprint will also be completed.

Following completion of this work, a more detailed description of PHC soil impacts and delineation within the Mall Area will be provided within the revised Remediation Plan.

Comment 2
Please update figure legends to reflect exceedance of the 2019 AEP Tier 1 Guidelines to support the text.

The summary of the trend analysis for 1,2-DCA sounds quite different in the response letter (10 April 2019) from what was included in the Remediation Plan. The Remediation Plan (5.3.3 VOCs) uses language such as: expanding, further analysis, fluctuating, uncertainty, etc.). The Remediation Plan must clearly summarize the results of trend analysis and provide a reference for review.

The response also stated no exceedances of the Tier 1 guidelines however, this is not reflected in the figures. Please clarify.

The figures presented within the Remediation Plan will be updated to reflect the 2019 AEP Tier 1 Guidelines opposed to the 2016 AEP Tier 1 Guidelines.

The summary of the trend analysis for 1,2-DCA from the Remediation Plan states the following:

> **"**Monitoring wells BH1928, BH1954, BH1981, and BH2003 serve as useful indicators of the 1,2-DCA concentrations near the downgradient VOC plume margin. A Mann-Kendall analysis of the plume based on historic 1,2-DCA concentrations in BH1928 indicated that the plume has been expanding since Spring 2017; it was stable in the fourth quarter of 2016. Concentrations of 1,2-DCA in BH1954 and BH1981 indicate that the plume is expanding at these locations. The plume was stable at BH1954 in the Spring 2017 sampling event. BH1981 represents the southernmost exceedance in Unit 3. Further analysis will be required to determine if the plume will continue to grow at these locations, which represent the south-southwest plume margins.
>
> There was an exceedance of 1,2-DCA in monitoring well BH1939 installed in Unit 4, the lower clayey silt. A Mann-Kendall analysis of the 1,2-DCA plume in BH1939 indicated that the plume is stable at this point. The Mann-Kendall analysis on the adjacent well, BH1937, indicated a fluctuating trend that was generally declining. The downgradient lateral extent of 1,2-DCA in Unit 4 may be delineated by wells BH1980 and BH2002, which have both been non-detect for 1,2-DCA in all monitoring and sampling events. There is some uncertainty as to the extents of the 1,2-DCA plume immediately south and southwest of BH1939."

A discussion of the trend analysis was also provided within the 10 April 2019 Response Letter which stated the following:

> "Statistical analysis has been completed on the 1,2 – DCA results from seven monitoring wells at the periphery of the groundwater plume. Of these seven wells, six show a deceasing and/or stable trend for this parameter. Only one well, MW1954 shows a statistical trend of increasing concentrations. This well is located in the southwest portion of the Hounsfield Heights Area and is down-gradient from where the liquid activated carbon barrier application is being proposed. The liquid activated carbon barrier is intended to control the expansion of the groundwater plume within this area. It should also be noted that the concentration of 1,2-DCA within this well is below the 2019 AEP Tier 1 Guidelines."

Clifton acknowledges that these two statements do contain contradictory information. The reason for the contradiction is the dataset which was available at the time of preparation of the Remediation Plan and the Response Letter. At the time the Remediation Plan was prepared, the most recent groundwater data was from Spring 2018 which resulted in the trends as they were discussed. However, since the preparation of the Remediation Plan and the subsequent Response Letter the Fall 2018 data was available. When this data was factored into the trend analysis the results had changed from the previous event showing trends as described in the Response Letter. The dataset used to perform this analysis is relatively small, ranging from 5 to 10 data points which includes seasonality. As more data becomes available through subsequent monitoring and sampling events we expect to see more consistency within the trends. Clifton will ensure that in the future monitoring and sampling reports when this trend analysis is performed that the discussion is appropriately framed based on the data that is available.

Comment 6

To date, AEP has not yet received the revised Tier 2 Guidelines for review.

The revised Tier 2 Guidelines have been provided for review in Appendix C.

Comment 9

AEP acknowledges the difficulty around evaluating the efficacy of remedial technologies and time estimates to achieve remedial targets due to uncertainty around the current distribution of liquid petroleum hydrocarbon (LPH).

In an effort to understand the circumstances and in an effort to make an informed decision regarding the potential Incremental Remediation Options as identified in Sears' May 21, 2019 letter from Mr. Greg Paliouras and Clifton's May 22, 2019 letter, AEP has the following questions/comments:

LPH

a) *Were wells with historic LPH exceedances resampled when determining the current LPH distribution (Figure D.3 Liquid Petroleum Hydrocarbons)?*
b) *Have wells with historic LPH exceedances been decommissioned or are they still available for sampling?*
c) *Please indicate dates of Historic LPH distribution and Current LPH Distribution represented in Figure D.3 Liquid Petroleum Hydrocarbons.*

Plumestop

It is not clear from the RAP, and correspondence provided to date, how the Plumestop application mentioned under the RAP would differ from the option of an additional Plumestop application proposed in response to Comment 9. Please clarify the location, extend and any other potential differences between these applications.

Mall Area

AEP requires soil and groundwater characterization, outlined in Comment 1 and 1A, in order to be able to provide input on the appropriate remedial plan for the mall area. Once the noted information is available, AEP will provide further comment on the Incremental Remedial Options identified in Sears' May 21, 2019 letter.

As depicted in Figure D.3 Liquid Petroleum Hydrocarbons, 11 monitoring wells had historically contained LPH. Each of these monitoring wells was subsequently decommissioned as a requirement of installing the DPVE extraction wells or as part of the drilling program in 2013 when the 1900 series replacement wells were installed.

The dates and recorded LPH levels for the 11 monitoring wells that have been decommissioned are attached in Appendix D.

Within the current well network, one monitoring well BH1704, contains LPH. The dates and recorded LPH levels for this monitoring well have been attached in Appendix D.

The second Plumestop application would be completed either along 14th Avenue NW or within Lion's Park. The current proposed application is occurring along 11th Avenue NW. The second potential application would be intended to transect the entire plume at this location. Due to the difference in geology, this injection would be at a greater depth than the barrier along 11th Avenue where the water table is relatively shallower.

A response to the comment related to the Mall Area is provided in our response to Comment 1.

Closure

Should you have any additional questions or comments please contact Stephen d'Abadie at Stephen_dabadie@clifton.ca or via telephone at 403-263-2556 ext. 4139.

Yours truly,
Clifton Associates Ltd.

Stephen d'Abadie, M.Eng. PBiol
Project Manager

Attachments

Appendix A: AEP Response Letter
Appendix B: Proposed Borehole and Monitoring Well Locations
Appendix C: Revised Tier 2 Groundwater Guidelines
Appendix D: Historical and Current LPH Monitoring

Appendix A

Clifton

Alberta Environment and Parks

Operations
South Saskatchewan Region
2nd Floor, 2938 – 11 Street NE
Calgary, AB T2E 7L7
Telephone: 403-297-8271
Fax: 403-297-8232
www.aep.alberta.ca

May 31, 2019

File No.: 00141934
EPO-2018/01-SSR

Mr. Greg Paliouras
Divisional Vice-President
Construction, Energy and Maintenance
Sears Canada Inc.
700 – 290 Younge Street
Toronto, ON M5B 2C3

Dear Mr. Paliouras:

Subject: Remediation Plan Hounsfield Heights and Mall Areas, Calgary Alberta

Alberta Environment and Parks (AEP) has reviewed Clifton's April 10, 2019 and May 1, 2019 responses (the "Clifton Response") to the remediation plan comments. AEP's supplemental comments have been provided below.

Comment 1
A review of the sampling program in mall area has revealed inadequate groundwater characterization. Groundwater exceedances identified in 2013 were not further investigated as the wells with exceedances were decommissioned. The replacement groundwater monitoring wells present the following concerns:

a) Replacement wells were not installed in locations with previously noted exceedances.
b) Some wells were screened above the water table.
c) Some wells have inappropriately long well screens.

AEP requires hydrogeological characterization of the mall area. This would include installation of groundwater monitoring wells in individual hydrostratigraphic units. For further information on groundwater monitoring well installation requirements please refer to the *Guidance Manual for Environmental Site Characterization in Support of Environmental and Human Health Risk Assessment* (CCME 2016).

Comment 1A
AEP agrees that additional boreholes are needed and would provide a more complete picture of soil concentrations in the mall area.

Comment 1B
The remediation plan should be revised to be clear that soil contamination in the mall area has been vertically as well as horizontally delineated.

Comment 2
Please update figure legends to reflect exceedances of 2019 AEP Tier 1 Guidelines to support the text.

The summary of the trend analysis for 1,2-DCA sounds quite different in the response letter

(April 10, 2019) from what was included in the remediation plan. The remediation plan (5.3.3 VOCs) uses language such as: expanding, further analysis, fluctuating, uncertainty, etc.). The remediation plan must clearly summarize the results of trend analysis and provide a reference for review.

The response also states no exceedances of Tier 1 guidelines however, this is not reflected in the figures. Please clarify.

Comment 6
To date, AEP has not yet received the revised Tier 2 Guidelines for review.

Comment 9
AEP acknowledges the difficulty around evaluating the efficacy of remedial technologies and time estimates to achieve remedial targets due to uncertainty around the current distribution of liquid petroleum hydrocarbons (LPH).

In an effort to understand the circumstances and in an effort to make an informed decision regarding the potential Incremental Remedial Options as identified in Sears' May 21, 2019 letter from Mr. Greg Paliouras and Clifton's May 22, 2019 letter, AEP has the following questions/comments:

LPH

a) Were wells with historic LPH exceedances resampled when determining the current LPH distribution (Figure D.3 Liquid Petroleum Hydrocarbons)?

b) Have wells with historic LPH exceedances been decommissioned or are they still available for sampling?

c) Please indicate dates of Historic LPH distribution and Current LPH Distribution represented in Figure D.3 Liquid Petroleum Hydrocarbons.

Plumestop

It is not clear from the RAP, and correspondence provided to date, how the Plumestop application mentioned under the RAP would differ from the option of an additional Plumestop application proposed in response to Comment 9. Please clarify the location, extent, and any other potential differences between these applications.

Mall area

AEP requires soil and groundwater characterization, outlined in Comment 1 and 1A, in order to be able to provide input on the appropriate remedial plan for the mall area. Once the noted information is available, AEP will provide further comment on the Incremental Remedial options identified in Sears' May 21, 2019 letter.

A revised remediation plan must be submitted to the Department, incorporating the above comments by July 31, 2019.

The information presented in this letter is based upon applicable environmental legislation and guidelines for the assessment, remediation, and management of contaminated sites in consideration of the information provided. This letter is not intended to exempt any party from future liability where either the land use may change, or additional concerns arise from any contamination remaining on or off the site.

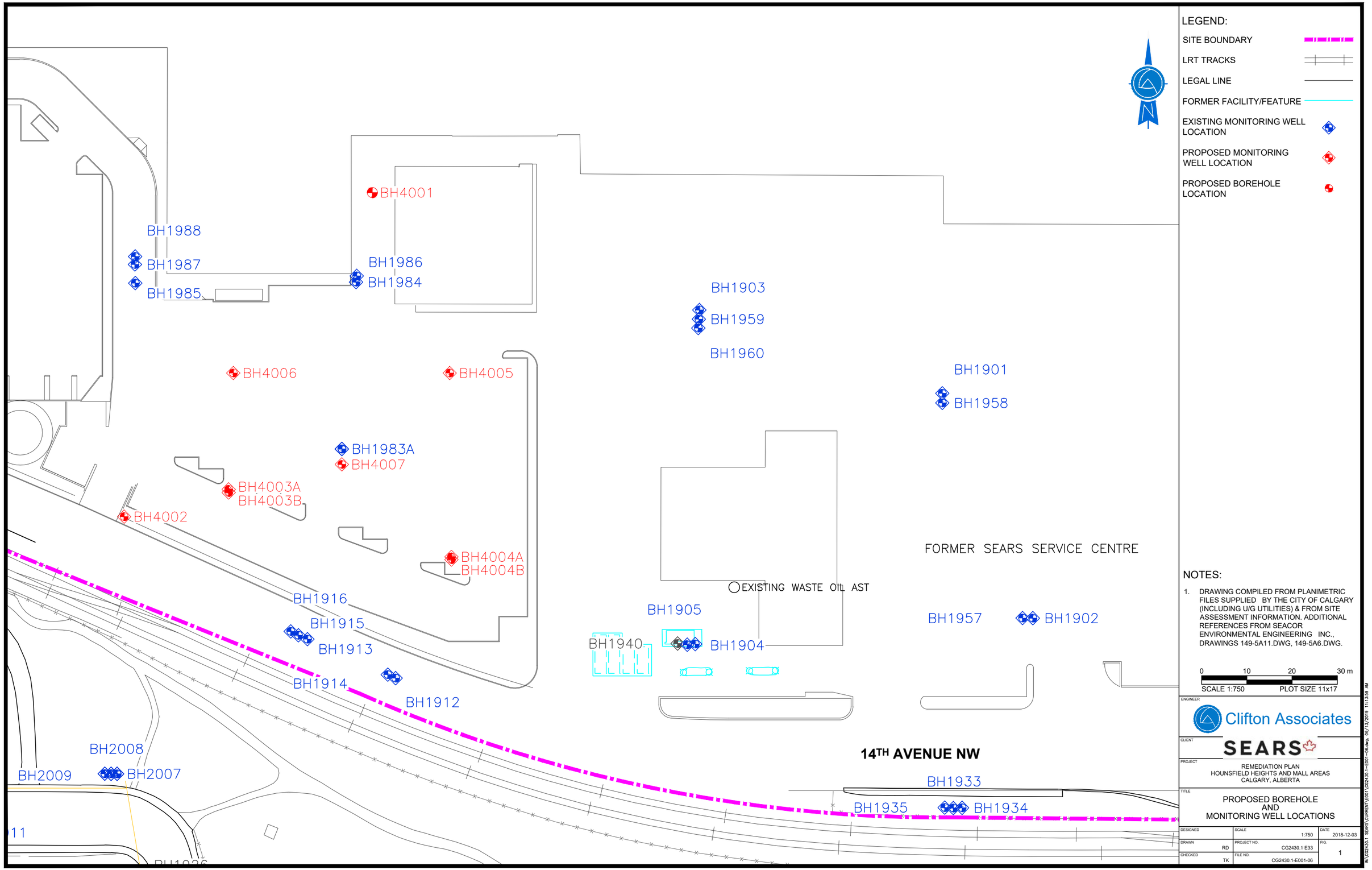
Sincerely,

Craig Knaus
Compliance Manager

cc: Calvin Chan, Concord North Hill GP Ltd.
Paul Gordon, Suncor Energy Products Partnership
Stephen d'Abadie, Clifton Associates
Barbara McEwen, AEP
Rick McClelland, AEP

Appendix B

Clifton



LEGEND:

- SITE BOUNDARY
- LRT TRACKS
- LEGAL LINE
- FORMER FACILITY/FEATURE
- EXISTING MONITORING WELL LOCATION
- PROPOSED MONITORING WELL LOCATION
- PROPOSED BOREHOLE LOCATION

NOTES:

1. DRAWING COMPILED FROM PLANIMETRIC FILES SUPPLIED BY THE CITY OF CALGARY (INCLUDING U/G UTILITIES) & FROM SITE ASSESSMENT INFORMATION. ADDITIONAL REFERENCES FROM SEACOR ENVIRONMENTAL ENGINEERING INC., DRAWINGS 149-5A11.DWG, 149-5A6.DWG.

0 10 20 30 m

SCALE 1:750 PLOT SIZE 11x17

ENGINEER: Clifton Associates

CLIENT: SEARS

PROJECT: REMEDIATION PLAN
HOUNSFIELD HEIGHTS AND MALL AREAS
CALGARY, ALBERTA

TITLE: PROPOSED BOREHOLE AND MONITORING WELL LOCATIONS

DESIGNED		SCALE 1:750	DATE 2018-12-03
DRAWN	RD	PROJECT NO. CG2430.1 E33	FIG. 1
CHECKED	TK	FILE NO. CG2430.1-E001-06	

M:\CG2430.1 SEARS\CURRENT\E001\CG2430.1-E001-06.dwg, 06/13/2019 11:13:59 AM

Appendix C

Clifton

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

April 18, 2019

Craig Knaus
Compliance Manager
Alberta Environment and Parks
South Saskatchewan Region
2nd Floor, 2938 – 11 Street NE
Calgary, AB,T2E 7L7

Dear Mr. Knaus,

Subject: Intrinsik Response to AEP Comments on the Remediation Plan for Hounsfield Heights and Mall Areas (File No. 00141934).

This letter specifically addresses Question 6 of Alberta Environment and Parks' (AEP)February 20, 2019 comments on the Remediation Plan proposed for the Hounsfield Heights and Mall areas (AEP 2019). Question 6 states:

> *Tier 2 soil and groundwater guidelines proposed in the April 2017 Human Health and Ecological Risk Assessment report have not been accepted by the Department. Prior to acceptance, the Tier 2 guidelines must be revised to limit adjustments to parameters that are measurable and stable as per the Alberta Tier 2 Soil and Groundwater Remediation Guidelines. It must be made clear that sufficient site-specific data is available to support parameter adjustments and that there is sufficient conservatism to ensure the same high level of protection across this large, geologically variable area. Revisions must include but are not limited to the following:*
>
> *a) Tier 2 groundwater guidelines for the protection of the vapour inhalation pathway were derived from maximum groundwater concentrations collected between February and September 2015. Justification is required to demonstrate that these concentrations are adequately conservative to encompass groundwater monitoring data collected since that time, including in other seasons.*
> *b) Tier 2 guidelines must be revised to use the default Henry's constant. AEP does not accept adjustments to the Henry's Law constant.*
> *c) Tier 2 guidelines must be revised to use the default soil moisture content. AEP does not recommend the use of site-specific soil moisture values as, in practice, this measurement is difficult to assess and must reflect both spatial and temporal variability for the site.*
> *d) Site-specific inputs were used for each geologic unit, calculating guidelines for each geologic unit in a designated sub area. Due to the size and variability of the site, as well as the uncertainty around the site-specific data and geologic units, the Tier 2 guidelines should be revised to a single guideline that is protective of all geologic units for a described area.*

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

OVERVIEW OF APPROACH

Intrinsik developed Tier 2 soil and groundwater quality guidelines (Intrinsik 2017) and indicated that the guidelines were developed with site-specific moisture contents for geologic units 2 and 3 and adjusted Henry's Law Constant (HLC) using a site-specific groundwater temperature. The average groundwater temperature in the Hounsfield Heights area was measured to be 10.8 ± 2.7 degrees Celsius (Intrinsik 2017). Intrinsik understands that these adjustments are not accepted under AEP (2016a,b) guidance. However, use of the default HLC at 25 ºC can overstate the volatility of the chemical in water such that the resulting inhalation guideline may be artificially low. Intrinsik determined that the adjustments were reasonable based on the following:

- The impacts at the Site are unique in that the contaminants are at depth (i.e., greater than 10 – 15 meters below ground surface in most areas where impacts are present) and vapour migration in the vadose zone occurs in three distinct soil strata (i.e., Unit 1 – sand, Unit 2 - clayey silt and Unit 3 – silty sand).
- Measured soil vapour data, including sub-slab and indoor air testing, suggested that the upward migration of vapours from groundwater was not apparent as concentrations were either non-detect or very low (i.e., well below soil vapour guidelines).
- Default Tier 2 groundwater guidelines for the protection of indoor vapour inhalation were considered overly conservative because comparisons to measured contaminants in groundwater had numerous exceedances when measured soil vapour concentrations were very low, indicating the lack of risk from upward vapour migration.
- The measured soil vapour data validated the use of site-specific assumptions (i.e., soil moisture content and HLC) to support the adjustment of the calculated Tier 2 groundwater guidelines.

In response to AEP's comments, Intrinsik has revised the Tier 2 groundwater guidelines with default AEP soil properties (e.g., moisture content, density, soil porosity, and air porosity) and chemical properties (HLC). Therefore, depth to contamination was the only site-specific parameter adjusted.

Table 1 presents a summary of the site-specific assumptions that were assumed for each area of Hounsfield Heights. Attachment A provides a figure that highlights designated areas of the community where the guidelines are applicable due to local geology (i.e., N1, N2, S1 and S2 areas). Attachment A also presents the monitoring well locations.

Table 1 also presents the monitoring wells that were used to define the thickness of each geologic unit within the community. None of these assumptions were changed in the revised Tier 2 groundwater guidelines presented below. Table 2 and Table 3 present the default soil properties and HLC that were assumed for the revised Tier 2 groundwater quality guidelines. Overall, the revised Tier 2 groundwater guidelines for the protection of indoor vapour inhalation were reduced by a factor of 2 to 3 (see Table 4) when compared to the Tier 2 guidelines presented in Intrinsik (2017), which incorporated the site-specific moisture content and adjusted HLC.

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

Table 1 Site-specific Assumptions Assumed for the Calculation of Tier 2 Groundwater Quality Guidelines for the Protection of Vapour Inhalation in the Hounsfield Heights Area

Input Variable	***Hounsfield Heights Area*** [1]			
	North of 11th Avenue NW (N1)	***North of 11th Avenue NW (N2)***	***South of 11th Avenue NW (S1)***	***South of 11th Avenue NW (S2)***
Boreholes/monitoring wells used to define Unit thickness and groundwater profiles	MW1921, MW1925 and MW1917	MW1922, MW1956 and MW1919	MW1943 and MW1944	Assumed default Tier 1 Vapour Inhalation Guideline as Unit 1 to Unit 3 are not present in the area.
Assumed thickness of Unit 1 below home [m]	4.0	1.8	Not applicable	
Assumed thickness of Unit 2 below home [m]	3.8	3.5	Not applicable	
Assumed thickness of Unit 3 below home [m]	2.5	2.5	3.8	
Depth to groundwater from surface [m]	Mean = 12.7 (Range 11.4 to 13.8)	Mean = 10.2 (Range 9.3 to 11.1)	6.2	
Assumed depth of basement – default value (AEP 2016a) [m]	2.44	2.44	2.44	
Assumed depth to groundwater below home [m]	10.3	7.8	3.8	

(1) Model calculations assumed residential homes constructed with basements 244 cm below grade and community areas presented in Attachment B.

Table 2 Default Soil Properties Assumed for Revised Tier 2 Groundwater Guidelines

Parameter	***Geologic Unit 1***	***Geologic Unit 2***	***Geologic Unit 3***
Assumed Soil Texture	Coarse	Fine	Fine
Mean bulk Density [kg/m^3]	1.70E+03	1.40E+03	1.40E+03
Mean total soil porosity, n [Unitless]	3.60E-01	4.70E-01	4.70E-01
Moisture-filled porosity, θw [Unitless]	1.19E-01	1.68E-01	1.68E-01
Air-filled porosity, θa [Unitless]	2.41E-01	3.02E-01	3.02E-01
Source: AEP 2016a			

Table 3 Comparison of Adjusted and Default Henry's Law Constant Assumed for Revised Tier 2 Groundwater Guidelines

COPC [1]	***Original Henry's Law Constant Adjusted to 11 degrees Celsius Groundwater Temperature***	***Default Henry's Law Constant at 25 degrees Celsius*** [2]
Benzene	0.11	0.225
Xylenes	0.12	0.252
1,2-DCA	0.024	0.0401

(1) Restricted comparison to chemicals of potential concern (COPC) highlighted in Intrinsik (2017) report.
(2) Source: AEP 2016a

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

Table 4 Revised Tier 2 Groundwater Guidelines for the Protection of Vapour Inhalation in the Hounsfield Heights Area

Input Variable	*AEP Groundwater Remediation Guidelines [mg/L](1)*	*Revised Tier 2 Groundwater Guidelines for Various Areas in Hounsfield Heights [mg/L](2)*			
		North of 11th Avenue NW (N1)	*North of 11th Avenue NW (N2)*	*South of 11th Avenue NW (S1)*	*South of 11th Avenue NW (S2)*
Benzene	2.8	4.6	4.4	3.2	2.8
Toluene	NGR(3)	NGR	NGR	NGR	NGR
Ethylbenzene	NGR	NGR	NGR	NGR	NGR
Xylenes	80	134	130	94	80
F1	19	32	31	23	19
F2	NGR	NGR	NGR	NGR	NGR
1,2-DCA	0.17	0.29	0.28	0.20	0.17

(1) Default AEP (2016a) guideline for the protection of indoor vapour inhalation for residential land use.
(2) Detailed calculations for calculated Tier 2 groundwater guidelines presented in Attachment B.
(3) NGR = No Guideline Required – calculated values are above compound solubility limit.

RESPONSE TO 6A

Since the Intrinsik (2017) report was submitted to AEP more groundwater monitoring data has become available for comparison to the revised guidelines. In addition, remediation programs have been active in the community (e.g., dual-phase vapour extraction system in zones N1 and N2 and a permeable reactive barrier was installed in two areas along 11th Avenue NW in zone S1 as a pilot program), which resulted in noticeable reductions in dissolved contaminant concentrations in monitoring wells. Groundwater concentrations from monitoring wells sampled between 2015 to 2018 in the community were screened against Tier 1 remediation guidelines for the protection of vapour inhalation (presented in Table 4) for the protection of indoor vapour inhalation under residential land use. In total the screening included 530 samples from 52 wells over the monitoring period, which represents a robust dataset. Based on the screening, only benzene and 1,2-dichloroethane (DCA) were measured at concentrations above the groundwater remediation guidelines for vapour inhalation of 2.8 and 0.17 mg/L, respectively. The exceedances were observed in areas N1, N2 and/or S1. All other petroleum hydrocarbons (i.e., toluene, ethylbenzene, xylenes, F1 and F2) were below their respective groundwater remediation guidelines for the protection of vapour inhalation. Groundwater was monitored from the following seasonal periods throughout the years:

- 2015 (spring, summer and fall);
- 2016 (spring and fall);
- 2017 (summer); and,
- 2018 (spring and fall).

Out of 52 monitoring wells in the community, five wells north of 11th avenue have exceeded Tier 1 and/or Tier 2 guidelines for benzene in the past but have shown a decreasing trend wherein

concentrations are now below guidelines (see Figure 1 and Figure 2). Sample data from extraction wells associated with the dual-phase vapour extraction system were excluded from the figures as these wells are associated with an active remediation system and not representative of the residual dissolved phase concentrations. Some of the highest benzene concentrations in groundwater (e.g., 14 mg/L in 2015) have been measured historically in zone S1 at BH1928 (see Figure 3). However, concentrations have been decreasing and only one monitoring well (i.e., BH1982) located along 11th avenue remains above the calculated Tier 2 vapour inhalation guideline of 3.2 mg/L. Further discussion of the indoor vapour inhalation risks associated with BH1982 are presented below with the assessment of measured soil vapour from monitoring wells.

Three monitoring wells north of 11th avenue have exceeded Tier 1 and/or Tier 2 guidelines for 1,2-DCA in the past but have shown a decreasing trend wherein concentrations are now below guidelines (see Figure 4 and Figure 5). Some of the highest 1,2-DCA concentrations in groundwater (e.g., 0.37 mg/L in 2018) were measured historically in zone N2 at BH1928 (see Figure 5) which is located just south of 11th avenue and 16A Street NW in the green space. Further discussion of the indoor vapour inhalation risks associated with 1,2-DCA are presented below with the assessment of measured soil vapour from monitoring wells in the community.

Concentrations of 1,2-DCA in zone S1 were historically above the calculated Tier 2 guideline (i.e., 0.2 mg/L) at three wells located along 11th avenue (i.e., BH1937, BH1939 and BH1982). These also have shown a decreasing trend since 2016 (see Figure 6) and recent concentrations in groundwater are below the limit for the protection of vapour inhalation. Groundwater monitoring in the community of Hounsfield Heights since 2015 has demonstrated that contaminant concentrations are predominantly below Tier 2 guidelines; however, some exceedances remain in two monitoring wells (i.e., BH1928 and BH1982). Indoor vapour inhalation risks are more accurately characterized with the assessment of measured soil vapour concentrations in the community, which is presented below.

Since 2016, soil vapour concentrations for benzene and 1,2-DCA were measured over five sampling periods (i.e., 2016 Q2, 2017 Q1 & Q3, 2018 Q2 and 2019 Q1) from over 40 monitoring wells installed at various depths below ground surface (i.e., 2 to 6 mbgs). In total, 227 soil vapour samples were collected in the community of Hounsfield Heights and represent a robust data set to assess indoor vapour inhalation risks. With the exception of SV32, measured soil vapour concentrations in the community of Hounsfield Heights for benzene and 1,2-DCA are consistently below the calculated soil vapour quality guidelines for the protection of vapour inhalation (see Figure 7 and Figure 8 respectively). Soil vapour data are the most applicable media for the assessment of vapour inhalation. The community wide soil vapour monitoring program has demonstrated that the groundwater exceedances are not expected to result in adverse health effects because the measured soil vapour concentrations indicate that unacceptable risks are not expected.

Recently, elevated PHC concentrations (i.e., F1) were detected in soil vapour sampled from SV32. The measured aliphatic C6-C8 concentration of 1,220,000 ug/m^3 (i.e., sum of aliphatic >C5-C6 and aliphatic >C6-C8) exceeded the guideline of 915,445 ug/m^3. Table 5 presents the historical and recent soil vapour testing of BTEX, PHC and 1,2-DCA at this location and

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

comparison to the soil vapour quality guidelines for the protection of indoor air inhalation and residential land use. Given the exceedance at the soil vapour well in the alley, further testing and investigation in the surrounding properties has been initiated (i.e., implementation of the Contingency Plan) to determine the extent of potential soil vapour impacts. The elevated results are surprising given that previous testing at the location was non-detect or below soil vapour guidelines and that a nearby groundwater monitoring well (i.e., BH1948) has consistently reported non-detect concentrations for BTEX, PHC and 1,2-DCA since 2015 (BH1948 has been sampled 9 times since 2015). The results of this investigation are ongoing and will be reported when completed.

Table 5 Measured Soil Vapour Concentrations at SV32 and Comparison to Residential Soil Vapour Guidelines [ug/m^3]

Chemical or Fraction	***Residential Guideline***	***2016***	***2017***		***2018***	***2019***
		Q2	***Q1***	***Q3***	***Q2***	***Q1***
Benzene	300	5.2	0.61	<0.32	0.86	<140
Toluene	187,790	111	0.74	0.4	0.86	<170
Ethylbenzene	49,625	96	<0.43	<0.43	<0.43	<190
Xylenes	8,909	447	<1.3	<1.3	<1.3	<580
1,2-DCA	40	<0.4	<0.4	<0.4	<0.4	<180
Aliphatic >C5-C6	NA	12.5	<5.0	NA	NA	532,000
Aliphatic >C6-C8	NA	123	<5.0	NA	NA	688,000
Aliphatic C6-C8	915,445	136	<10	<10	<10	1,220,000
Aliphatic >C8-C10	48,060	198	<5.0	<5.0	<5	<2200
Aliphatic >C10-C12	50,000	1,140	<5.0	<5.0	34.7	<2200
Aliphatic >C12-C16	50,000	490	<5.0	<5.0	7.7	<2200
Aromatic >C8-C10	8,125	692	<5.0	<5.0	<5.0	<2200
Aromatic >C10-C12	10,000	569	<5.0	<5.0	<5.0	<2200
Aromatic >C12-C16	10,000	77	<5.0	<5.0	<5.0	<2200

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

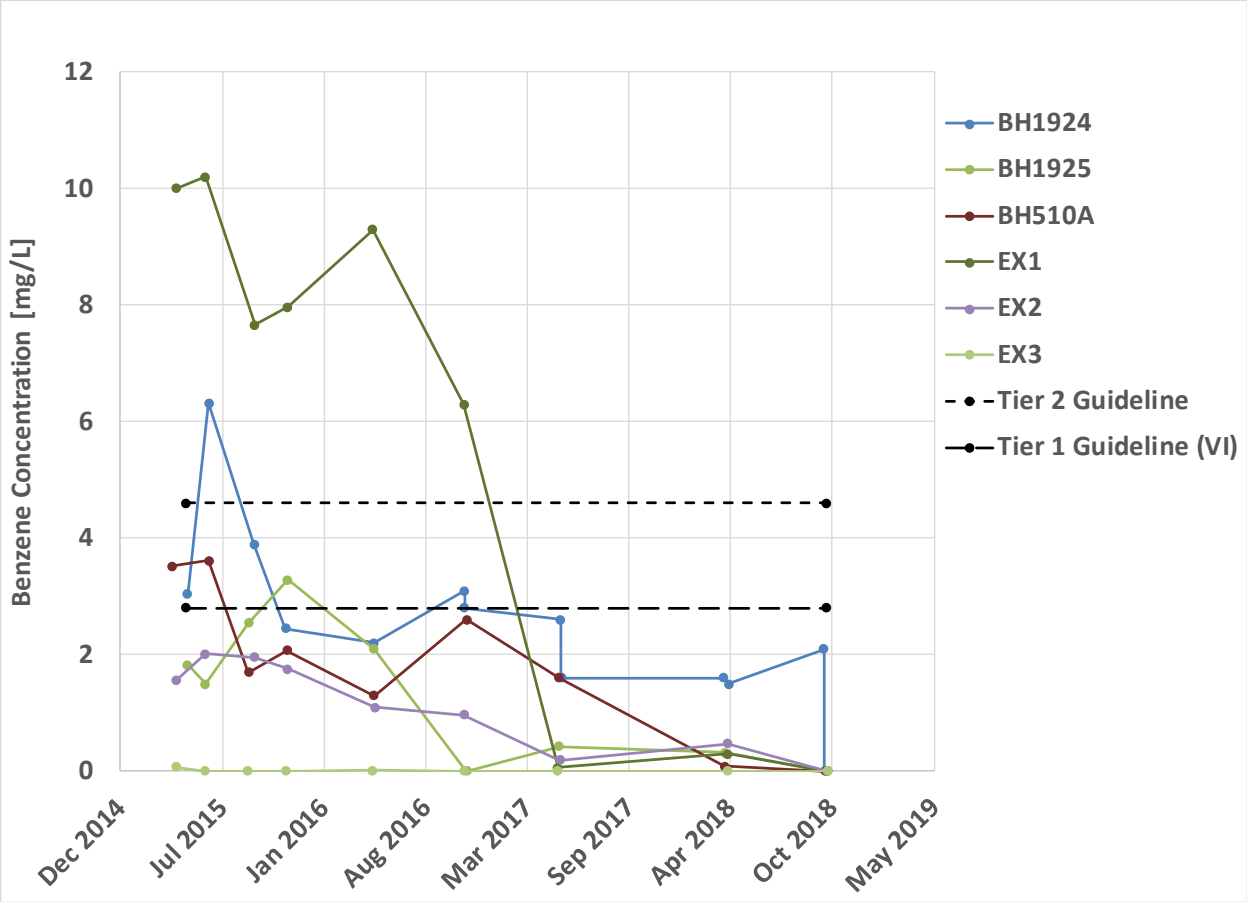


Figure 1 **Benzene Concentrations in Groundwater in Zone N1 that exceeded Tier 1 and Tier 2 Guidelines**

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

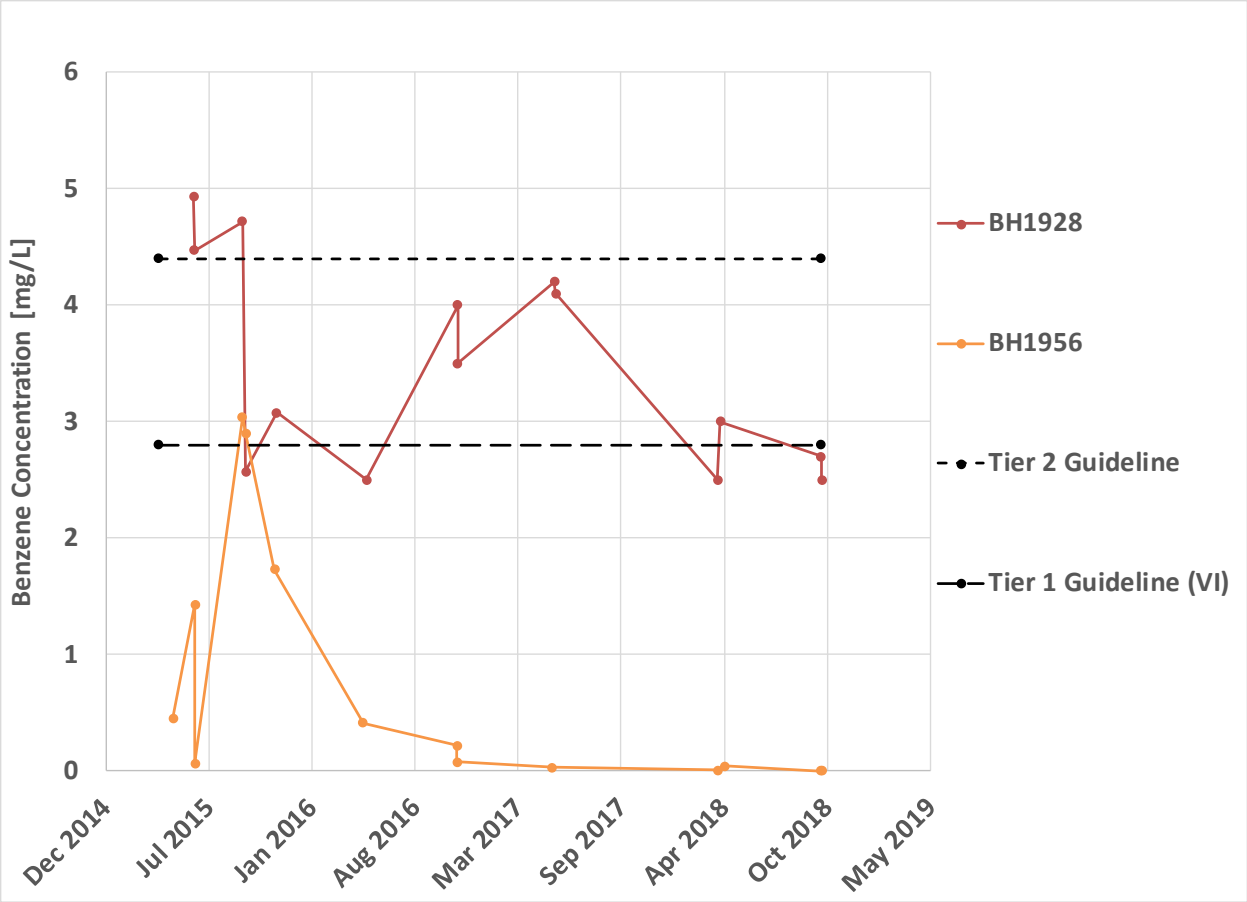


Figure 2 **Benzene Concentrations in Groundwater in Zone N2 that exceeded Tier 1 and Tier 2 Guidelines**

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

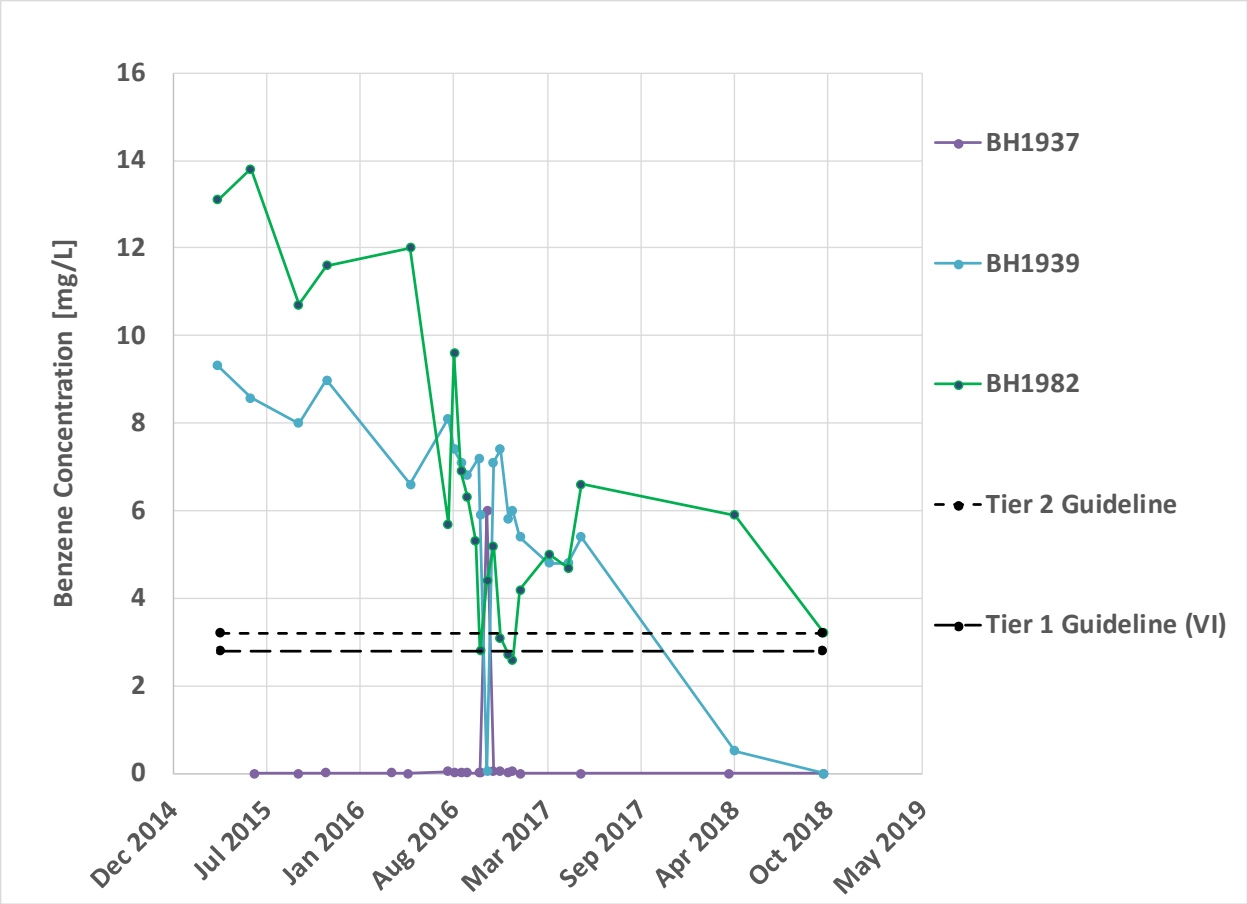


Figure 3 **Benzene Concentrations in Groundwater in Zone S1 that exceeded Tier 1 and Tier 2 Guidelines**

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

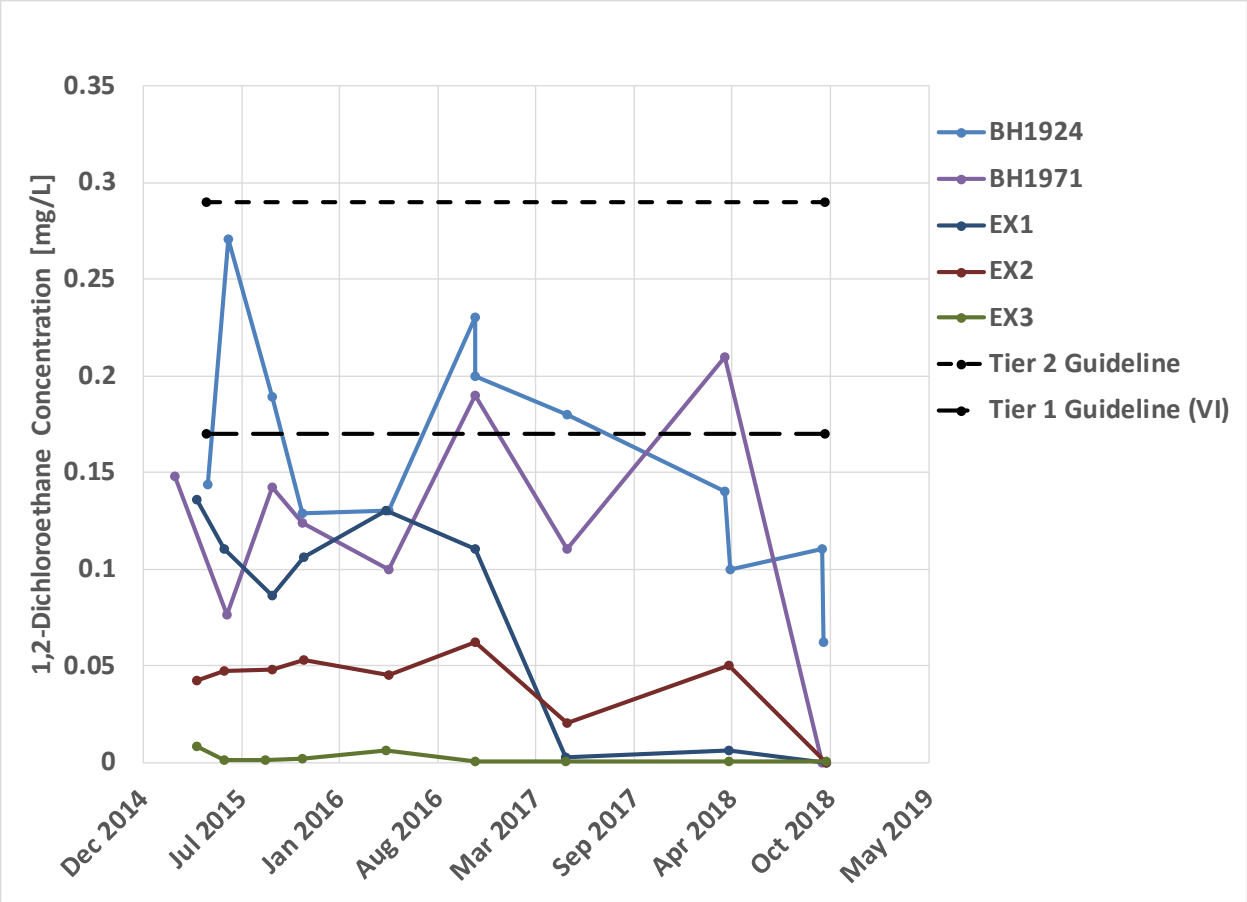


Figure 4 **1,2-DCA Concentrations in Groundwater in Zone N1 that exceeded Tier 1 and Tier 2 Guidelines**

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

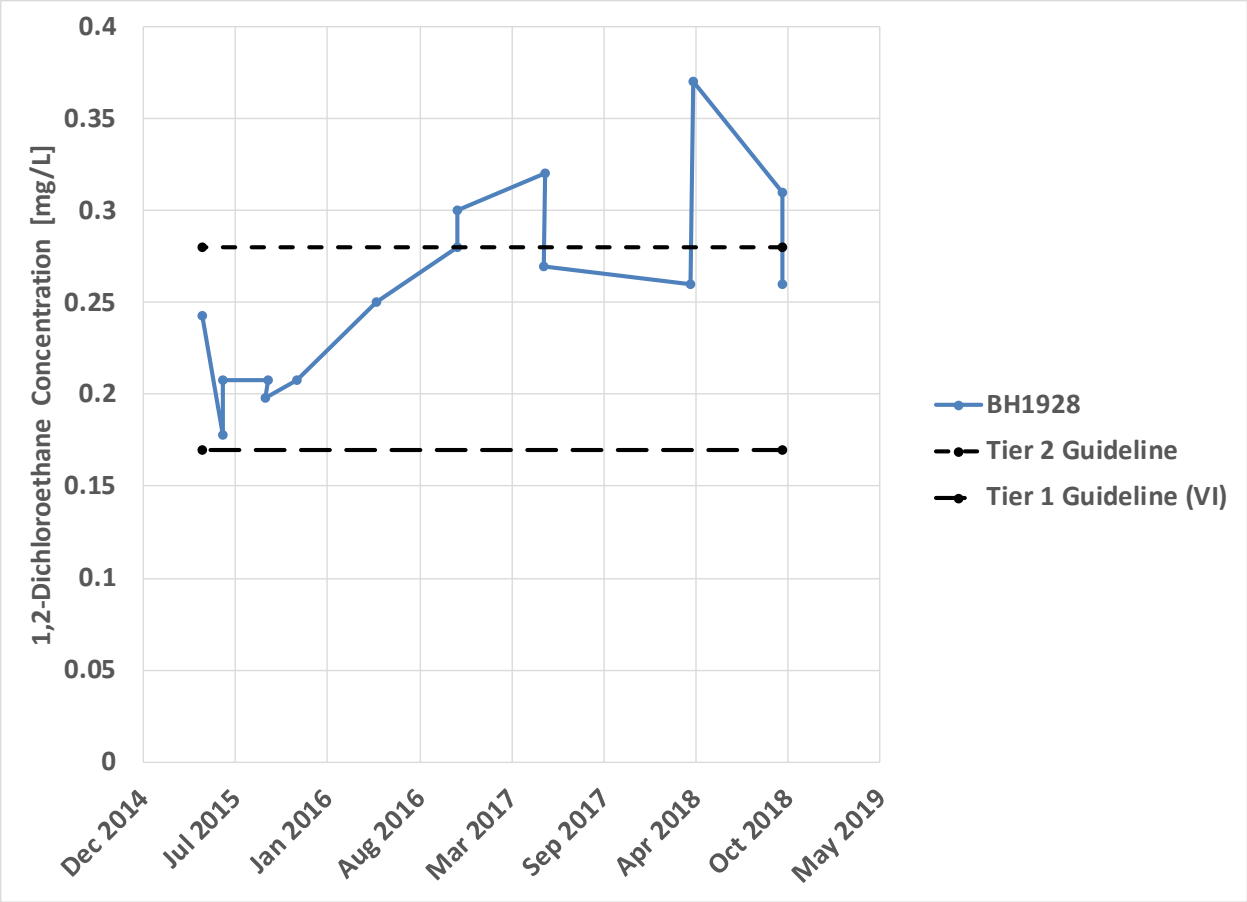


Figure 5 **1,2-DCA Concentrations in Groundwater in Zone N2 that exceeded Tier 1 and Tier 2 Guidelines**

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

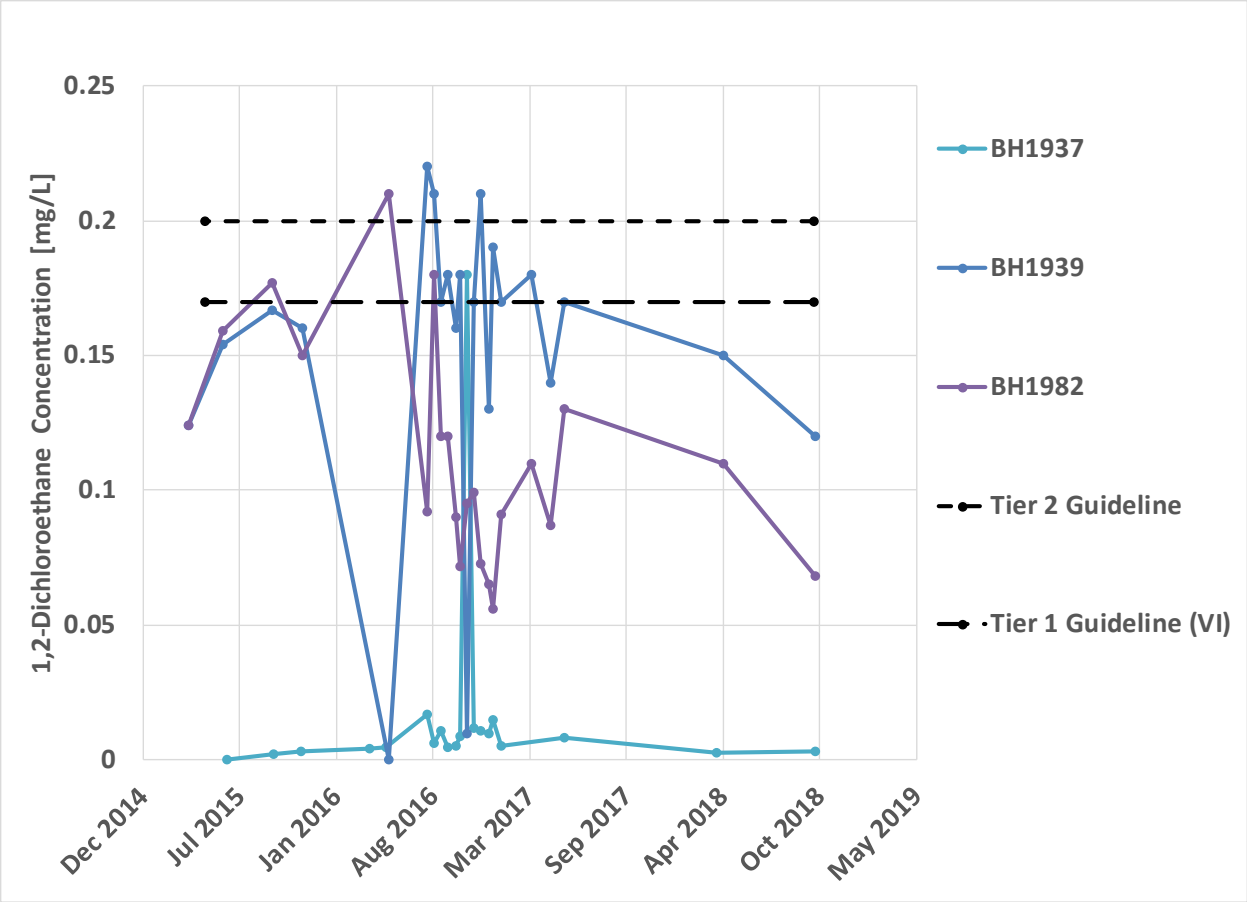


Figure 6 **1,2-DCA Concentrations in Groundwater in Zone S1 that exceeded Tier 1 and Tier 2 Guidelines**

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

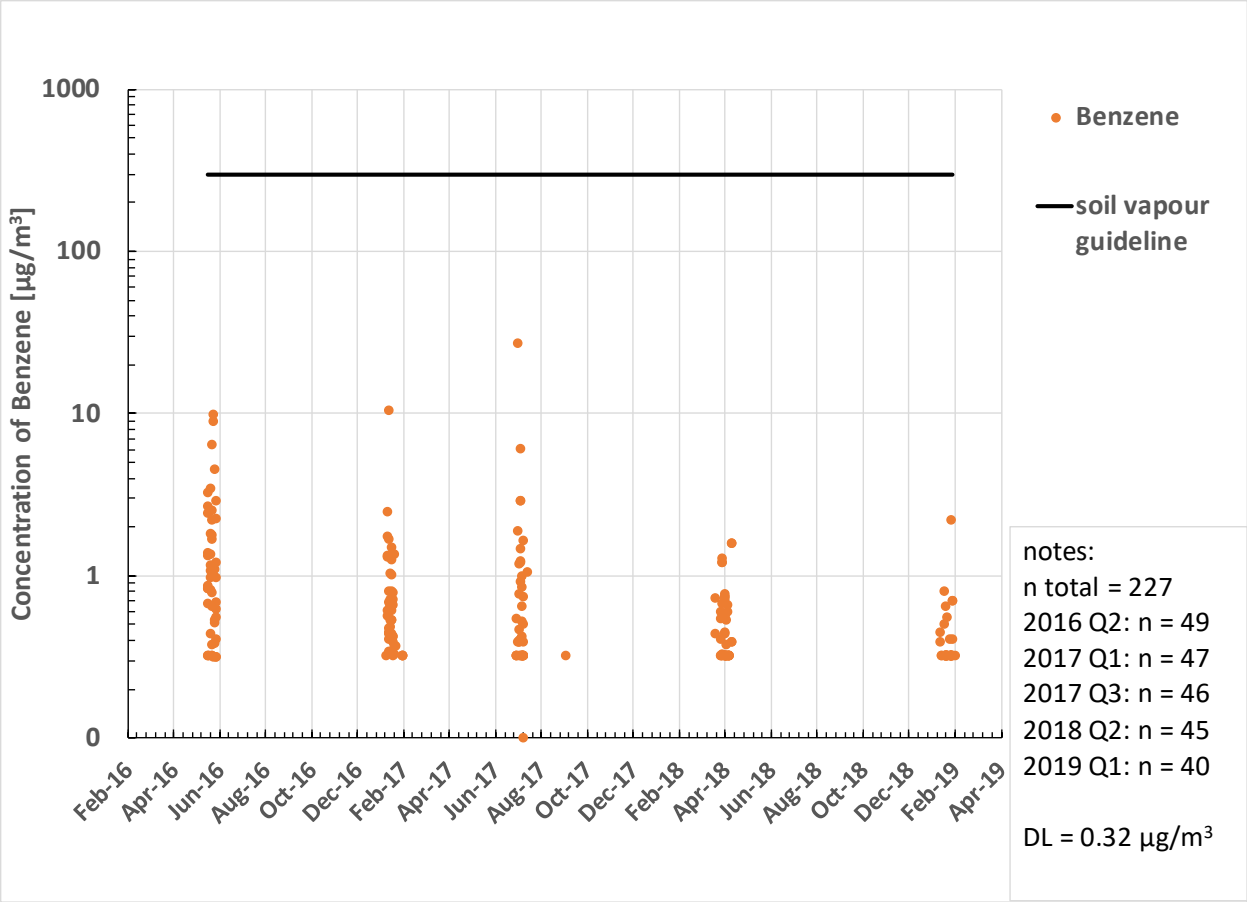


Figure 7 **Comparison of Measured Soil Vapour Benzene Concentrations in the Community to Calculated Soil Vapour Quality Guidelines**

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

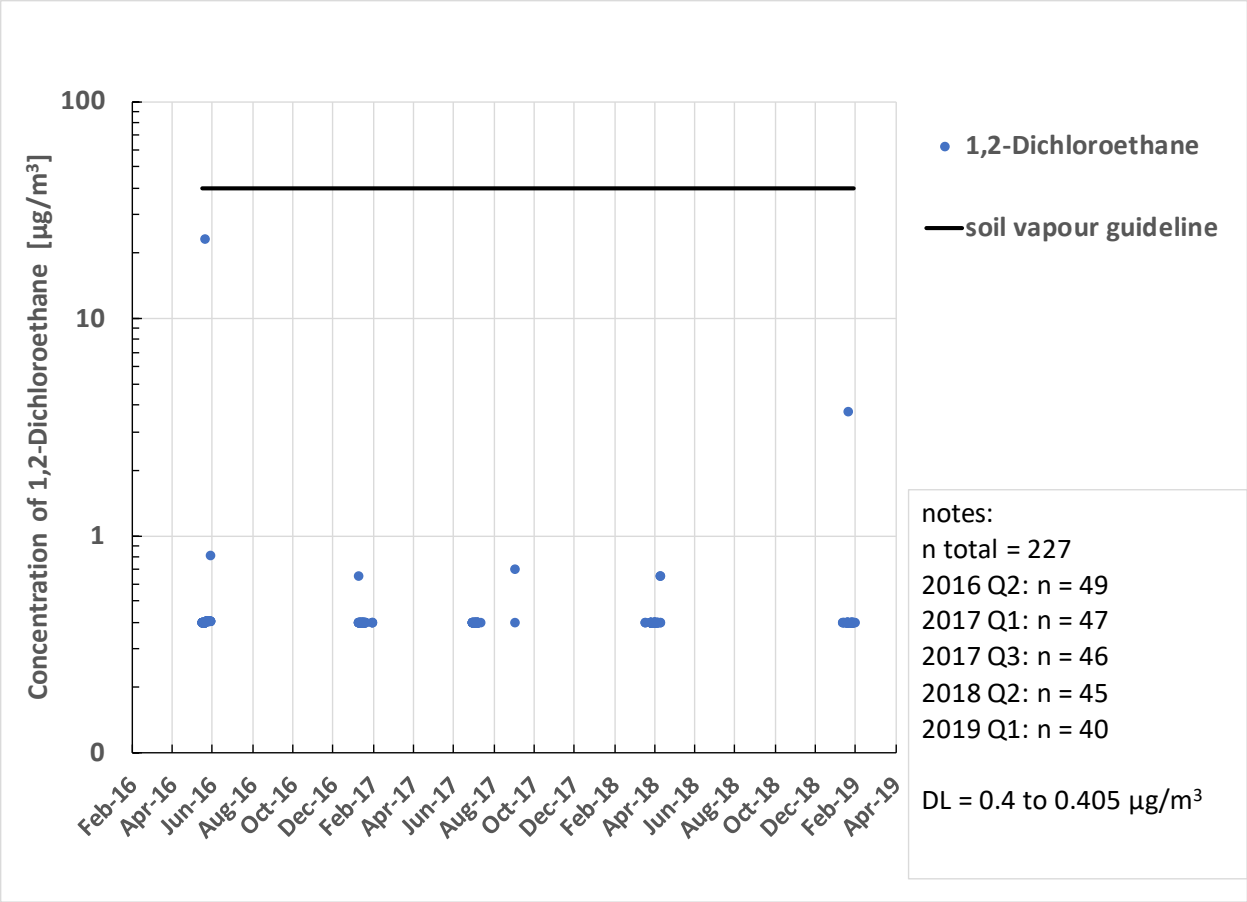


Figure 8 Comparison of Measured Soil Vapour 1,2-DCA Concentrations in the Community to Calculated Soil Vapour Quality Guidelines

RESPONSE TO 6B

The guidelines have been revised and are presented in Table 4.

RESPONSE TO 6C

The guidelines have been revised and are presented in Table 4.

RESPONSE TO 6D

The recommendation to calculate Tier 2 guidelines that are protective of all geologic units for the community would be overly conservative given that groundwater impacts are at substantial depths through-out the community and the depth to groundwater varies through-out the community. In addition, the calculated guidelines for each designated area incorporated multiple

geologic units by calculating an overall effective diffusion coefficient for the vapour migration in the vadose zone. Further details regarding the calculated diffusion coefficient for each area are discussed below.

Soil stratigraphy and depth to groundwater from surface in the Hounsfield Heights area is variable based on the rapidly decreasing elevation from north of 13th Avenue NW to south of 11th Avenue NW combined with multiple layers of varying soil types (i.e., clay, sand, silt). Attachment C (i.e., Table C1) presents the soil stratigraphy data and depth to groundwater for each borehole/monitoring well that was used to characterize the vapour inhalation model for the area N1 (i.e., MW1917, MW1921 and MW1925). Attachment C also presents the monitoring wells that were used to characterize the thickness of each geologic unit and groundwater depth within area N2 (i.e., MW1919, MW1922 and MW1956) and S1 (i.e., MW1943 and MW1944). Finally, Attachment D presents the borehole logs that were used characterize each area.

For example, BH1925 (see Attachment D) has a measured depth to groundwater of 13.8 mbgs and Table C1 in Attachment C shows how Unit 1, Unit 2 and Unit 3 are 8.2, 3.6 and 2.5 m thick, respectively. Subtracting the assumed depth of a basement (i.e., 2.4 m) from the upper Unit 1 would result in a thickness of 5.8 m of Unit 1 followed by 3.6 m of Unit 2 for vapour migration. Finally, Unit 3 is 2.5 m thick above groundwater. Vapour migration in the vadose zone at BH1925 is anticipated to occur through a combined 11.9 m of material before (i.e., sum of Unit 1 = 5.8m + Unit 2 = 3.6m + Unit 3 = 2.5m) reaching the foundation of a home with a basement. Similar methods were applied to the other wells identified in Table C1 to C3 and a central estimate was assumed for the calculation of the Tier 2 guidelines within each designated area.

Finally, the diffusion coefficient for each layer was calculated separately and the overall effective diffusion coefficient was calculated with the following equation (Johnson and Ettinger 1991):

$$D^{eff} = \frac{L_t}{\left({S_A}/{D_A^{eff}} + {S_B}/{D_B^{eff}} + {S_C}/{D_C^{eff}} \right)}$$

Where

D^{eff}	=	Overall diffusion coefficient through the vadose zone (cm^2/s)
L_t	=	Total thickness of the vadose zone (cm)
S_A	=	Stratum A thickness (cm)
S_B	=	Stratum B thickness (cm)
S_C	=	Stratum C thickness (cm)
D^{eff}_A	=	Stratum A effective diffusion coefficient (cm^2/s)
D^{eff}_B	=	Stratum B effective diffusion coefficient (cm^2/s)
D^{eff}_C	=	Stratum C effective diffusion coefficient (cm^2/s)

Attachment B presents the calculations for each stratum (i.e., Unit 1 to 3) for benzene, and Table 6 presents a summary for the calculated overall diffusion coefficient in area N1 for benzene.

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

Table 6 Summary of Assumptions for Calculating the Diffusion Coefficient in N1 for Benzene

Description	Units	Unit 1	Unit 2	Unit 3
Diffusion coefficient in air	cm^2/s	0.088	0.088	0.088
Diffusion coefficient in water	cm^2/s	0.00E+00	0.00E+00	0.00E+00
Dimensionless Henry's Law Constant	Unitless	0.225	0.225	0.225
Stratum volumetric moisture content	m^3-water / m^3-soil	0.119	0.168	0.168
Stratum volumetric vapour content	m^3-vapour / m^3-soil	0.241	0.302	0.302
Stratum soil dry bulk density	g/cm^3	1.7	1.4	1.4
Stratum soil total porosity	m^3-voids / m^3-soil	0.36	0.47	0.47
Stratum thickness	cm	400	380	250
Stratum effective diffusion coefficient	cm^2/s	5.91E-03	7.36E-03	7.36E-03
Total thickness of the vadose zone (cm)		*1030*		
Overall diffusion coefficient through vadose zone (cm^2/s)		*6.72E-03*(1)		

(1) Detailed calculation presented in Attachment B.

Should you require further information or clarification of any point, or if you wish to discuss any concerns that you might have regarding the findings, please feel free to contact me by telephone at (403) 237-0364, or alternatively by e-mail at kbresee@intrinsik.com. I would be pleased to answer any questions that you may have.

Yours Sincerely,
INTRINSIK CORP.

Karl Bresee, BSc., PBD, P.Biol.
Senior Scientist

REFERENCES

AEP (Alberta Environment and Parks). 2016a. Alberta Tier 1 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division. February 2, 2016.

AEP (Alberta Environment and Parks). 2016b. Alberta Tier 2 Soil and Groundwater Remediation Guidelines. Land Policy Branch, Policy and Planning Division. February 2, 2016.

AEP (Alberta Environment and Parks). 2019. Remediation Plan Hounsfield Heights and Mall Areas, Calgary Alberta. Letter from Craig Knaus to Greg Paliouras (Sears Canada Inc.) dated February 20, 2019. File No. 00141934.

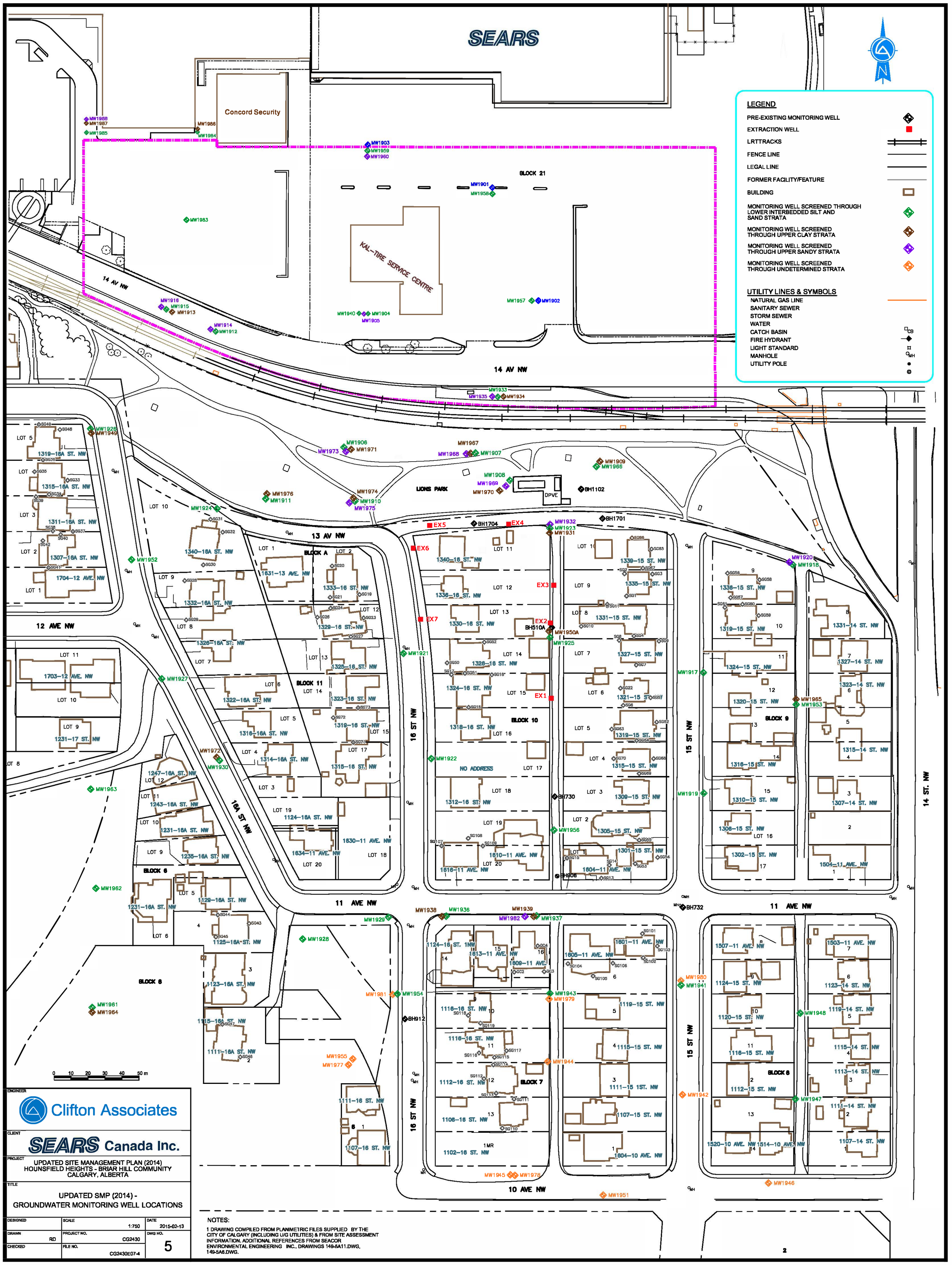
CAL (Clifton Associates Ltd). 2016. Subsurface Investigation Mall and Hounsfield Heights Areas Calgary, Alberta. File CG2430 E13. January 22 2016.

CAL (Clifton Associates Limited). 2019. 2018 Fourth Quarter Groundwater Monitoring and Sampling Report Hounsfield Heights – Briar Hill Community Calgary, Alberta. File CG2430.1 E32. 25 January 2019.

Intrinsik. 2017. Human health and ecological risk assessment for the Hounsfield Heights and North Hill Mall Areas, Calgary, Alberta. Final Report to Sears Canada. April 13, 2017.

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

ATTACHMENT A



LEGEND

- PRE-EXISTING MONITORING WELL
- EXTRACTION WELL
- LRTTRACKS
- FENCE LINE
- LEGAL LINE
- FORMER FACILITY/FEATURE
- BUILDING
- MONITORING WELL SCREENED THROUGH LOWER INTERBEDDED SILT AND SAND STRATA
- MONITORING WELL SCREENED THROUGH UPPER CLAY STRATA
- MONITORING WELL SCREENED THROUGH UPPER SANDY STRATA
- MONITORING WELL SCREENED THROUGH UNDETERMINED STRATA

UTILITY LINES & SYMBOLS

- NATURAL GAS LINE
- SANITARY SEWER
- STORM SEWER
- WATER
- CATCH BASIN (CB)
- FIRE HYDRANT
- LIGHT STANDARD
- MANHOLE (MH)
- UTILITY POLE

ENGINEER: Clifton Associates

CLIENT: SEARS Canada Inc.

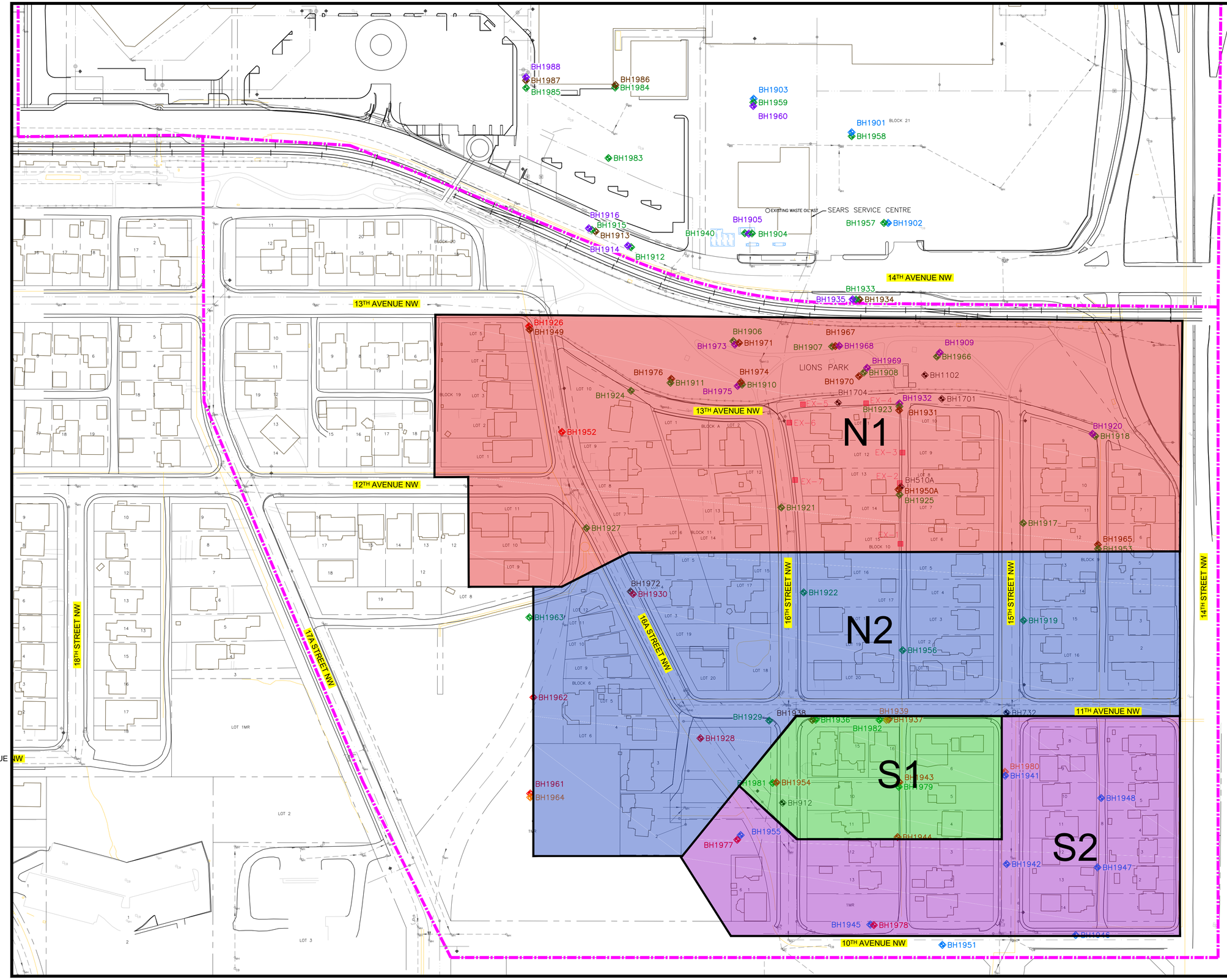
PROJECT: UPDATED SITE MANAGEMENT PLAN (2014)
HOUNSFIELD HEIGHTS - BRIAR HILL COMMUNITY
CALGARY, ALBERTA

TITLE: UPDATED SMP (2014) -
GROUNDWATER MONITORING WELL LOCATIONS

DESIGNED	SCALE	DATE
	1:750	2015-02-13
DRAWN: RD	PROJECT NO.: CG2430	DWG NO.: 5
CHECKED	FILE NO.: CG2430E07-4	

NOTES:

1 DRAWING COMPILED FROM PLANIMETRIC FILES SUPPLIED BY THE CITY OF CALGARY (INCLUDING U/G UTILITIES) & FROM SITE ASSESSMENT INFORMATION. ADDITIONAL REFERENCES FROM SEACOR ENVIRONMENTAL ENGINEERING INC., DRAWINGS 149-5A11.DWG, 149-5A6.DWG.



LEGEND

- SITE BOUNDARY
- PRE-EXISTING MONITORING WELL
- EXTRACTION WELL
- LRT TRACKS
- FENCE LINE
- LEGAL LINE
- FORMER FACILITY/FEATURE
- BUILDING
- MONITORING WELL SCREENED THROUGH UNIT 1 - UPPER SILTY SAND
- MONITORING WELL SCREENED THROUGH UNIT 2 - UPPER CLAYEY SILT
- MONITORING WELL SCREENED THROUGH UNIT 3 - MIDDLE SANDY SILT
- MONITORING WELL SCREENED THROUGH UNIT 4 - LOWER CLAYEY SILT
- MONITORING WELL SCREENED THROUGH UNIT 5 - LOWER SILTY SAND AND GRAVEL
- MONITORING WELL SCREENED THROUGH UNDETERMINED STRATA

UTILITY LINES & SYMBOLS

- NATURAL GAS LINE
- SANITARY SEWER
- STORM SEWER
- WATER
- CATCH BASIN
- FIRE HYDRANT
- LIGHT STANDARD
- MANHOLE
- UTILITY POLE

NOTES:

1 DRAWING COMPILED FROM PLANIMETRIC FILES SUPPLIED BY THE CITY OF CALGARY (INCLUDING U/G UTILITIES) & FROM SITE ASSESSMENT INFORMATION. ADDITIONAL REFERENCES FROM SEACOR ENVIRONMENTAL ENGINEERING INC., DRAWINGS 149-5A11.DWG, 149-5A6.DWG.

0 10 20 30 40 50 m

PLOT SIZE 22x34

ENGINEER

Clifton Associates

CLIENT

SEARS Canada Inc.

PROJECT

HUMAN HEALTH RISK ASSESSMENT
HOUNSFIELD HEIGHTS - BRIAR HILL COMMUNITY
CALGARY, ALBERTA

TITLE

BOROUGH AND MONITORING WELL LOCATION MAP

DESIGNED	SCALE	DATE
	1:1000	2015-12-04
DRAWN: RD	PROJECT NO.: CG2430	FIG.: 1
CHECKED	FILE NO.: CG2430-E13-14	

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

ATTACHMENT B

Indoor Vapour Intrusion Model
North 1

Input Variables

Input Variables for Indoor Vapour Inhalation

Required Input Variables

Below Ground Surface Area of Building

Description	Abbreviation	Units	Value	Reference/Comment
Building length	L_b	cm	1225	AEP 2016
Building width	W_b	cm	1225	AEP 2016
Depth below grade to bottom of building	L_f	cm	244	AEP 2016
Crack depth below grade	Z_{crack}	cm	244	AEP 2016
Building Area	A_b	cm^2	2.70E+06	AEP 2016

Flow Rate of Fresh air Into Building

Description	Abbreviation	Units	Value	Reference/Comment
Building length	L_b	cm	1225	
Building width	W_b	cm	1225	
Building height	H_b	cm	360	AEP 2016
Indoor air exchange rate per hour	ACH	exch/hr	0.5	AEP 2016
Building ventilation rate	Q_b	cm^3/s	7.50E+04	AEP 2016

Pressure-driven Soil Gas Flow Rate From Subsurface Into Building

Description	Abbreviation	Units	Value	Reference/Comment
Soil-building pressure differential	dP	$g/cm\text{-}s^2$	40	AEP 2016
Soil effective vapour permeability adjacent to building	k_v	cm^2	1.00E-09	AEP 2016
Building length	L_b	cm	1.23E+03	
Building width	W_b	cm	1.23E+03	
Crack area	A_{crack}	cm^2	9.95E+02	AEP 2016
Floor-wall seam perameter	X_{crack}	cm	4900	AEP 2016
Vapour viscosity at average soil temperature	μ	g/cm s	1.73E-04	AEP 2016
Crack depth below grade	Z_{crack}	cm	244	
Building Area	A_b	cm^2	2.70E+06	
Crack radius	r_{crack}	cm	0.20	AEP 2016
Average varpour flow rate into building	Q_{soil}	cm^3/s	9.16E-01	AEP 2016

Soil Parameters for Site

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A moisture content	O_w^A	m^3-water / m^3-soil	0.119	Unit 1 Coarse; AEP 2016
Stratum B moisture content	O_{wB}	m^3-water / m^3-soil	0.168	Unit 2 Fine; AEP 2016
Stratum C moisture content	O_w^C	m^3-water / m^3-soil	0.168	Unit 3 Fine; AEP 2016
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	Unit 1 Coarse; AEP 2016
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	Unit 2 Fine; AEP 2016
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	Unit 3 Fine; AEP 2016
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	Unit 1 Coarse; AEP 2016
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	Unit 2 Fine; AEP 2016
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	Unit 3 Fine; AEP 2016
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	Unit 1 Coarse; AEP 2016
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	Unit 2 Fine; AEP 2016
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	Unit 3 Fine; AEP 2016
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	

Soil Parameters for Impacted Soil Layer

Description	Abbreviation	Units	Value	Reference/Comment
Fraction of organic carbon	f_{oc}	mass/mass	0.005	AEP 2016
Impacted layer moisture content	O_w^I	m^3-water / m^3-soil	0.168	Unit 3 Fine: AEP 2016
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	Unit 3 Fine: AEP 2016
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	Unit 3 Fine: AEP 2016
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.4	Unit 3 Fine: AEP 2016

Miscelaneous Attenuation Coefficient Varaibles

Description	Abbreviation	Units	Value	Reference/Comment
Building floor thickness	L_{crack}	cm	11.25	AEP 2016
Building Area	A_b	cm^2	2.70E+06	

Exposure Variables

Description	Abbreviation	Units	Value	Reference/Comment
Exposure term for residential	ET	Unitless	1	AEP 2016

Benzene

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	103,459	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	32	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	2.6	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1780	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	4.6	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	3.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.23	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	8.80E-02	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RsC	mg/m^3	0.0030	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	81	AEP 2016
Soil allocation factor	SAF	Unitless	1	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	12640	Health Canada 2009
Molecular Weight	MW	g/mole	78.11	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	398,270	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	398,270,077	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	124,667	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	400,500	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	400,500,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	125,365	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.088	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.225	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	400	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.91E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.088	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.225	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	380	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	7.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.088	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.225	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	7.36E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.91E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	7.36E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	7.36E-03	
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	6.72E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	2.25E-02	
Alpha	Alpha	Unitless	2.90E-05	
Dilution Factor	DF	Unitless	34,452	

Toluene

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	134,378,636	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	35,659	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	3270	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	515	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	NGR	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	3800.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.27	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	8.70E-02	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.0442	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	3.8	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	234	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	3800	Health Canada 2009
Molecular Weight	MW	g/mole	92.14	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	141,238	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	141,237,837	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	37,479	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	141,110	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	141,110,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	37,445	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.087	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.274	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	400	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.85E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.087	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.274	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	380	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	7.28E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.087	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.274	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	7.28E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.85E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	7.28E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	7.28E-03	
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	5.85E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	2.23E-02	
Alpha	Alpha	Unitless	2.83E-05	
Dilution Factor	DF	Unitless	35,363	

Ethylbenzene

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	39,835,422	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	9,188	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	1592	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	152	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	NGR	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	1000.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.36	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	7.50E-02	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.0075	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	1	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	537	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	1270	Health Canada 2009
Molecular Weight	MW	g/mole	106.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	54,304	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	54,304,217	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	12,526	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	54,416	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	54,416,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	12,552	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.075	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.358	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	400	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.04E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.075	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.358	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	380	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	6.27E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.075	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.358	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	6.27E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.04E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	6.27E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	6.27E-03	
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	5.04E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.92E-02	
Alpha	Alpha	Unitless	2.51E-05	
Dilution Factor	DF	Unitless	39,835	

Xylenes

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	6,832,514	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	1,576	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	417	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	198	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	134.2	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	180.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.25	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	7.80E-02	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.00182	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	0.18	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	586	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	1070	Health Canada 2009
Molecular Weight	MW	g/mole	106.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	45,752	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	45,752,371	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	10,553	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	49,896	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	49,896,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	11,509	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.078	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.252	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	400	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.24E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.078	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.252	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	380	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	6.53E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.078	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.252	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	6.53E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.24E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	6.53E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	6.53E-03	
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	5.96E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	2.00E-02	
Alpha	Alpha	Unitless	2.63E-05	
Dilution Factor	DF	Unitless	37,958	

Naphthalene

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	141,008	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	27	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	87	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	31.7	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	23.6	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	3.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.0204	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.059	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	7.50E-06	Health Canada 2009
Background indoor air concentration	C_a	mg/m^3	0.00095	AEP 2016
Reference Concentration	RfC	mg/m^3	0.003	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	708	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016
Background soil concentration	BSC	mg/kg	0	AEP 2016
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa	10.4	Health Canada 2009
Maximum vapour concentration	C_{max}	ppm	103	
Molecular Weight	MW	g/mole	128.17	Health Canada 2009
Maximum vapour concentration	C_{max}	mg/m^3	538	
Maximum vapour concentration	C_{max}	µg/m^3	538,056	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.059	
Diffusion coefficient in water	D_w	cm^2/s	7.50E-06	
Dimensionless Henry's Law Constant	H	Unitless	0.0204	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	400	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.97E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.059	
Diffusion coefficient in water	D_w	cm^2/s	7.50E-06	
Dimensionless Henry's Law Constant	H	Unitless	0.0204	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	380	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.94E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.059	
Diffusion coefficient in water	D_w	cm^2/s	7.50E-06	
Dimensionless Henry's Law Constant	H	Unitless	0.0204	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.94E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.97E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.94E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.94E-03	
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	4.51E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.51E-02	
Alpha	Alpha	Unitless	2.13E-05	
Dilution Factor	DF	Unitless	47,003	

1,2-DCA

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	11,541	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	3	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	0.09	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	8520	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	0.29	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	3.8E-01	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.040	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	1.04E-01	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RsC	mg/m^3	0.0004	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	38	AEP 2016
Soil allocation factor	SAF	Unitless	1	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	1	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	10531.13385	EPI Suite
Molecular Weight	MW	g/mole	98.96	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	420,396	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	420,396,204	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	103,867	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	341,652	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	341,652,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	84,412	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.104	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.0401	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	400	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	6.99E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.104	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.0401	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	380	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	8.70E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.104	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.0401	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	8.70E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	6.99E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	8.70E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	8.70E-03	
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	7.95E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	2.66E-02	
Alpha	Alpha	Unitless	3.33E-05	
Dilution Factor	DF	Unitless	30,006	

Calculation of Overall F1 Soil and Groundwater Quality Criteria for the Protection of Indoor Vapour Inhalation

Fraction	Soil Quality Guideline [mg/kg]	Groundwater Quality Guideline [mg/L]	Percent Composition Soil	Percent Composition Soil
Aliphatic C6 to C8	2986	97	55%	58%
Aliphatic C8 to C10	558	3.2	36%	7%
Aromatic C8 to C10	730	90	9%	36%
F1	***1050***	***32.5***		

Calculation of Overall F2 Soil and Groundwater Quality Criteria for the Protection of Indoor Vapour Inhalation

Fraction	Soil Quality Guideline [mg/kg]	Groundwater Quality Guideline [mg/L]	Percent Composition Soil	Percent Composition Soil
Aliphatic C10 to C12	2828	2.21	36%	2%
Aliphatic C12 to C16	12809	0.51	44%	0.15%
Aromatic C10 to C12	4806	378	9%	60%
Aromatic C12 to C16	25162	999	11%	37%
F2	***5412***	***63.5***		

F1C6_C8Aliphatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	974,099,965	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	238,167	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	2986	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	97	AEP 2016
Indoor Air Concentration	C_{tA}	ug/m^3	18400	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	50	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.09111	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	18.4	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	3981	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa	6383	CCME 2008
Molecular Weight	MW	g/mole	100.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	257,502	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	257,502,309	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	62,959	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	50,000,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	50,000,000,000,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	12,225,000,000	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	50	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	400	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	50	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	380	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	50	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.82E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.89E-05	
Dilution Factor	DF	Unitless	52,940	

F1C8_C10Aliphatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	52,940,183	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	9,957	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	558	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	3.2	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	1000	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	80	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.03881	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	1	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	31623	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa	638	CCME 2008
Molecular Weight	MW	g/mole	130.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	33,475	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	33,475,300	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	6,296	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	80,000,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	################	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	15,046,153,846	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	80	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	400	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	80	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	380	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	80	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.82E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.89E-05	
Dilution Factor	DF	Unitless	52,940	

F1C8_C10Aromatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	10,587,955	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	2,157	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	730	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	90	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	200	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.48	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.03745	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	0.2	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	1585	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa	638	CCME 2008
Molecular Weight	MW	g/mole	120.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	30,900	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	30,900,277	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	6,296	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	480,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	480,000,000,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	97,800,000	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	0.48	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	400	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.48	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	380	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.48	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.82E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.89E-05	
Dilution Factor	DF	Unitless	52,940	

F2C10_C12Aliphatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	52,940,222	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	#DIV/0!	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	2828	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	2.2	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	1000	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	120	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	1	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	251189	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa		
Molecular Weight	MW	g/mole		
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	-	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	-	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	#DIV/0!	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	120,000,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	################	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	#DIV/0!	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	120	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	400	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	120	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	380	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	120	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.82E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.89E-05	
Dilution Factor	DF	Unitless	52,940	

F2C12_C16Aliphatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	52,940,223	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	#DIV/0!	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	12809	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	0.51	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	1000	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	520	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	1	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	5.01E+06	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa		
Molecular Weight	MW	g/mole		
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	-	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	-	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	#DIV/0!	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	520,000,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	################	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	#DIV/0!	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	520	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	400	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	520	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	380	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	520	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.82E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.89E-05	
Dilution Factor	DF	Unitless	52,940	

F2C10_C12Aromatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	10,587,865	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	#DIV/0!	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	4806	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	378	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	200	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.14	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	0.2	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	2512	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa		
Molecular Weight	MW	g/mole		
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	-	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	-	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	#DIV/0!	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	140,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	140,000,000,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	#DIV/0!	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	0.14	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	400	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.14	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	380	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.14	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.82E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.89E-05	
Dilution Factor	DF	Unitless	52,939	

F2C12_C16Aromatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	10,587,570	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	#DIV/0!	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	25162	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	999	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	200	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.053	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	0.2	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	5012	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa		
Molecular Weight	MW	g/mole		
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	-	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	-	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	#DIV/0!	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	53,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	53,000,000,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	#DIV/0!	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	0.053	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	400	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.053	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	380	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.053	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.19E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.19E-03	
Stratum A thickness	S_a	cm	400	
Stratum B thickness	S_b	cm	380	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	1030	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.82E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.89E-05	
Dilution Factor	DF	Unitless	52,938	

Indoor Vapour Intrusion Model
North 2

Input Variables

Input Variables for Indoor Vapour Inhalation

Required Input Variables

Below Ground Surface Area of Building

Description	Abbreviation	Units	Value	Reference/Comment
Building length	L_b	cm	1225	AEP 2016
Building width	W_b	cm	1225	AEP 2016
Depth below grade to bottom of building	L_f	cm	244	AEP 2016
Crack depth below grade	Z_{crack}	cm	244	AEP 2016
Building Area	A_b	cm^2	2.70E+06	AEP 2016

Flow Rate of Fresh air Into Building

Description	Abbreviation	Units	Value	Reference/Comment
Building length	L_b	cm	1225	
Building width	W_b	cm	1225	
Building height	H_b	cm	360	AEP 2016
Indoor air exchange rate per hour	ACH	exch/hr	0.5	AEP 2016
Building ventilation rate	Q_b	cm^3/s	7.50E+04	AEP 2016

Pressure-driven Soil Gas Flow Rate From Subsurface Into Building

Description	Abbreviation	Units	Value	Reference/Comment
Soil-building pressure differential	dP	$g/cm\text{-}s^2$	40	AEP 2016
Soil effective vapour permeability adjacent to building	k_v	cm^2	1.00E-09	AEP 2016
Building length	L_b	cm	1.23E+03	
Building width	W_b	cm	1.23E+03	
Crack area	A_{crack}	cm^2	9.95E+02	AEP 2016
Floor-wall seam perameter	X_{crack}	cm	4900	AEP 2016
Vapour viscosity at average soil temperature	μ	g/cm s	1.73E-04	AEP 2016
Crack depth below grade	Z_{crack}	cm	244	
Building Area	A_b	cm^2	2.70E+06	
Crack radius	r_{crack}	cm	0.20	AEP 2016
Average varpour flow rate into building	Q_{soil}	cm^3/s	9.16E-01	AEP 2016

Soil Parameters for Site

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A moisture content	O_w^A	m^3-water / m^3-soil	0.119	Unit 1 Coarse; AEP 2016
Stratum B moisture content	O_{wB}	m^3-water / m^3-soil	0.168	Unit 2 Fine; AEP 2016
Stratum C moisture content	O_w^C	m^3-water / m^3-soil	0.168	Unit 3 Fine; AEP 2016
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	Unit 1 Coarse; AEP 2016
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	Unit 2 Fine; AEP 2016
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	Unit 3 Fine; AEP 2016
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	Unit 1 Coarse; AEP 2016
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	Unit 2 Fine; AEP 2016
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	Unit 3 Fine; AEP 2016
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	Unit 1 Coarse; AEP 2016
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	Unit 2 Fine; AEP 2016
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	Unit 3 Fine; AEP 2016
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	

Soil Parameters for Impacted Soil Layer

Description	Abbreviation	Units	Value	Reference/Comment
Fraction of organic carbon	f_{oc}	mass/mass	0.005	AEP 2016
Impacted layer moisture content	O_w^I	m^3-water / m^3-soil	0.168	Unit 3 Fine: AEP 2016
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	Unit 3 Fine: AEP 2016
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	Unit 3 Fine: AEP 2016
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.4	Unit 3 Fine: AEP 2016

Miscelaneous Attenuation Coefficient Varaibles

Description	Abbreviation	Units	Value	Reference/Comment
Building floor thickness	L_{crack}	cm	11.25	AEP 2016
Building Area	A_b	cm^2	2.70E+06	

Exposure Variables

Description	Abbreviation	Units	Value	Reference/Comment
Exposure term for residential	ET	Unitless	1	AEP 2016

Benzene

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	100,010	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	31	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	2.5	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1780	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	4.4	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	3.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.23	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	8.80E-02	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RsC	mg/m^3	0.0030	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	81	AEP 2016
Soil allocation factor	SAF	Unitless	1	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	12640	Health Canada 2009
Molecular Weight	MW	g/mole	78.11	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	398,270	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	398,270,077	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	124,667	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	400,500	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	400,500,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	125,365	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.088	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.225	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	180	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.91E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.088	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.225	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	350	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	7.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.088	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.225	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	7.36E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.91E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	7.36E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	7.36E-03	
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	6.97E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	2.25E-02	
Alpha	Alpha	Unitless	3.00E-05	
Dilution Factor	DF	Unitless	33,303	

Toluene

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	129,857,594	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	34,459	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	3160	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	515	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	NGR	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	3800.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.27	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	8.70E-02	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.0442	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	3.8	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	234	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	3800	Health Canada 2009
Molecular Weight	MW	g/mole	92.14	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	141,238	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	141,237,837	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	37,479	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	141,110	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	141,110,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	37,445	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.087	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.274	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	180	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.85E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.087	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.274	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	350	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	7.28E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.087	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.274	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	7.28E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.85E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	7.28E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	7.28E-03	
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	5.85E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	2.23E-02	
Alpha	Alpha	Unitless	2.93E-05	
Dilution Factor	DF	Unitless	34,173	

Ethylbenzene

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	38,455,314	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	8,870	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	1536	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	152	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	NGR	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	1000.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.36	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	7.50E-02	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.0075	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	1	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	537	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	1270	Health Canada 2009
Molecular Weight	MW	g/mole	106.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	54,304	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	54,304,217	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	12,526	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	54,416	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	54,416,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	12,552	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.075	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.358	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	180	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.04E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.075	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.358	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	350	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	6.27E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.075	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.358	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	6.27E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.04E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	6.27E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	6.27E-03	
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	5.04E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.92E-02	
Alpha	Alpha	Unitless	2.60E-05	
Dilution Factor	DF	Unitless	38,455	

Xylenes

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	6,599,283	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	1,522	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	402	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	198	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	129.6	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	180.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.25	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	7.80E-02	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.00182	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	0.18	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	586	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	1070	Health Canada 2009
Molecular Weight	MW	g/mole	106.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	45,752	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	45,752,371	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	10,553	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	49,896	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	49,896,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	11,509	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.078	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.252	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	180	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.24E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.078	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.252	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	350	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	6.53E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.078	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.252	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	6.53E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	5.24E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	6.53E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	6.53E-03	
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	6.18E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	2.00E-02	
Alpha	Alpha	Unitless	2.73E-05	
Dilution Factor	DF	Unitless	36,663	

Naphthalene

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	135,872	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	26	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	83	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	31.7	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	22.8	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	3.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.0204	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.059	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	7.50E-06	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.00095	AEP 2016
Reference Concentration	RfC	mg/m^3	0.003	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	708	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016
Background soil concentration	BSC	mg/kg	0	AEP 2016
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa	10.4	Health Canada 2009
Maximum vapour concentration	C_{max}	ppm	103	
Molecular Weight	MW	g/mole	128.17	Health Canada 2009
Maximum vapour concentration	C_{max}	mg/m^3	538	
Maximum vapour concentration	C_{max}	µg/m^3	538,052	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.059	
Diffusion coefficient in water	D_w	cm^2/s	7.50E-06	
Dimensionless Henry's Law Constant	H	Unitless	0.0204	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	180	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.97E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.059	
Diffusion coefficient in water	D_w	cm^2/s	7.50E-06	
Dimensionless Henry's Law Constant	H	Unitless	0.0204	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	350	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.94E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.059	
Diffusion coefficient in water	D_w	cm^2/s	7.50E-06	
Dimensionless Henry's Law Constant	H	Unitless	0.0204	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.94E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.97E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.94E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.94E-03	
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	4.67E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.51E-02	
Alpha	Alpha	Unitless	2.21E-05	
Dilution Factor	DF	Unitless	45,291	

1,2-DCA

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	11,167	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	3	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	0.09	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	8520	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	0.28	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	4E-01	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.040	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	1.04E-01	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RsC	mg/m^3	0.0004	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	38	AEP 2016
Soil allocation factor	SAF	Unitless	1	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	1	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	10531.13385	EPI Suite
Molecular Weight	MW	g/mole	98.96	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	420,396	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	420,396,204	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	103,867	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	341,652	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	341,652,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	84,412	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.104	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.0401	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	180	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	6.99E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.104	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.0401	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	350	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	8.70E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.104	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.0401	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	8.70E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	6.99E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	8.70E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	8.70E-03	
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	8.24E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	2.66E-02	
Alpha	Alpha	Unitless	3.44E-05	
Dilution Factor	DF	Unitless	29,034	

Calculation of Overall F1 Soil and Groundwater Quality Criteria for the Protection of Indoor Vapour Inhalation

Fraction	Soil Quality Guideline [mg/kg]	Groundwater Quality Guideline [mg/L]	Percent Composition Soil	Percent Composition Soil
Aliphatic C6 to C8	2872	93	55%	58%
Aliphatic C8 to C10	537	3.1	36%	7%
Aromatic C8 to C10	703	86	9%	36%
F1	***1010***	***31.2***		

Calculation of Overall F2 Soil and Groundwater Quality Criteria for the Protection of Indoor Vapour Inhalation

Fraction	Soil Quality Guideline [mg/kg]	Groundwater Quality Guideline [mg/L]	Percent Composition Soil	Percent Composition Soil
Aliphatic C10 to C12	2720	2.12	36%	2%
Aliphatic C12 to C16	12320	0.49	44%	0.15%
Aromatic C10 to C12	4623	364	9%	60%
Aromatic C12 to C16	24201	961	11%	37%
F2	***5206***	***61.1***		

F1C6_C8Aliphatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	936,907,428	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	229,074	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	2872	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	93	AEP 2016
Indoor Air Concentration	C_{tA}	ug/m^3	18400	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	50	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.09111	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	18.4	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	3981	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa	6383	CCME 2008
Molecular Weight	MW	g/mole	100.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	257,502	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	257,502,309	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	62,959	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	50,000,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	50,000,000,000,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	12,225,000,000	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	50	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	180	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	50	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	350	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	50	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.96E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.96E-05	
Dilution Factor	DF	Unitless	50,919	

F1C8_C10Aliphatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	50,918,849	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	9,577	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	537	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	3.1	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	1000	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	80	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.03881	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	1	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	31623	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa	638	CCME 2008
Molecular Weight	MW	g/mole	130.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	33,475	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	33,475,300	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	6,296	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	80,000,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	################	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	15,046,153,846	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	80	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	180	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	80	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	350	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	80	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.96E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.96E-05	
Dilution Factor	DF	Unitless	50,919	

F1C8_C10Aromatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	10,183,703	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	2,075	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	703	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	86	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	200	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.48	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.03745	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	0.2	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	1585	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa	638	CCME 2008
Molecular Weight	MW	g/mole	120.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	30,900	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	30,900,277	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	6,296	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	480,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	480,000,000,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	97,800,000	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	0.48	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	180	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.48	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	350	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.48	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.96E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.96E-05	
Dilution Factor	DF	Unitless	50,919	

F2C10_C12Aliphatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	50,918,888	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	#DIV/0!	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	2720	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	2.1	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	1000	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	120	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	1	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	251189	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa		
Molecular Weight	MW	g/mole		
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	-	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	-	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	#DIV/0!	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	120,000,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	################	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	#DIV/0!	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	120	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	180	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	120	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	350	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	120	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.96E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.96E-05	
Dilution Factor	DF	Unitless	50,919	

F2C12_C16Aliphatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	50,918,889	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	#DIV/0!	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	12320	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	0.49	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	1000	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	520	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	1	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	5.01E+06	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa		
Molecular Weight	MW	g/mole		
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	-	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	-	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	#DIV/0!	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	520,000,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	################	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	#DIV/0!	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	520	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	180	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	520	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	350	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	520	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.96E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.96E-05	
Dilution Factor	DF	Unitless	50,919	

F2C10_C12Aromatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	10,183,649	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	#DIV/0!	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	4623	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	364	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	200	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.14	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	0.2	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	2512	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa		
Molecular Weight	MW	g/mole		
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	-	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	-	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	#DIV/0!	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	140,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	140,000,000,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	#DIV/0!	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	0.14	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	180	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.14	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	350	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.14	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.18E-03	
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.96E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.96E-05	
Dilution Factor	DF	Unitless	50,918	

F2C12_C16Aromatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	10,183,438	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	#DIV/0!	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	24201	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	961	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	200	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.053	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	0.2	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	5012	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa		
Molecular Weight	MW	g/mole		
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	-	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	-	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	#DIV/0!	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	53,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	53,000,000,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	#DIV/0!	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	0.053	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.119	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.241	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.7	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.36	
Stratum A thickness	S_a	cm	180	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.053	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0.168	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0.302	
Stratum B soil dry bulk density	Pb^B	g/cm^3	1.4	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0.47	
Stratum B thickness	S_b	cm	350	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.053	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0.168	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0.302	
Stratum C soil dry bulk density	Pb^C	g/cm^3	1.4	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0.47	
Stratum C thickness	S_c	cm	250	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.19E-03	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	3.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	4.18E-03	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	4.19E-03	
Stratum A thickness	S_a	cm	180	
Stratum B thickness	S_b	cm	350	
Stratum C thickness	S_c	cm	250	
Total thickness of vadose zone	L_t	cm	780	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	3.96E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.28E-02	
Alpha	Alpha	Unitless	1.96E-05	
Dilution Factor	DF	Unitless	50,917	

Indoor Vapour Intrusion Model
South 1

Input Variables

Input Variables for Indoor Vapour Inhalation

Required Input Variables

Below Ground Surface Area of Building

Description	Abbreviation	Units	Value	Reference/Comment
Building length	L_b	cm	1225	AEP 2016
Building width	W_b	cm	1225	AEP 2016
Depth below grade to bottom of building	L_f	cm	244	AEP 2016
Crack depth below grade	Z_{crack}	cm	244	AEP 2016
Building Area	A_b	cm^2	2.70E+06	AEP 2016

Flow Rate of Fresh air Into Building

Description	Abbreviation	Units	Value	Reference/Comment
Building length	L_b	cm	1225	
Building width	W_b	cm	1225	
Building height	H_b	cm	360	AEP 2016
Indoor air exchange rate per hour	ACH	exch/hr	0.5	AEP 2016
Building ventilation rate	Q_b	cm^3/s	7.50E+04	AEP 2016

Pressure-driven Soil Gas Flow Rate From Subsurface Into Building

Description	Abbreviation	Units	Value	Reference/Comment
Soil-building pressure differential	dP	$g/cm\text{-}s^2$	40	AEP 2016
Soil effective vapour permeability	k_v	cm^2	1.00E-09	AEP 2016
Building length	L_b	cm	1.23E+03	
Building width	W_b	cm	1.23E+03	
Crack area	A_{crack}	cm^2	9.95E+02	AEP 2016
Floor-wall seam perameter	X_{crack}	cm	4900	AEP 2016
Vapour viscosity at average soil temperature	μ	g/cm s	1.73E-04	AEP 2016
Crack depth below grade	Z_{crack}	cm	244	
Building Area	A_b	cm^2	2.70E+06	
Crack radius	r_{crack}	cm	0.20	AEP 2016
Average varpour flow rate into building	Q_{soil}	cm^3/s	9.16E-01	AEP 2016

Soil Parameters for Site

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A moisture content	O_w^A	m^3-water / m^3-soil	0.168	Unit 3 Fine; AEP 2016
Stratum B moisture content	O_{wB}	m^3-water / m^3-soil		
Stratum C moisture content	O_w^C	m^3-water / m^3-soil		
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	Unit 3 Fine; AEP 2016
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil		
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil		
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	Unit 3 Fine; AEP 2016
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil		
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil		
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	Unit 3 Fine; AEP 2016
Stratum B soil dry bulk density	Pb^B	g/cm^3		
Stratum C soil dry bulk density	Pb^C	g/cm^3		
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm		
Stratum C thickness	S_c	cm		
Total thickness of vadose zone	L_t	cm	380	

Soil Parameters for Impacted Soil Layer

Description	Abbreviation	Units	Value	Reference/Comment
Fraction of organic carbon	f_{oc}	mass/mass	0.005	AEP 2016
Impacted layer moisture content	O_w^I	m^3-water / m^3-soil	0.168	Unit 3 Fine: AEP 2016
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	Unit 3 Fine: AEP 2016
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	Unit 3 Fine: AEP 2016
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.4	Unit 3 Fine: AEP 2016

Miscelaneous Attenuation Coefficient Varaibles

Description	Abbreviation	Units	Value	Reference/Comment
Building floor thickness	L_{crack}	cm	11.25	AEP 2016
Building Area	A_b	cm^2	2.70E+06	

Exposure Variables

Description	Abbreviation	Units	Value	Reference/Comment
Exposure term for residential	ET	Unitless	1	AEP 2016

Benzene

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	72,070	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	23	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	1.8	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1780	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	3.2	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	3.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.23	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	8.80E-02	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RsC	mg/m^3	0.0030	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	81	AEP 2016
Soil allocation factor	SAF	Unitless	1	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	12640	Health Canada 2009
Molecular Weight	MW	g/mole	78.11	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	398,270	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	398,270,077	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	124,667	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	400,500	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	400,500,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	125,365	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.088	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.225	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.168	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	
Stratum A thickness	S_a	cm	380	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	7.36E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.088	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.225	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0	
Stratum B soil dry bulk density	Pb^B	g/cm^3	0	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0	
Stratum B thickness	S_b	cm	0	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.088	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.225	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0	
Stratum C soil dry bulk density	Pb^C	g/cm^3	0	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0	
Stratum C thickness	S_c	cm	0	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	7.36E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm	0	
Stratum C thickness	S_c	cm	0	
Total thickness of vadose zone	L_t	cm	380	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	7.36E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	3.22E-02	
Alpha	Alpha	Unitless	4.17E-05	
Dilution Factor	DF	Unitless	23,999	

Toluene

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	92,093,945	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	24,438	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	2241	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	515	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	NGR	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	3800.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.27	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	8.70E-02	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.0442	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	3.8	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	234	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	3800	Health Canada 2009
Molecular Weight	MW	g/mole	92.14	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	141,238	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	141,237,837	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	37,479	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	141,110	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	141,110,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	37,445	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.087	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.274	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.168	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	
Stratum A thickness	S_a	cm	380	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	7.28E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.087	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.274	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0	
Stratum B soil dry bulk density	Pb^B	g/cm^3	0	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0	
Stratum B thickness	S_b	cm	0	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.087	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.274	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0	
Stratum C soil dry bulk density	Pb^C	g/cm^3	0	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0	
Stratum C thickness	S_c	cm	0	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	7.28E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm	0	
Stratum C thickness	S_c	cm	0	
Total thickness of vadose zone	L_t	cm	380	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	7.28E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	3.18E-02	
Alpha	Alpha	Unitless	4.13E-05	
Dilution Factor	DF	Unitless	24,235	

Ethylbenzene

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	27,471,607	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	6,337	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	1098	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	152	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	NGR	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	1000.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.36	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	7.50E-02	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.0075	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	1	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	537	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	1270	Health Canada 2009
Molecular Weight	MW	g/mole	106.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	54,304	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	54,304,217	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	12,526	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	54,416	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	54,416,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	12,552	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.075	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.358	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.168	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	
Stratum A thickness	S_a	cm	380	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	6.27E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.075	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.358	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0	
Stratum B soil dry bulk density	Pb^B	g/cm^3	0	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0	
Stratum B thickness	S_b	cm	0	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.075	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.358	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0	
Stratum C soil dry bulk density	Pb^C	g/cm^3	0	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0	
Stratum C thickness	S_c	cm	0	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	6.27E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm	0	
Stratum C thickness	S_c	cm	0	
Total thickness of vadose zone	L_t	cm	380	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	6.27E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	2.74E-02	
Alpha	Alpha	Unitless	3.64E-05	
Dilution Factor	DF	Unitless	27,472	

Xylenes

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	4,785,274	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	1,104	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	292	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	198	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	94.0	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	180.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.25	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	7.80E-02	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.00182	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	0.18	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	586	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	1070	Health Canada 2009
Molecular Weight	MW	g/mole	106.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	45,752	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	45,752,371	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	10,553	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	49,896	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	49,896,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	11,509	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.078	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.252	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.168	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	
Stratum A thickness	S_a	cm	380	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	6.53E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.078	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.252	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0	
Stratum B soil dry bulk density	Pb^B	g/cm^3	0	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0	
Stratum B thickness	S_b	cm	0	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.078	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.252	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0	
Stratum C soil dry bulk density	Pb^C	g/cm^3	0	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0	
Stratum C thickness	S_c	cm	0	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	6.53E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm	0	
Stratum C thickness	S_c	cm	0	
Total thickness of vadose zone	L_t	cm	380	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	6.53E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	2.85E-02	
Alpha	Alpha	Unitless	3.76E-05	
Dilution Factor	DF	Unitless	26,585	

Naphthalene

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	100,183	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	19	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	61	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	31.7	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	16.8	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	3.0	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.0204	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.059	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	7.50E-06	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.00095	AEP 2016
Reference Concentration	RfC	mg/m^3	0.003	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	708	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016
Background soil concentration	BSC	mg/kg	0	AEP 2016
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa	10.4	Health Canada 2009
Maximum vapour concentration	C_{max}	ppm	103	
Molecular Weight	MW	g/mole	128.17	Health Canada 2009
Maximum vapour concentration	C_{max}	mg/m^3	538	
Maximum vapour concentration	C_{max}	µg/m^3	538,056	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.059	
Diffusion coefficient in water	D_w	cm^2/s	7.50E-06	
Dimensionless Henry's Law Constant	H	Unitless	0.0204	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.168	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	
Stratum A thickness	S_a	cm	380	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.94E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.059	
Diffusion coefficient in water	D_w	cm^2/s	7.50E-06	
Dimensionless Henry's Law Constant	H	Unitless	0.0204	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0	
Stratum B soil dry bulk density	Pb^B	g/cm^3	0	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0	
Stratum B thickness	S_b	cm	0	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.059	
Diffusion coefficient in water	D_w	cm^2/s	7.50E-06	
Dimensionless Henry's Law Constant	H	Unitless	0.0204	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0	
Stratum C soil dry bulk density	Pb^C	g/cm^3	0	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0	
Stratum C thickness	S_c	cm	0	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.94E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm	0	
Stratum C thickness	S_c	cm	0	
Total thickness of vadose zone	L_t	cm	380	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	4.94E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	2.16E-02	
Alpha	Alpha	Unitless	2.99E-05	
Dilution Factor	DF	Unitless	33,395	

1,2-DCA

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	7,986	AEP 2016
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	2	
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	0.06	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	8520	AEP 2016
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	0.20	AEP 2016
Indoor Air Concentration	C_{IA}	ug/m^3	4E-01	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.040	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	1.04E-01	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RsC	mg/m^3	0.0004	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	38	AEP 2016
Soil allocation factor	SAF	Unitless	1	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	1	AEP 2016
Vapour pressure at STP	V_{stp}	Pa	10531.13385	EPI Suite
Molecular Weight	MW	g/mole	98.96	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	420,396	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	420,396,204	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	103,867	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	341,652	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	341,652,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	84,412	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.104	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.0401	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.168	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	
Stratum A thickness	S_a	cm	380	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	8.70E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.104	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.0401	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0	
Stratum B soil dry bulk density	Pb^B	g/cm^3	0	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0	
Stratum B thickness	S_b	cm	0	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.104	
Diffusion coefficient in water	D_w	cm^2/s	0.00E+00	
Dimensionless Henry's Law Constant	H	Unitless	0.0401	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0	
Stratum C soil dry bulk density	Pb^C	g/cm^3	0	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0	
Stratum C thickness	S_c	cm	0	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	8.70E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm	0	
Stratum C thickness	S_c	cm	0	
Total thickness of vadose zone	L_t	cm	380	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	8.70E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	3.80E-02	
Alpha	Alpha	Unitless	4.82E-05	
Dilution Factor	DF	Unitless	20,763	

Calculation of Overall F1 Soil and Groundwater Quality Criteria for the Protection of Indoor Vapour Inhalation

Fraction	Soil Quality Guideline [mg/kg]	Groundwater Quality Guideline [mg/L]	Percent Composition Soil	Percent Composition Soil
Aliphatic C6 to C8	2142	70	55%	58%
Aliphatic C8 to C10	400	2.3	36%	7%
Aromatic C8 to C10	524	64	9%	36%
F1	***753***	***23.3***		

Calculation of Overall F2 Soil and Groundwater Quality Criteria for the Protection of Indoor Vapour Inhalation

Fraction	Soil Quality Guideline [mg/kg]	Groundwater Quality Guideline [mg/L]	Percent Composition Soil	Percent Composition Soil
Aliphatic C10 to C12	2029	1.58	36%	2%
Aliphatic C12 to C16	9189	0.37	44%	0.15%
Aromatic C10 to C12	3448	271	9%	60%
Aromatic C12 to C16	18051	717	11%	37%
F2	***3883***	***45.6***		

F1C6_C8Aliphatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	698,813,599	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	170,860	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	2142	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	70	AEP 2016
Indoor Air Concentration	C_{tA}	ug/m^3	18400	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	50	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.09111	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	18.4	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	3981	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa	6383	CCME 2008
Molecular Weight	MW	g/mole	100.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	257,502	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	257,502,309	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	62,959	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	50,000,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	50,000,000,000,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	12,225,000,000	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	50	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.168	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	
Stratum A thickness	S_a	cm	380	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	50	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0	
Stratum B soil dry bulk density	Pb^B	g/cm^3	0	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0	
Stratum B thickness	S_b	cm	0	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	50	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0	
Stratum C soil dry bulk density	Pb^C	g/cm^3	0	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0	
Stratum C thickness	S_c	cm	0	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.18E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm	0	
Stratum C thickness	S_c	cm	0	
Total thickness of vadose zone	L_t	cm	380	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	4.18E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.83E-02	
Alpha	Alpha	Unitless	2.63E-05	
Dilution Factor	DF	Unitless	37,979	

F1C8_C10Aliphatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	37,978,967	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	7,143	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	400	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	2.3	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	1000	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	80	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.03881	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	1	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	31623	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa	638	CCME 2008
Molecular Weight	MW	g/mole	130.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	33,475	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	33,475,300	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	6,296	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	80,000,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	################	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	15,046,153,846	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	80	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.168	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	
Stratum A thickness	S_a	cm	380	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	80	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0	
Stratum B soil dry bulk density	Pb^B	g/cm^3	0	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0	
Stratum B thickness	S_b	cm	0	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	80	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0	
Stratum C soil dry bulk density	Pb^C	g/cm^3	0	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0	
Stratum C thickness	S_c	cm	0	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.18E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm	0	
Stratum C thickness	S_c	cm	0	
Total thickness of vadose zone	L_t	cm	380	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	4.18E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.83E-02	
Alpha	Alpha	Unitless	2.63E-05	
Dilution Factor	DF	Unitless	37,979	

F1C8_C10Aromatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	7,595,734	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	1,548	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	524	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	64	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	200	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.48	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0.03745	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	0.2	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	1585	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa	638	CCME 2008
Molecular Weight	MW	g/mole	120.00	Health Canada 2009
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	30,900	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	30,900,277	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	6,296	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	480,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	480,000,000,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	97,800,000	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	0.48	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.168	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	
Stratum A thickness	S_a	cm	380	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.48	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0	
Stratum B soil dry bulk density	Pb^B	g/cm^3	0	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0	
Stratum B thickness	S_b	cm	0	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.48	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0	
Stratum C soil dry bulk density	Pb^C	g/cm^3	0	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0	
Stratum C thickness	S_c	cm	0	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.18E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm	0	
Stratum C thickness	S_c	cm	0	
Total thickness of vadose zone	L_t	cm	380	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	4.18E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.83E-02	
Alpha	Alpha	Unitless	2.63E-05	
Dilution Factor	DF	Unitless	37,979	

F2C10_C12Aliphatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	37,979,006	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	#DIV/0!	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	2029	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	1.6	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	1000	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	120	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	1	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	251189	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa		
Molecular Weight	MW	g/mole		
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	-	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	-	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	#DIV/0!	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	120,000,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	################	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	#DIV/0!	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	120	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.168	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	
Stratum A thickness	S_a	cm	380	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	120	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0	
Stratum B soil dry bulk density	Pb^B	g/cm^3	0	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0	
Stratum B thickness	S_b	cm	0	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	120	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0	
Stratum C soil dry bulk density	Pb^C	g/cm^3	0	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0	
Stratum C thickness	S_c	cm	0	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.18E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm	0	
Stratum C thickness	S_c	cm	0	
Total thickness of vadose zone	L_t	cm	380	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	4.18E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.83E-02	
Alpha	Alpha	Unitless	2.63E-05	
Dilution Factor	DF	Unitless	37,979	

F2C12_C16Aliphatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	37,979,006	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	#DIV/0!	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	9189	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	0.37	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	1000	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	520	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	1	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	5.01E+06	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa		
Molecular Weight	MW	g/mole		
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	-	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	-	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	#DIV/0!	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	520,000,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	################	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	#DIV/0!	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	520	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.168	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	
Stratum A thickness	S_a	cm	380	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	520	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0	
Stratum B soil dry bulk density	Pb^B	g/cm^3	0	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0	
Stratum B thickness	S_b	cm	0	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	520	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0	
Stratum C soil dry bulk density	Pb^C	g/cm^3	0	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0	
Stratum C thickness	S_c	cm	0	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.18E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm	0	
Stratum C thickness	S_c	cm	0	
Total thickness of vadose zone	L_t	cm	380	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	4.18E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.83E-02	
Alpha	Alpha	Unitless	2.63E-05	
Dilution Factor	DF	Unitless	37,979	

F2C10_C12Aromatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	7,595,699	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	#DIV/0!	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	3448	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	271	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	200	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.14	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	0.2	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	2512	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa		
Molecular Weight	MW	g/mole		
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	-	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	-	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	#DIV/0!	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	140,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	140,000,000,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	#DIV/0!	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	0.14	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.168	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	
Stratum A thickness	S_a	cm	380	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.18E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.14	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0	
Stratum B soil dry bulk density	Pb^B	g/cm^3	0	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0	
Stratum B thickness	S_b	cm	0	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.14	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0	
Stratum C soil dry bulk density	Pb^C	g/cm^3	0	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0	
Stratum C thickness	S_c	cm	0	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.18E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm	0	
Stratum C thickness	S_c	cm	0	
Total thickness of vadose zone	L_t	cm	380	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	4.18E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.83E-02	
Alpha	Alpha	Unitless	2.63E-05	
Dilution Factor	DF	Unitless	37,978	

F2C12_C16Aromatic

Soil Vapour Guideline for Indoor Vapour Inhalation

Required Input Variables

Calculated Guidelines

Description	Abbreviation	Units	Value	Reference/Comment
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ug/m^3	7,595,531	
Tier 1 Soil Vapour Guideline at Source	C_{sv}	ppm	#DIV/0!	Not applicable to fractions of hydrocarbons
Impacted layer volumetric moisture content	O_w^I	m^3-water / m^3-soil	0.168	
Impacted layer volumetric vapour content	O_a^I	m^3-vapour / m^3-soil	0.302	
Impacted layer soil total porosity	O_t^I	m^3-voids / m^3-soil	0.47	
Impacted layer soil dry bulk density	Pb^I	g/cm^3	1.40	
Tier 1 Soil Quality Guideline for Indoor Vapour Concentrations	SQG_{II}	mg/kg	18051	AEP 2016
Fraction of organic carbon	foc	mass/mass	0.0050	
Solubility	S	mg/L	1000000.0000	Temporary high value
Groundwater Quality Guideline for Vapour Inhalation	$CWQG_{II}$	mg/L	717	AEP 2016
Indoor Air Concentration	C_{iA}	ug/m^3	200	

Chemical Properties

Description	Abbreviation	Units	Value	Reference/Comment
Dimensionless Henry's Law Constant	H	Unitless	0.053	AEP 2016
Diffusion coefficient in air	D_a	cm^2/s	0.05	AEP 2016
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	AEP 2016
Background indoor air concentration	C_a	mg/m^3	0	AEP 2016 or use default value of zero for carcinogens
Reference Concentration	RfC	mg/m^3	0.2	AEP 2016
Concentration Ratio	CR	Unitless	1	Maximum acceptable
Water organic carbon partition	K_{oc}	mL/g	5012	AEP 2016
Soil allocation factor	SAF	Unitless	0.5	AEP 2016 or use default value of 1 for carcinogens
Background soil concentration	BSC	mg/kg	0	AEP 2016 or use default value of zero for carcinogens
Adjustment Factor for Degradation	AF	Unitless	10	
Vapour pressure at STP	V_{stp}	Pa		
Molecular Weight	MW	g/mole		
Maximum vapour concentration (NAPL Present)	C_{max}	mg/m^3	-	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (NAPL Present)	C_{max}	µg/m^3	-	
Maximum vapour concentration (NAPL Present)	C_{max}	ppm	#DIV/0!	
Maximum vapour concentration (No NAPL Present)	C_{max}	mg/m^3	53,000,000	Health Canada 2010; Part VII: Guidance for Soil Vapour Intrusion A
Maximum vapour concentration (No NAPL Present)	C_{max}	µg/m^3	53,000,000,000	
Maximum vapour concentration (No NAPL Present)	C_{max}	ppm	#DIV/0!	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer A

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	1.00E-05	
Dimensionless Henry's Law Constant	H	Unitless	0.053	
Stratum A volumetric moisture content	O_w^A	m^3-water / m^3-soil	0.168	
Stratum A volumetric vapour content	O_a^A	m^3-vapour / m^3-soil	0.302	
Stratum A soil dry bulk density	Pb^A	g/cm^3	1.4	
Stratum A soil total porosity	O_t^A	m^3-voids / m^3-soil	0.47	
Stratum A thickness	S_a	cm	380	
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.19E-03	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer B

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.053	
Stratum B volumetric moisture content	O_w^B	m^3-water / m^3-soil	0	
Stratum B volumetric vapour content	O_a^B	m^3-vapour / m^3-soil	0	
Stratum B soil dry bulk density	Pb^B	g/cm^3	0	
Stratum B soil total porosity	O_t^B	m^3-voids / m^3-soil	0	
Stratum B thickness	S_b	cm	0	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	

Effective Vapour-phase Diffusion Coefficient Through Soil Layer C

Description	Abbreviation	Units	Value	Reference/Comment
Diffusion coefficient in air	D_a	cm^2/s	0.05	
Diffusion coefficient in water	D_w	cm^2/s	0.00001	
Dimensionless Henry's Law Constant	H	Unitless	0.053	
Stratum C volumetric moisture content	O_w^C	m^3-water / m^3-soil	0	
Stratum C volumetric vapour content	O_a^C	m^3-vapour / m^3-soil	0	
Stratum C soil dry bulk density	Pb^C	g/cm^3	0	
Stratum C soil total porosity	O_t^C	m^3-voids / m^3-soil	0	
Stratum C thickness	S_c	cm	0	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	

Effective Overall Vapour-phase Diffusion Coefficient Through The Vadose Zone

Description	Abbreviation	Units	Value	Reference/Comment
Stratum A effective diffusion coefficient	$D^{eff}A$	cm^2/s	4.19E-03	
Stratum B effective diffusion coefficient	$D^{eff}B$	cm^2/s	0.00E+00	
Stratum C effective diffusion coefficient	$D^{eff}C$	cm^2/s	0.00E+00	
Stratum A thickness	S_a	cm	380	
Stratum B thickness	S_b	cm	0	
Stratum C thickness	S_c	cm	0	
Total thickness of vadose zone	L_t	cm	380	
Overal effective diffusion coefficient	D^{eff}	cm^2/s	4.19E-03	

Attenuation Coefficient

Description	Abbreviation	Units	Value	Reference/Comment
Diffusivity in cracks	D_{crack}	cm^2/s	1.83E-02	
Alpha	Alpha	Unitless	2.63E-05	
Dilution Factor	DF	Unitless	37,978	

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

ATTACHMENT C

Table C1 Summary of Borehole Logs Used to Characterize Stratigraphy and Groundwater Depth in Area N1

Unit[a]	MW1921 [m]	MW1925 [m]	MW1917 [m]	Average [m]
1	5	8.2	5.8	6.3
2	4.2	3.4	4.2	3.9
3	2.2	2.5	2.7	2.5
Depth to groundwater [mbgs][b]	11	14	13	13

(a) Thickness of units derived from borehole logs (CAL 2016).
(b) Derived from monitoring wells (CAL 2019).

Table C2 Summary of Borehole Logs Used to Characterize Stratigraphy and Groundwater Depth in Area N2

Unit[a]	MW1922 [m]	MW1956 [m]	MW1919 [m]	Average [m]
1	4	3	3.2	3.4
2	5.0	3.2	4	4.1
3	2.1	2.5	3	2.5
Depth to groundwater [mbgs][b]	11	9.3	10	10

(a) Thickness of units derived from borehole logs (CAL 2016).
(b) Derived from monitoring wells (CAL 2019).

Table C3 Summary of Borehole Logs Used to Characterize Stratigraphy and Groundwater Depth in Area S1

Unit[a]	MW1943 [m]	MW1944 [m]	Average [m]
1	NA	NA	NA
2	NA	NA	NA
3	6.1	6.0	6.1
Depth to groundwater [mbgs][b]	6.2	6.0	6.1

(a) Thickness of units derived from borehole logs (CAL 2016).
(b) Derived from monitoring wells (CAL 2016; CAL 2019).

Reference

CAL (Clifton Associates Limited). 2016. Subsurface Investigation Mall and Hounsfield Heights Areas Calgary, Alberta. File CG2430 E13. 22 January 2016.

CAL (Clifton Associates Limited). 2019. 2018 Fourth Quarter Groundwater Monitoring and Sampling Report Hounsfield Heights – Briar Hill Community Calgary, Alberta. File CG2430.1 E32. 25 January 2019.

Intrinsik Corp.
736 8th Avenue SW, Suite 1060
Calgary, Alberta, T2P 1H4

ATTACHMENT D

Env BH m elev CAL v09.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 1917

Client:	Sears Canada Inc.	Northing:	5660865.661	Date:	27 October 2014
Project:	Sears Site Management	Easting:	703474.0807	Driller:	All Service Drilling
Location:	15th Street NW, Calgary, Alberta	Ground Elev.:	1089.5463	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1089.3873	Logged by:	AM

Elev (m) / Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	Moisture Content (percent) Plastic Limit ▲ / Natural Moisture ● / Liquid Limit ◆ (0 – 50 – 100)	Headspace Vapour OVA/PID ppm (10 – 100 – 1000 – 10000)	Monitoring Well Construction Detail
1089 / 0		TOPSOIL: Some gravel, brown, dry		1917-01A				0/1	Cement/ roadbox
		SAND: Medium grained, brown, moist, loose							Sand
									Hydrated bentonite chips
1				1917-01B				0/1	
1088									
2		(2.0 m- 2.1 m) Some clay, wet		1917-02A				0/0	
1087									
				1917-02B				0/1	50 mm PVC pipe
3		(3.0 m-4.6 m) Compact							
1086				1917-03A				0/1	
4									
				1917-03B				0/1	
1085									
5				1917-04A*				5/1	Bentonite grout
1084		(5.3 m-5.7 m) Wet							
				1917-04B				0/1	
6		CLAY: Brown, moist, firm, high plasticity							
1083		(6.1 m-7.3 m) Firm to stiff		1917-05A				0/1	
7									
				1917-05B				0/0	
1082		(7.3 m-7.6 m) Silty, trace gravel, soft, low plasticity							
8		(7.6 m-9.1 m) Some silt, trace gravel, medium plasticity		1917-06A				0/1	Hydrated bentonite chips
1081									
				1917-06B				0/1	
9									
1080		(9.2 m-9.4 m) Sand lens, some clay, wet, loose		1917-07A				0/0	
		(9.4 m-10.0 m) Sandy, low plasticity							
10		SAND: Medium grained, brown, moist, compact		1917-07B*				20/1	

Env BH m elev CAL v09.ldf

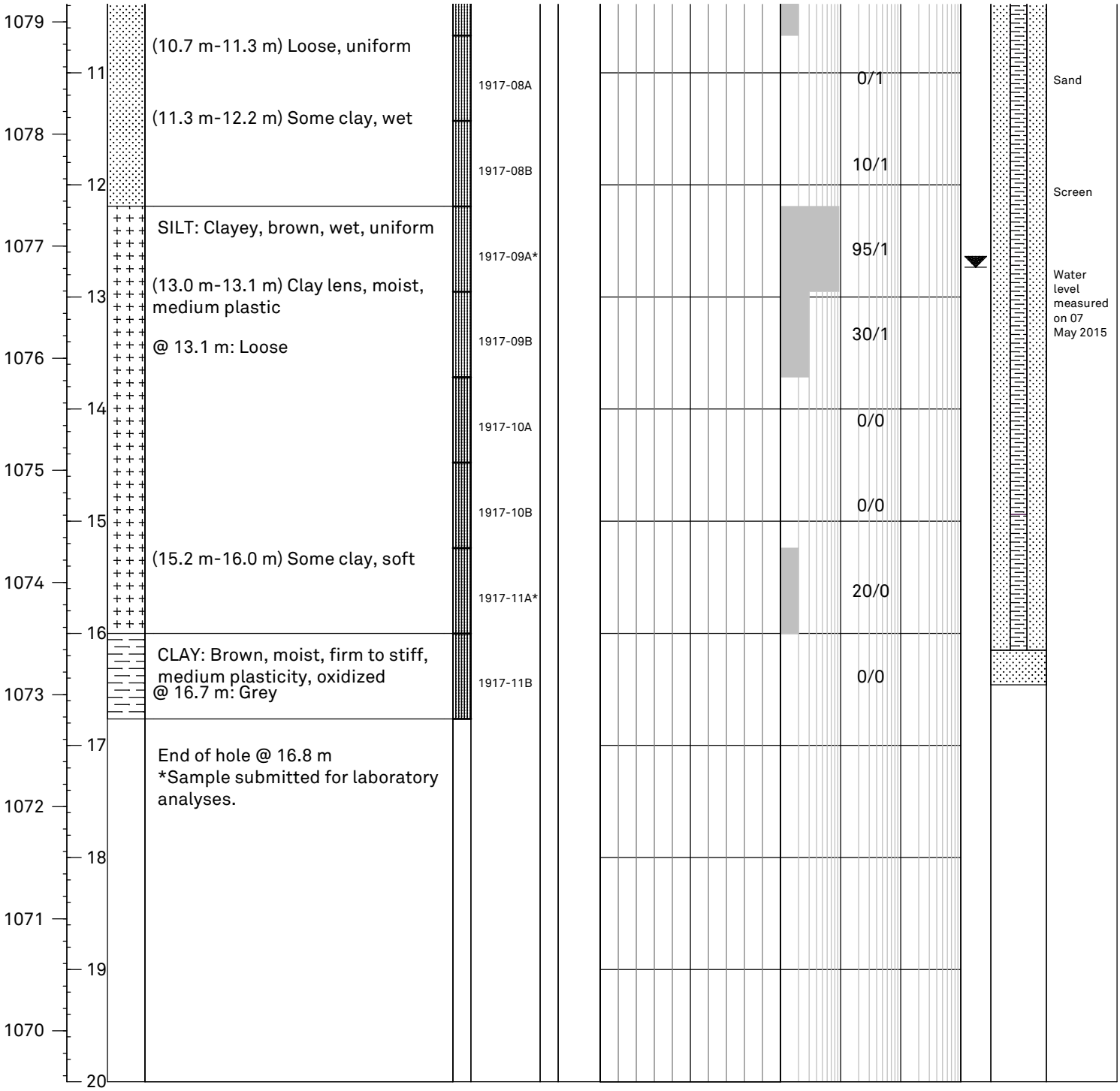
Clifton Associates

BOREHOLE LOG

Borehole: 1917

Page: 2 of 2

Client:	Sears Canada Inc.	Northing:	5660865.661	Date:	27 October 2014
Project:	Sears Site Management	Easting:	703474.0807	Driller:	All Service Drilling
Location:	15th Street NW, Calgary, Alberta	Ground Elev.:	1089.5463	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1089.3873	Logged by:	AM



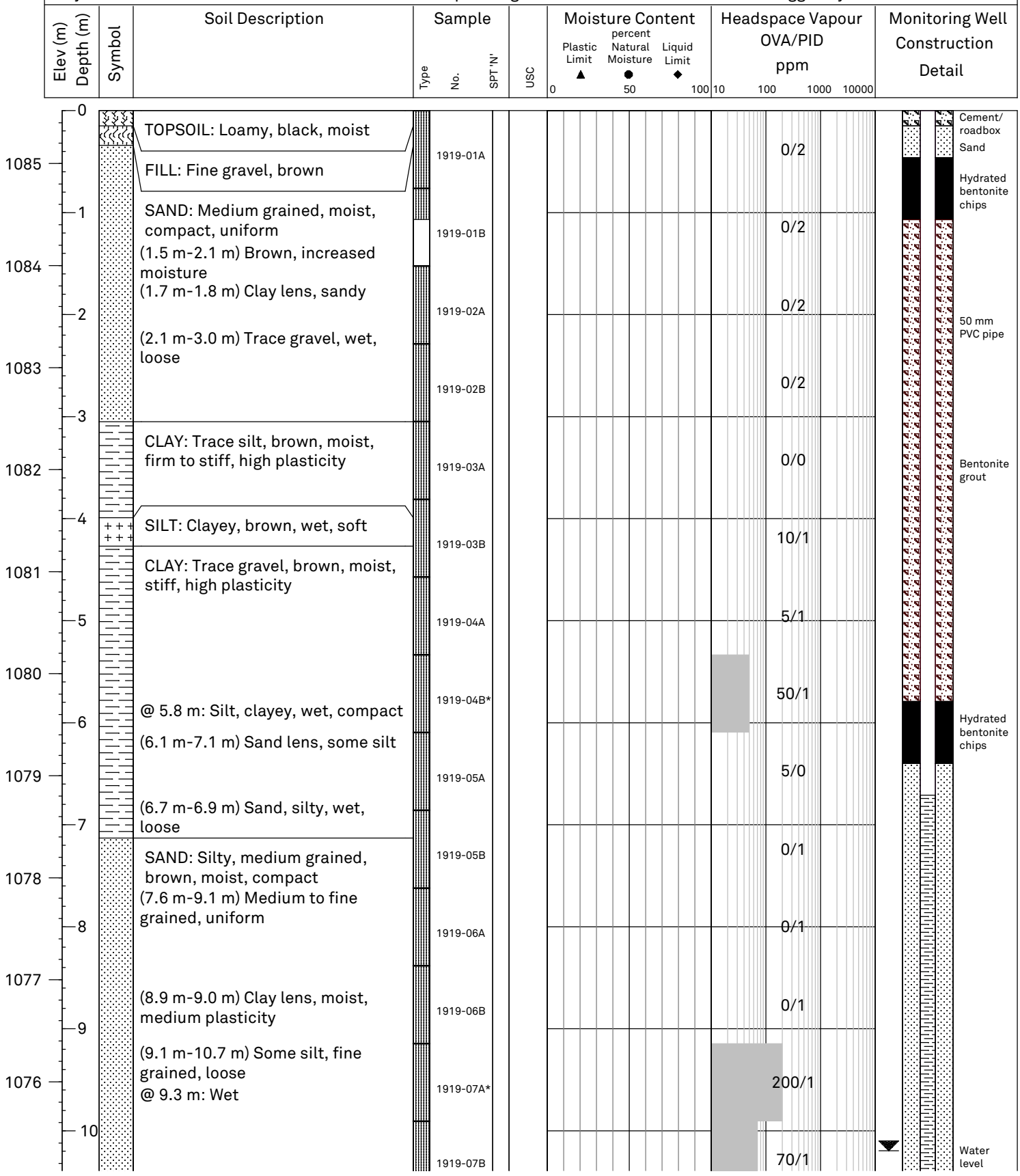
Env BH m elev CAL v09.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 1919

Client:	Sears Canada Inc.	Northing:	5660812.304	Date:	17 November 2014
Project:	Sears Site Management	Easting:	703476.4752	Driller:	All Service Drilling
Location:	15th Street NW, Calgary, Alberta	Ground Elev.:	1085.5193	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1085.4673	Logged by:	AM



Env BH m elev CAL v09.ldf

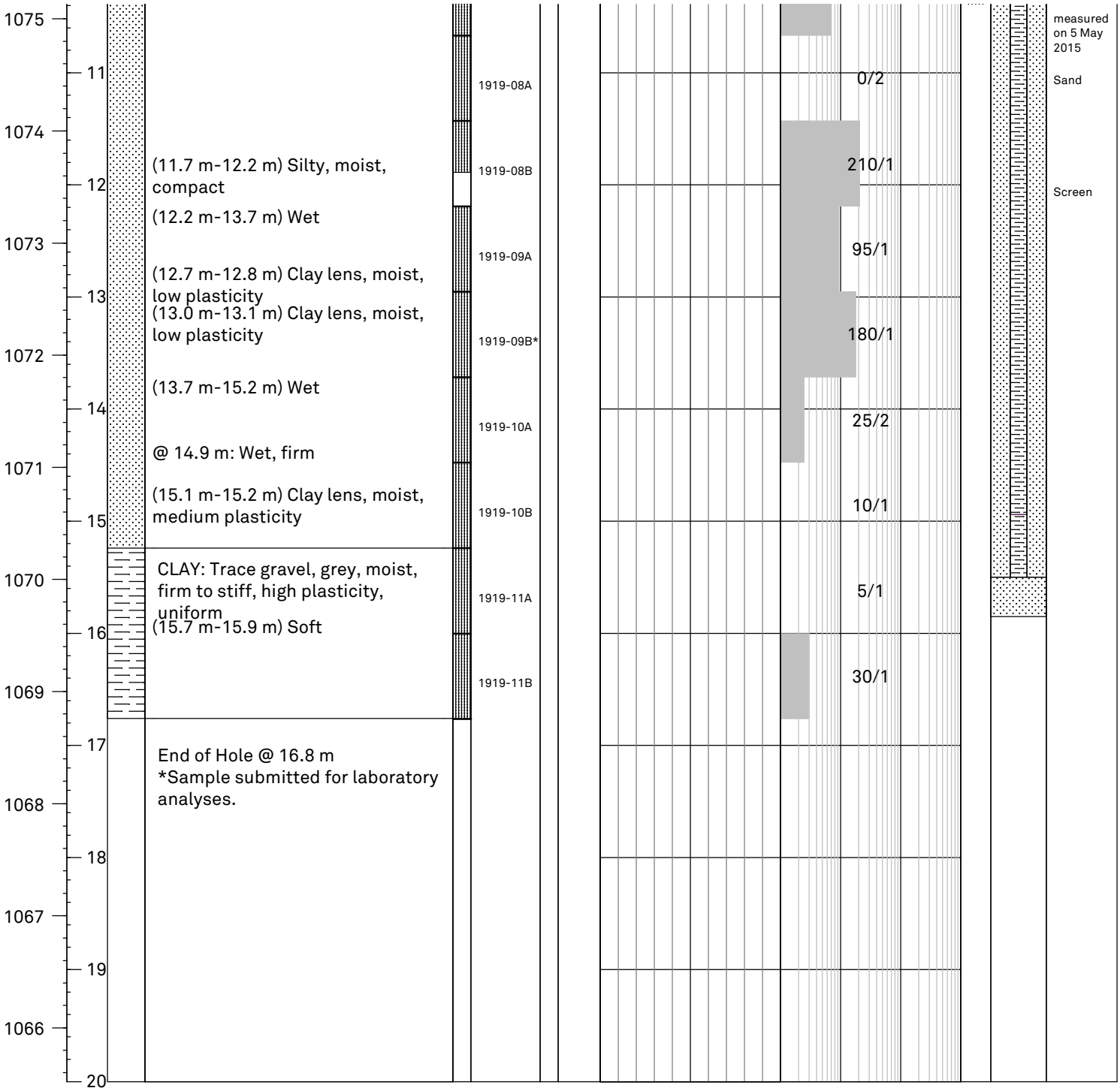
Clifton Associates

BOREHOLE LOG

Borehole: 1919

Page: 2 of 2

Client:	Sears Canada Inc.	Northing:	5660812.304	Date:	17 November 2014
Project:	Sears Site Management	Easting:	703476.4752	Driller:	All Service Drilling
Location:	15th Street NW, Calgary, Alberta	Ground Elev.:	1085.5193	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1085.4673	Logged by:	AM



Env BH m elev CAL v09.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 1921

Client:	Sears Canada Inc.	Northing:	5660868.784	Date:	03 November 2014
Project:	Sears Site Management	Easting:	703341.1948	Driller:	All Service Drilling
Location:	16th Street NW, Calgary, Alberta	Ground Elev.:	1089.1093	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1088.9223	Logged by:	AM

Elev (m) / Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	Moisture Content (percent) Plastic Limit ▲ / Natural Moisture ● / Liquid Limit ◆ (0 – 50 – 100)	Headspace Vapour OVA/PID ppm (10 – 100 – 1000 – 10000)	Monitoring Well Construction Detail
1089 / 0		GRAVEL: Coarse		1921-01A				0/2	Cement/ roadbox; Sand
		SAND: Medium grained, light brown, moist, uniform							
1088 / 1				1921-01B				0/2	Hydrated bentonite chips
		(1.5 m-3.3 m) Brown, loose							
1087 / 2				1921-02A				0/2	
				1921-02B				0/1	50 mm PVC pipe
1086 / 3									
		(3.3 m-3.5 m) Clay lens, sandy, brown, wet, soft		1921-03A*				10/1	
		(3.5 m-4.6 m) Some clay, fine grained, brown, wet							
1085 / 4				1921-03B				5/1	
		(4.6 m-5.0 m) Some clay, brown, wet, loose							Bentonite grout
1084 / 5				1921-04A				0/2	
		CLAY: Trace gravel, moist, firm, high plasticity, uniform							
				1921-04B				0/3	
1083 / 6		(6.1 m-7.6 m) Brown, firm to stiff							
		(6.2 m-6.3 m) Silt lens, clayey, wet		1921-05A				0/2	
1082 / 7									
				1921-05B				0/1	
		(7.6 m-9.1 m) Trace silt, brown, firm to soft							
1081 / 8				1921-06A*				0/0	Hydrated bentonite chips
				1921-06B				0/2	
1080 / 9		(9.1 m-9.3 m) Brown, medium plasticity							
		SAND: Fine grained, brown, moist, compact		1921-07A				0/2	
		(9.7 m-9.8 m) Clay lens, low plasticity							
1079 / 10				1921-07B				0/1	

Env BH m elev CAL v09.ldf

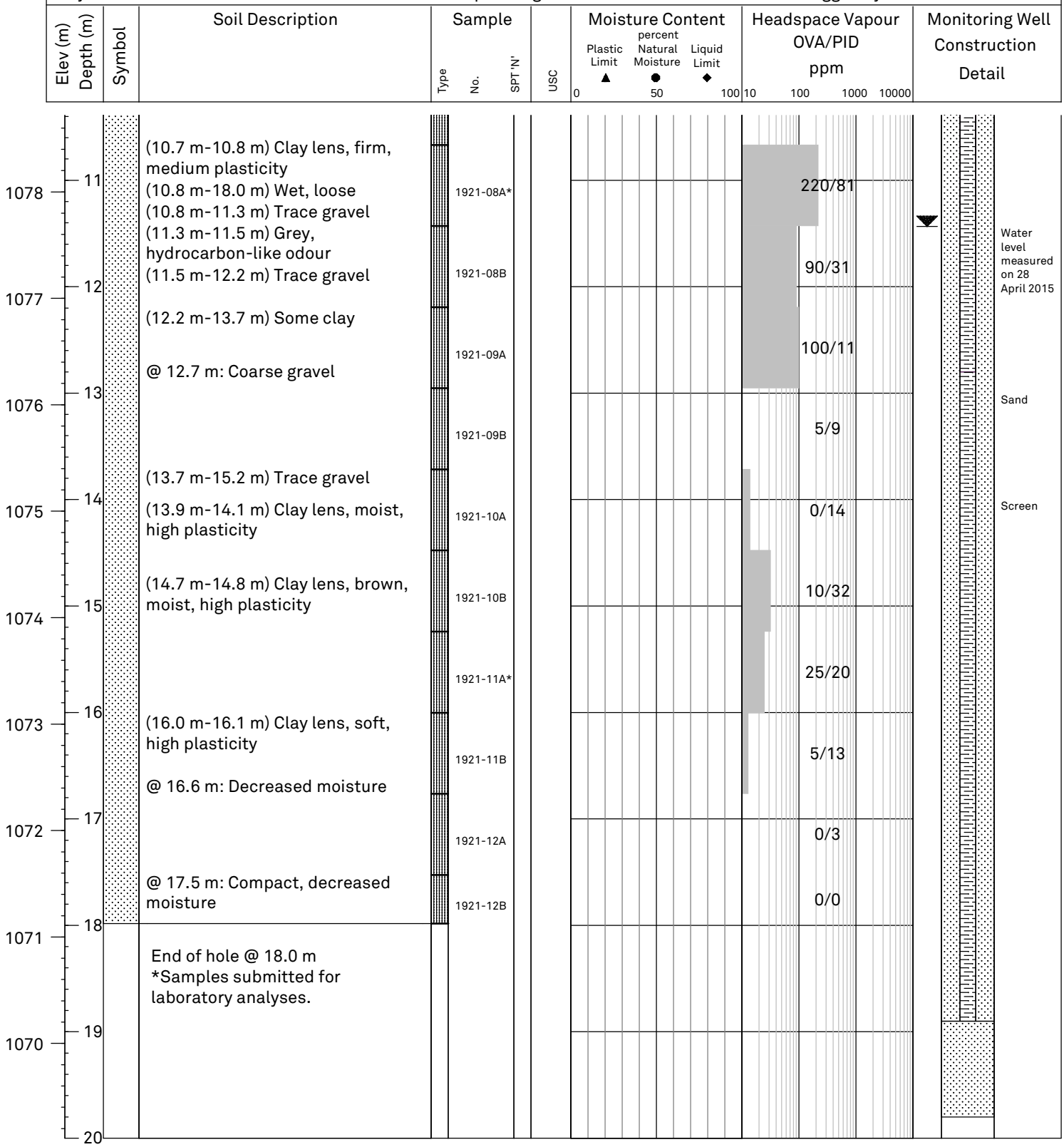
Clifton Associates

BOREHOLE LOG

Borehole: 1921

Page: 2 of 2

Client:	Sears Canada Inc.	Northing:	5660868.784	Date:	03 November 2014
Project:	Sears Site Management	Easting:	703341.1948	Driller:	All Service Drilling
Location:	16th Street NW, Calgary, Alberta	Ground Elev.:	1089.1093	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1088.9223	Logged by:	AM



Env BH m elev CAL v09.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 1922

Client:	Sears Canada Inc.	Northing:	5660822.747	Date:	04 November 2014
Project:	Sears Site Management	Easting:	703355.3658	Driller:	All Service Drilling
Location:	16th Street NW, Calgary, Alberta	Ground Elev.:	1087.7563	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1087.6473	Logged by:	AM

Elev (m) / Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	Moisture Content (percent) Plastic Limit ▲ / Natural Moisture ● / Liquid Limit ◆ (0 – 50 – 100)	Headspace Vapour OVA/PID ppm (10 – 100 – 1000 – 10000)	Monitoring Well Construction Detail
0 / 1087		TOPSOIL: Sandy, black, dry		1922-01A				0/2	Cement; Sand; Hydrated bentonite chips
1		SAND: Fine grained, light brown, dry, compact, uniform, decreasing moisture		1922-01B				0/1	
1086		(1.5 m-3.0 m) Moist		1922-02A				0/1	50 mm PVC pipe
2									
1085		(2.5 m-2.6 m) Clay lens, sandy, trace gravel, dry		1922-02B				0/1	
3		(3.0 m-3.6 m) Medium grained		1922-03A*				0/0	
1084		CLAY: Brown, moist, firm, high plasticity							
4		(3.8 m-4.3 m) Silt lens, clayey, trace gravel, wet, soft		1922-03B				0/0	Bentonite grout
1083		(4.3 m-4.6 m) Silty, light brown, soft, low plasticity							
5		(4.6 m-4.9 m) Soft, uniform		1922-04A				20/1	
1082				1922-04B				0/0	
6		(6.1 m-7.5 m) Stiff, oxidized		1922-05A*				0/2	
1081									
7				1922-05B				0/2	Hydrated bentonite chips
1080		(7.5 m-7.6 m) Silt lens, sandy, trace gravel, wet, soft							
8		(7.6 m-8.2 m) Uniform		1922-06A				0/0	
		(8.2 m-8.5 m) Silt lens, wet, soft							
1079		(8.5 m-9.1 m) Sandy, light brown, medium plasticity		1922-06B				0/3	
9		SAND: Silty, brown, moist							
		(9.1 m-10.7 m) Medium grained, compact, uniform		1922-07A				0/1	
1078									
10		@ 10.1 m: Wet		1922-07B				0/5	

Env BH m elev CAL v09.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 1922

Page: 2 of 2

Client:	Sears Canada Inc.	Northing:	5660822.747	Date:	04 November 2014
Project:	Sears Site Management	Easting:	703355.3658	Driller:	All Service Drilling
Location:	16th Street NW, Calgary, Alberta	Ground Elev.:	1087.7563	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1087.6473	Logged by:	AM

Elev (m) / Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	Moisture Content (percent) Plastic Limit ▲ / Natural Moisture ● / Liquid Limit ◆ (0 – 50 – 100)	Headspace Vapour OVA/PID ppm (10 – 100 – 1000 – 10000)	Monitoring Well Construction Detail
1077 / 11		(10.7 m-12.2 m) Some clay, light brown, wet, non-plastic, slight hydrocarbon-like odour		1922-08A*				190/95	Water level measured on 5 May 2015
1076 / 12				1922-08B				145/86	
		SILT: And clay, trace coarse gravel, brown, wet, compact, low plasticity		1922-09A*				200/99	
1075 / 13				1922-09B				185/97	Sand
1074 / 14		(13.7 m-15.2 m) Clayey		1922-10A				120/70	Screen
		(14.2 m-14.3 m) Clay lens							
1073 / 15		(14.9 m-15.0 m) Clay lens		1922-10B				55/31	
		(15.2 m-16.8 m) Soft, non-plastic		1922-11A				0/11	
1072 / 16		(16.1 m-16.2 m) Clay lens, medium plasticity		1922-11B				35/0	
		(16.6 m-16.7 m) Clay lens							
1071 / 17		SAND: Silty, fine grained, brown, wet, loose, uniform		1922-12A				10/1	
1070 / 18				1922-12B*				195/0	
		(18.3 m-18.9 m) Trace gravel, grey, moist to wet							
1069 / 19		CLAY: Silty, grey, moist, soft to firm, low to medium plasticity End of hole @ 19.8 m Samples submitted for laboratory analyses.		1922-13A				5/0	
				1922-13B				5/0	
1068 / 20									

Env BH m elev CAL v09.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 1925

Client:	Sears Canada Inc.	Northing:	5660878.438	Date:	06 November 2014
Project:	Sears Site Management	Easting:	703405.7342	Driller:	All Service Drilling
Location:	Back alley of 16th Street NW, Calgary, Alberta	Ground Elev.:	1091.2433	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1091.1493	Logged by:	AM

Elev (m) / Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	Moisture Content (percent) Plastic Limit ▲ / Natural Moisture ● / Liquid Limit ◆ (0 – 50 – 100)	Headspace Vapour OVA/PID ppm (10 – 100 – 1000 – 10000)	Monitoring Well Construction Detail
1091 / 0		GRAVEL: Some topsoil, fine grained, brown, moist		1925-01A	0/6				Cement/ roadbox; Sand
		SAND: Some clay, medium grained, brown, moist, loose							Hydrated bentonite chips
1090 / 1				1925-01B	0/7				
		(1.5 m-3.0 m) Compact, uniform							
2				1925-02A	0/7				
1089		(2.4 m-2.5 m) Silty, wet, loose							
				1925-02B	0/7				
3		(3.0 m-3.7 m) Loose, uniform							
1088				1925-03A	0/7				
		(3.7 m-4.6 m) Wet							
4		(4.0 m-4.1 m) Clayey, wet, low plasticity		1925-03B	0/7				
1087		(4.6 m-6.1 m) Compact, uniform							50mm PVC pipe
				1925-04A	0/7				
5									
1086				1925-04B	0/7				
		(5.8 m-5.9 m) Clay lens, moist, soft, high plasticity							
6		(6.1 m-6.3 m) Uniform							
1085		(6.3 m-6.6 m) Clay lens, brown, soft		1925-05A	0/7				
		(6.6 m-7.6 m) Wet							
7				1925-05B	0/8				
1084		(7.3 m-7.4 m) Clay lens, brown, firm, high plasticity							
		(7.6 m-8.2 m) Wet		1925-06A*	25/8				
8									
1083		CLAY: Brown, moist, firm to stiff, high plasticity							Bentonite grout
				1925-06B	0/6				
9									
1082		(9.1 m-10.7 m) Trace gravel, stiff, uniform, some oxidation		1925-07A	0/7				
10									
1081				1925-07B	0/8				

Env BH m elev CAL v09.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 1925

Client:	Sears Canada Inc.	Northing:	5660878.438	Date:	06 November 2014
Project:	Sears Site Management	Easting:	703405.7342	Driller:	All Service Drilling
Location:	Back alley of 16th Street NW, Calgary, Alberta	Ground Elev.:	1091.2433	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1091.1493	Logged by:	AM

Elev (m) / Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	Moisture Content (percent) Plastic Limit ▲ / Natural Moisture ● / Liquid Limit ◆ (0 – 50 – 100)	Headspace Vapour OVA/PID ppm (10 – 100 – 1000 – 10000)	Monitoring Well Construction Detail
1080 / 11		(11.3 m-11.4 m) Silt lens, wet, soft @ 11.6 m: Increased silt or fine sand, low plasticity		1925-08A*				0/7	
1079 / 12		SAND: Clayey, fine grained, brown, compact (12.2 m-13.7 m) Medium grained, moist to wet		1925-08B				65/60	
				1925-09A				5/27	
1078 / 13		@ 12.9 m: Wet, hydrocarbon-like odour							
		(13.7 m-13.9 m) Hydrocarbon-like odour		1925-09B*				over 11,100/over 2,000	
1077 / 14		(13.9 m-14.1 m) Clay lens, brown, moist, firm, medium plasticity							
		SILT: Clayey, wet, soft, hydrocarbon-like odour		1925-10A				410/147	
1076 / 15		(14.7 m-14.8 m) Clay lens, brown, moist, soft		1925-10B				270/104	
		(15.7 m-15.9 m) Clay lens, brown, moist, firm		1925-11A				105/44	
1075 / 16		(16.6 m-16.7 m) Clay lens, brown, moist, soft		1925-11B				230/82	
		(16.8 m-17.0 m) Clay lens, sandy, brown, moist, firm, low plasticity							
1074 / 17		SAND: Fine grained, brown, wet, loose		1925-12A				105/43	
				1925-12B				25/15	
1073 / 18		(18.3 m-19.8 m) Trace clay, uniform							
				1925-13A				15/9	
1072 / 19				1925-13B*				60/7	
1071 / 20		CLAY: Some sand, some fine gravel, grey, wet to moist, soft, medium plasticity		1925-14A				55/7	

Water level measured on 6 May 2015

Hydrated bentonite chips

Sand

Screen

Env BH m elev CAL v09.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 1925

Client:	Sears Canada Inc.	Northing:	5660878.438	Date:	06 November 2014
Project:	Sears Site Management	Easting:	703405.7342	Driller:	All Service Drilling
Location:	Back alley of 16th Street NW, Calgary, Alberta	Ground Elev.:	1091.2433	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1091.1493	Logged by:	AM

Elev (m) / Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	Sample SPT 'N'	USC	Moisture Content (percent) Plastic Limit ▲ / Natural Moisture ● / Liquid Limit ◆ (0 – 50 – 100)	Headspace Vapour OVA/PID ppm (10 – 100 – 1000 – 10000)	Monitoring Well Construction Detail
21 / 1070				1925-14B				0/4	
		End of hole @ 21.3 m *Samples submitted for laboratory analyses.							
22 / 1069									
23 / 1068									
24 / 1067									
25 / 1066									
26 / 1065									
27 / 1064									
28 / 1063									
29 / 1062									
30									

Env BH m elev CAL v09.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 1943

Client:	Sears Canada Inc.	Northing:	5660720.903	Date:	25 November 2014
Project:	Sears Site Management	Easting:	703412.0597	Driller:	All Service Drilling
Location:	Back alley of 16th Street NW, Calgary, Alberta	Ground Elev.:	1078.9143	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1078.7233	Logged by:	AM

Elev (m) / Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	Sample SPT 'N'	USC	Moisture Content (percent) Plastic Limit ▲ / Natural Moisture ● / Liquid Limit ◆ (0 – 50 – 100)	Headspace Vapour OVA/PID ppm (10 – 100 – 1000 – 10000)	Monitoring Well Construction Detail
0 / 1078		FILL: Gravel and topsoil		1943-01A				0/1	Cement/ roadbox; Sand; Hydrated bentonite chips
1 / 1078		SAND: Fine grained, some gravel, brown, dry, compact		1943-01B				0/0	
1 / 1077		(1.5 m - 3.0 m): Some clay, trace gravel, medium grained		1943-02A				0/1	
2 / 1077				1943-02B				0/0	50 mm PVC pipe
3 / 1076		(3.0 m - 4.6 m): Medium grained, uniform		1943-03A				0/0	
4 / 1075		@ 4.3 m: Moist		1943-03B				0/0	Bentonite grout
5 / 1074		(4.6 m - 6.1 m): Medium grained, moist to wet, uniform; (5.0 m - 5.1 m): Wet, loose		1943-04A				0/1	
6 / 1073		(5.5 m - 5.6 m): Gravel		1943-04B*				0/13	
6 / 1072		CLAY: Some silt, brown, wet, soft, medium plasticity; (6.8 m - 7.1 m): Moist, firm, high plasticity; (7.5 m - 7.7 m): Sand lens, medium grained, wet		1943-05A				110/7	Water level measured on 13 April 2015
7 / 1072				1943-05B*				0/33	Hydrated bentonite chips
8 / 1071		SAND: Medium grained, wet, loose		1943-06A				5/20	
8 / 1070		CLAY: Silty, trace gravel, brown, wet, soft, low plasticity; (8.5 m - 8.8 m) Moist, firm, high plasticity		1943-06B*				10/60	
9 / 1070		SILT: Clayey, brown, wet, very soft		1943-07A				0/4	
10 / 1069		CLAY: Brown, moist, firm, high		1943-07B				0/5	Sand

Env BH m elev CAL v09.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 1943

Client:	Sears Canada Inc.	Northing:	5660720.903	Date:	25 November 2014
Project:	Sears Site Management	Easting:	703412.0597	Driller:	All Service Drilling
Location:	Back alley of 16th Street NW, Calgary, Alberta	Ground Elev.:	1078.9143	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1078.7233	Logged by:	AM

Elev (m) / Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	Moisture Content (percent) Plastic Limit ▲ / Natural Moisture ● / Liquid Limit ◆ (0 – 50 – 100)	Headspace Vapour OVA/PID ppm (10 – 100 – 1000 – 10000)	Monitoring Well Construction Detail
1078 – 0		plasticity							
1068 – 11		SAND: Grey, wet, loose @ 10.9 m: Interbedded sand and clay, brown, wet, soft, compact		1943-08A				0/0	Screen
1067 – 12		CLAY: Grey, moist, firm, high plasticity, uniform		1943-08B				0/0	
		SAND: Medium grained, grey, wet, loose, uniform		1943-09A				0/4	
1066 – 13				1943-09B				0/1	
1065 – 14		CLAY: Trace gravel, grey, moist, firm, medium to high plasticity (14.1 m - 14.2 m): Wet, soft (14.9 m - 15.0 m): Wet, soft		1943-10A				0/1	
1064 – 15		(15.1 m - 15.2 m): Sand lens, medium grained, grey, wet, soft		1943-10B*				135/1	
1063 – 16		End of hole @ 15.2 m *Samples submitted for laboratory analyses.							
1062 – 17									
1061 – 18									
1060 – 19									
1059 – 20									

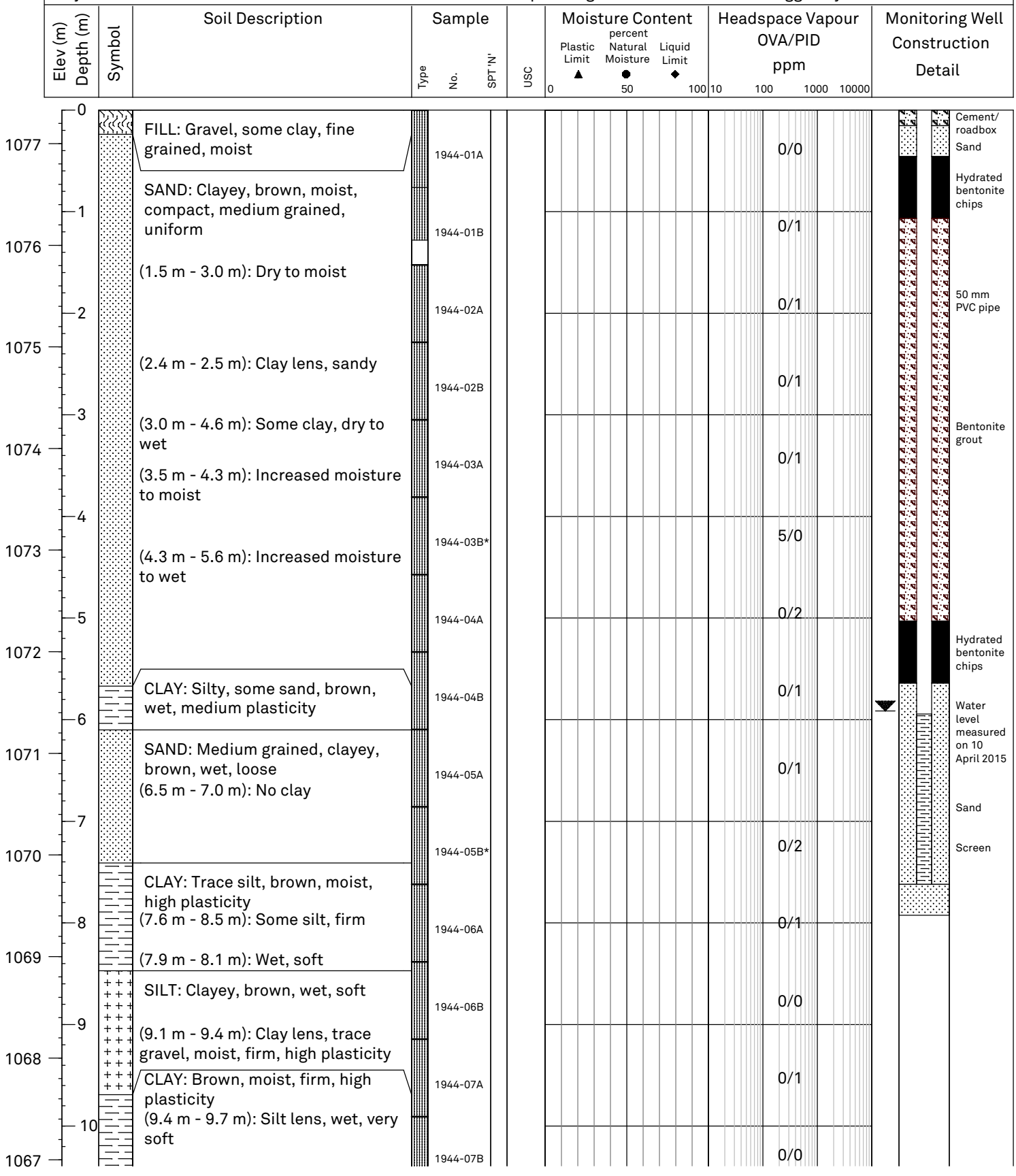
Env BH m elev CAL v09.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 1944

Client:	Sears Canada Inc.	Northing:	5660690.768	Date:	25 November 2014
Project:	Sears Site Management	Easting:	703412.2996	Driller:	All Service Drilling
Location:	Back alley of 16th Street NW, Calgary, Alberta	Ground Elev.:	1077.3313	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1077.1203	Logged by:	AM



Env BH m elev CAL v09.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 1944

Page: 2 of 2

Client:	Sears Canada Inc.	Northing:	5660690.768	Date:	25 November 2014
Project:	Sears Site Management	Easting:	703412.2996	Driller:	All Service Drilling
Location:	Back alley of 16th Street NW, Calgary, Alberta	Ground Elev.:	1077.3313	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1077.1203	Logged by:	AM

Elev (m) / Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	Sample SPT N'	USC	Moisture Content (percent) Plastic Limit ▲ / Natural Moisture ● / Liquid Limit ◆ (0 – 50 – 100)	Headspace Vapour OVA/PID ppm (10 – 100 – 1000 – 10000)	Monitoring Well Construction Detail
1067 / 10									
11 / 1066		(9.9 m - 10.1 m): Silt lens, wet, very soft (10.4 m - 10.7 m): Silt lens, clayey, wet, soft (10.7 m - 11.8 m): Grey, firm to stiff (10.9 m - 11.1 m): Wet, soft		1944-08A				0/0	
12 / 1065		SAND: Grey, wet, loose		1944-08B*				10/0	
		(12.5 m - 12. m): Some clay, compact, non-plastic		1944-09A				0/2	
13 / 1064		CLAY: Trace silt, grey, moist, soft to firm, high plasticity		1944-09B				0/1	
14 / 1063		End of hole @ 13.7 m *Samples submitted for laboratory analyses.							
15 / 1062									
16 / 1061									
17 / 1060									
18 / 1059									
19 / 1058									
20									

Env BH m elev CAL v09.ldf

Clifton Associates

BOREHOLE LOG

Borehole: 1956

Client:	Sears Canada Inc.	Northing:	5660793.278	Date:	5 December 2014
Project:	Sears Site Management	Easting:	703410.8818	Driller:	All Service Drilling
Location:	Back alley of 16th Street NW, Calgary, Alberta	Ground Elev.:	1084.9193	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1084.7613	Logged by:	AM

Elev (m) / Depth (m)	Symbol	Soil Description	Sample Type	Sample No.	SPT 'N'	USC	Moisture Content (percent) Plastic Limit ▲ / Natural Moisture ● / Liquid Limit ◆ (0 – 50 – 100)	Headspace Vapour OVA/PID ppm (10 – 100 – 1000 – 10000)	Monitoring Well Construction Detail
1084 / 0		FILL: Gravel, sandy, black, frozen		1956-01A				0/1	Cement/ roadbox; Sand
1084 / 1		SAND: Some gravel, some clay, medium grained, brown, moist, compact		1956-01B				0/0	Hydrated bentonite chips
1083 / 2		(1.5 m - 2.9 m): Clayey, fine grained, non-plastic		1956-02A*				0/0	50 mm PVC pipe
				1956-02B				0/1	
1082 / 3		CLAY: Trace silt, brown, moist, firm, high plasticity							
		(3.0 m - 6.1 m): Trace gravel, stiff, oxidized, uniform		1956-03A				0/0	Bentonite grout
1081 / 4		(3.9 m - 4.0 m): Sand lens, fine grained		1956-03B*				0/0	
1080 / 5		(4.8 m - 4.9 m): Sand lens, fine grained, moist		1956-04A				5/0	Hydrated bentonite chips
		(5.4 m - 5.5 m): Sand lens, fine grained, wet							
1079 / 6		(6.1 m - 6.2 m): Sand lens, medium grained, brown, compact		1956-04B				0/0	
		(6.2 m - 6.5 m): Trace sand							
1078 / 7		SAND: Medium grained, brown, moist, compact, uniform		1956-05A*				0/1	
				1956-05B				0/0	
1077 / 8		(7.8 m - 7.9 m): Clay lens		1956-06A				0/1	
1076 / 9				1956-06B*				0/0	Sand
		(9.1 m - 11.9 m): Wet, loose							Water level measured on 17 Mar. 2015
				1956-07A				0/0	
1075 / 10				1956-07B*				0/1	

Env BH m elev CAL v09.ldf

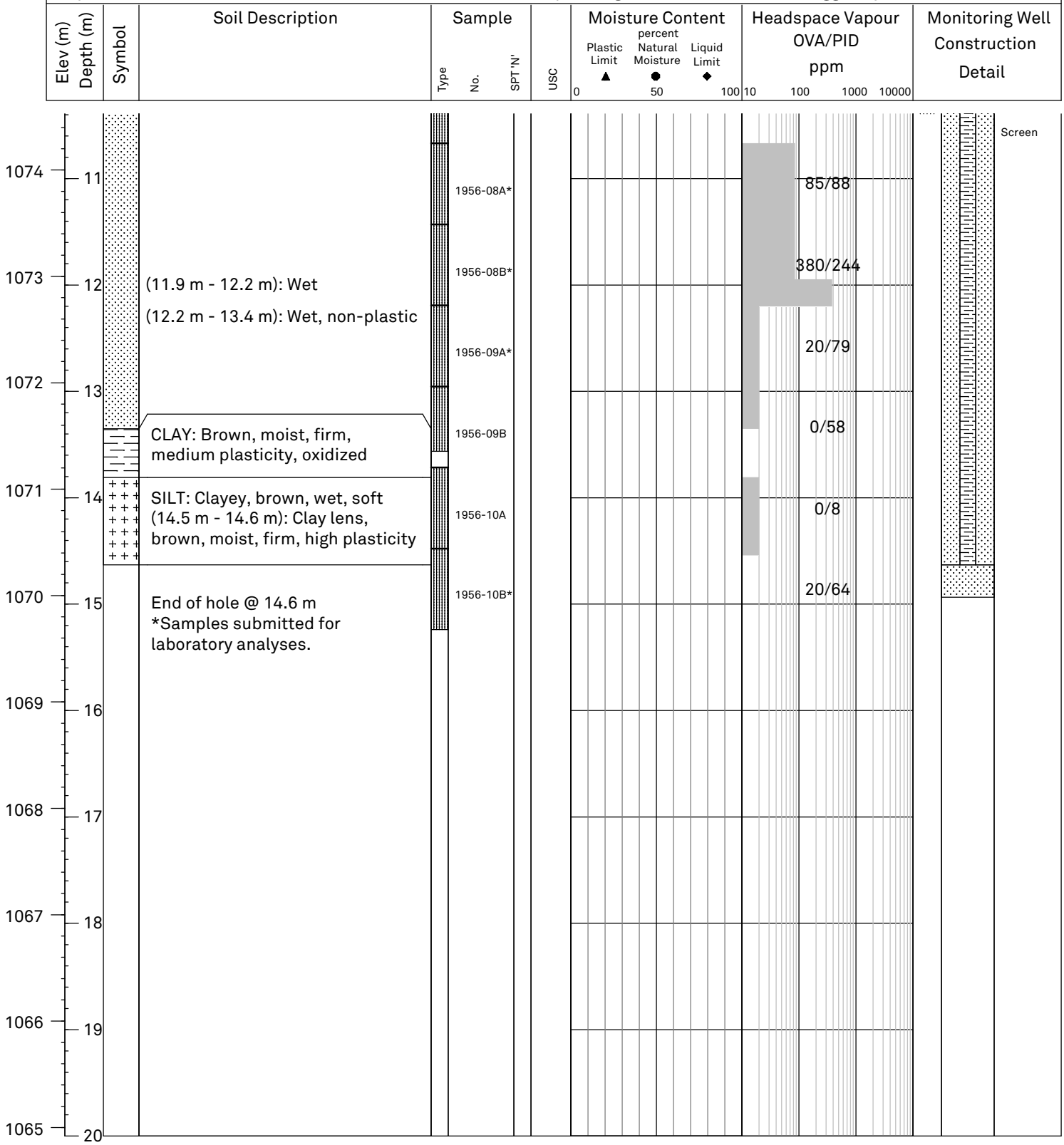
Clifton Associates

BOREHOLE LOG

Borehole: 1956

Page: 2 of 2

Client:	Sears Canada Inc.	Northing:	5660793.278	Date:	5 December 2014
Project:	Sears Site Management	Easting:	703410.8818	Driller:	All Service Drilling
Location:	Back alley of 16th Street NW, Calgary, Alberta	Ground Elev.:	1084.9193	Method:	Direct Push
Project No.:	CG2430 · E07	Top Casing Elev.:	1084.7613	Logged by:	AM



Appendix D

Clifton

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH1303 Continued	13-Sep-11		-	7.646	0.000	-	1075.236	10	
	13-Dec-11		-	7.645	0.000	-	1075.237	40	
	21-Mar-12		-	7.790	0.000	-	1075.092	8	
	1-Oct-12		-	7.709	0.000	-	1075.173	85	O2 sock with rusty cable
	29-Apr-13		-	7.654	0.000	-	1075.228	165	
BH1701	23-Sep-10	1088.191	-	9.470	0.000	-	1078.721	76	
	4-Oct-10		-	9.462	0.000	-	1078.729	12	
	8-Apr-11		-	9.525	0.000	-	1078.666	280	
	1-Jun-11		-	9.545	0.000	-	1078.646	64	
	13-Sep-11		-	9.451	0.000	-	1078.740	170	
	15-Dec-11		-	9.424	0.000	-	1078.767	15	
	23-Mar-12		-	9.540	0.000	-	1078.651	88	
	4-Oct-12		-	9.522	0.000	-	1078.669	110	
	30-Apr-13		-	9.610	0.000	-	1078.551	0	Top of pipe elevation w/o collar was 1088.161m.
BH1702	23-Sep-10	1090.039	-	11.367	0.000	-	1078.672	86	
	4-Oct-10		-	11.345	0.000	-	1078.694	50	
	5-Apr-11		-	11.295	0.000	-	1078.744	80	
	2-Jun-11		-	11.262	0.000	-	1078.777	64	
	13-Sep-11		-	11.270	0.000	-	1078.769	160	
	15-Dec-11		-	11.243	0.000	-	1078.796	80	
	22-Mar-12		-	11.305	0.000	-	1078.734	60	dry @ 11.305
	4-Oct-12		-	11.340	0.000	-	1078.699	95	
	30-Apr-13		-	11.319	0.000	-	1078.690	0	Top of pipe elevation w/o collar was 1090.009m.
BH1703	23-Sep-10	1089.689	-	11.031	0.000	-	1078.658	1,000	
	4-Oct-10		-	11.095	0.000	-	1078.594	12	
	5-Apr-11		-	11.043	0.000	-	1078.646	30	
	2-Jun-11		11.002	11.992	0.015	-	1077.697	1,000	
	13-Sep-11		10.912	11.230	0.318	-	1078.459	5,000	
	13-Dec-11		10.910	10.930	0.020	-	1078.459	6,100	
	22-Mar-12		11.091	11.092	0.010	-	1078.598	5,000	Recovered 1.0L from passive bailer
	4-Oct-12		10.972	10.973	0.010	-	1078.716	20	Recovered 1.0L from passive bailer
	1-May-13		-	11.035	-	-	1078.654	120	Top of pipe elevation w/o collar was 1089.689m.
BH1704	23-Sep-10	1089.460	-	10.525	0.000	-	1078.935	180	
	4-Oct-10		-	10.582	0.000	-	1078.878	10	
	8-Apr-11		-	-	0.000	-	-	590	Blocked with ice and bailer at 0.1m. Bailer top broke off.
	2-Jun-11		-	10.473	0.000	-	1078.987	1,600	
	13-Sep-11		-	10.477	0.000	-	1078.983	40	
	15-Dec-11		-	10.430	0.000	-	1079.030	15	
	23-Mar-12		-	-	0.000	-	-		Blocked with ice

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH508 Continued	3-Oct-05		-	11.444	0.000	-	1079.732	62	
	18-Jan-06		-	11.071	0.000	-	1080.105	390	
	10-May-06		-	10.695	0.000	-	1080.481	84	
	25-Jul-06		-	10.803	0.000	-	1080.373	90	
	24-Jan-07		-	9.205	0.000	-	1081.971	118	
	23-May-07		-	9.405	0.000	-	1081.771	65	
	21-Aug-07		-	8.965	0.000	-	1082.211	80	
	22-Nov-07		-	8.817	0.000	-	1082.359	74	
	13-Mar-08		-	8.699	0.000	-	1082.477	200	
	3-Jun-08		-	8.743	0.000	-	1082.433	82	
	26-Jun-08		-	8.613	0.000	-	1082.563	58	well decommissioned on June 26, 2008
BH509	5-Dec-02	1089.588	-	11.194	0.029	-	1078.417	>10,000	P.B. installed from BH213
	14-Jan-03		11.793	11.854	0.061	-	1077.783	nm	recovered 400 ml product from P.B.
	19-Feb-03		11.783	11.814	0.031	-	1077.799	nm	recovered 400 mL
	7-Mar-03		11.755	11.815	0.060	-	1077.821	nm	recovered 500 ml from P.B.
	25-Apr-03		11.2	11.255	0.055	-	1078.377	nm	recovered 800 mL
	29-Apr-03		-	11.761	0.000	-	1077.827	nm	recovered 300 mL
	12-May-03		11.68	11.682	0.002	-	1077.908	-	recovered 200 ml product from P.B.
	28-May-03		11.536	11.538	0.002	-	1078.052	nm	recovered 200 ml product from P.B.
	4-Jun-03		nm	nm	nm	-	nm	nm	recovered 300 ml product from P.B.
	1-Jul-03		11.567	11.580	0.013	-	1078.018	nm	recovered 200 ml product from P.B.
	24-Jul-03		11.568	11.573	0.005	-	1078.019	nm	recovered 300 ml product from P.B.
	5-Aug-03		11.686	11.689	0.003	-	1077.901	-	recovered 300 ml product from P.B.
	16-Sep-03		nm	nm	nm	-	-	nm	recovered 200 ml product from P.B.
	12-Nov-03		nm	nm	nm	-	nm	nm	bailed 100 ml of clear orange product
	20-Nov-03		11.162	11.602	0.440	-	1078.338	1,200	
	3-Dec-03		11.535	11.795	0.260	-	1078.001	nm	
	4-Dec-03		11.685	11.690	0.005	-	1077.902	-	
	8-Dec-03		-	11.848	0.000	-	1077.740	260	recovered 800 ml from P.B. and 500 ml from H.B.
	17-Dec-03		-	11.830	0.000	-	1077.758	1,600	
	22-Dec-03		nm	nm	nm	-	nm	nm	recovered 250 ml product from P.B.
	7-Jan-04		-	11.730	0.000	-	1077.858	nm	recovered 750 ml product from P.B.
	10-Jan-04		-	11.615	0.000	-	1077.973	nm	recovered 100 ml product from P.B.
	12-Jan-04		-	11.605	0.000	-	1077.983	nm	recovered 100 ml product from P.B.
	15-Jan-04		cnm	cnm	cnm	-	cnm	cnm	CNM - Plugged with ice

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH509 Continued	16-Jan-04		-	11.170	0.000	-	1078.418	nm	bailer was caught on ice and not set at depth
	20-Jan-04		-	11.540	0.000	-	1078.048	nm	recovered 50 ml product from P.B.
	23-Jan-04		-	10.703	0.000	-	1078.885	nm	recovered 300 ml product from P.B.
	5-Feb-04		-	11.779	0.000	-	1077.809	nm	recovered 500 ml from P.B.
	9-Feb-04		-	11.823	0.000	-	1077.765	nm	recovered 300 ml product from P.B.
	19-Feb-04		-	11.655	0.000	-	1077.933	nm	recovered 300 ml product from P.B.
	23-Feb-04		-	11.650	0.000	-	1077.938	nm	recovered 300 ml product from P.B.
	26-Feb-04		-	11.682	0.000	-	1077.906	nm	recovered 200 ml from passive bailer
	3-Mar-04		-	11.773	0.000	-	1077.815	nm	recovered 150 ml product from P.B.
	22-Mar-04		cnm	cnm	cnm	-	cnm	cnm	P.B. stuck in well; unable to retrieve
	31-Mar-04		11.626	11.823	0.197	-	1077.923	nm	300 ml product recovered from P.B. - before hand bailing
	31-Mar-04		11.740	11.793	0.053	-	1077.837	nm	350 ml product recovered by hand bailer
	12-Apr-04		11.592	11.660	0.068	-	1077.982	nm	recovered 200 ml product from P.B.; H.B. 50 ml
	13-Apr-04		11.565	11.608	0.043	-	1078.014	nm	recovered 150 ml from P.B.; not enough to hand bail
	15-Apr-04		11.635	11.645	0.010	-	1077.951	nm	recovered 350 ml product from P.B.
	16-Apr-04		-	11.695	0.000	-	1077.893	nm	recovered 200 ml product from P.B.
	19-Apr-04		11.570	11.580	0.010	-	1078.016	nm	recovered 250 ml product from P.B.; not enough to H.B.
	22-Apr-04		11.754	11.756	0.002	-	1077.834	nm	recovered 300 ml product from P.B.
	30-Apr-04		-	11.688	0.000	-	1077.900	nm	recovered 50 ml product from P.B.; H.B. 1 mm product
	6-May-04		-	11.760	0.000	-	1077.828	nm	recovered 250 ml from passive bailer
	7-May-04		-	11.653	0.000	-	1077.935	nm	recovered 30 ml from passive bailer
	10-May-04		-	11.685	0.000	-	1077.903	nm	recovered 250 ml from passive bailer
	17-May-04		-	11.748	0.000	-	1077.840	nm	recovered 200 ml from passive bailer
	20-May-04		-	11.680	0.000	-	1077.908	nm	recovered 150 ml from passive bailer
	28-May-04		11.595	11.600	0.005	-	1077.992	nm	300 ml recovered from passive bailer
	15-Jun-04		-	11.704	0.000	-	1077.884	6,000	800 ml recovered; hand bailer checked - no visible product
	18-Jun-04		-	11.759	0.000	-	1077.829	nm	bailer checked; no visible product
	14-Jul-04		-	11.742	0.000	-	1077.846	>10,000	600 ml recovered
	28-Jul-04		11.754	11.760	0.006	-	1077.833	nm	700 ml recovered
	6-Aug-04		-	11.690	0.000	-	1077.898	nm	150 ml recovered
	10-Aug-04		-	11.760	0.000	-	1077.828	nm	100 ml recovered
	11-Aug-04		-	11.754	0.000	-	1077.834	nm	10 ml recovered
	13-Aug-04		-	11.765	0.000	-	1077.823	nm	10 ml recovered
	18-Aug-04		-	11.785	0.000	-	1077.803	nm	100 ml recovered
	24-Aug-04		-	11.664	0.000	-	1077.924	>10,000	300ml product in PB. Bailer check showed 1mm in bailer.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH509 Continued	7-Sep-04		-	11.723	0.000	-	1077.865	nm	500 ml recovered
	9-Sep-04		-	11.715	0.000	-	1077.873	nm	50 ml recovered
	13-Sep-04		-	11.659	0.000	-	1077.929	nm	200 ml recovered
	15-Sep-04		-	11.667	0.000	-	1077.921	nm	50 ml recovered
	17-Sep-04		-	11.623	0.000	-	1077.965	nm	100 ml recovered
	20-Sep-04		11.700	11.701	0.001	-	1077.888	nm	75 ml recovered
	22-Sep-04		-	11.705	0.000	-	1077.883	nm	50 ml recovered
	24-Sep-04		-	11.733	0.000	-	1077.855	nm	25 ml recovered
	29-Sep-04		-	11.735	0.000	-	1077.853	nm	150 ml recovered
	4-Oct-04		-	11.757	0.000	-	1077.831	nm	150 ml recovered
	6-Oct-04		-	11.693	0.000	-	1077.895	nm	25 ml recovered
	12-Oct-04		-	11.805	0.000	-	1077.783	nm	200 ml recovered
	15-Oct-04		-	11.743	0.000	-	1077.845	nm	50 ml recovered
	5-Nov-04		-	11.719	0.000	-	1077.869	nm	650 ml recovered
	8-Nov-04		-	11.725	0.000	-	1077.863	nm	150 ml recovered
	10-Nov-04		-	11.795	0.000	-	1077.793	nm	20 ml recovered
	17-Nov-04		-	11.775	0.000	-	1077.813	nm	150 ml recovered
	25-Nov-04		-	11.688	0.000	-	1077.900	nm	200 ml recovered
	29-Nov-04		-	11.713	0.000	-	1077.875	nm	50 ml recovered
	1-Dec-04		-	11.755	0.000	-	1077.833	nm	50 ml product recovered from P.B.
	17-Jan-05		11.775	11.780	0.005	-	1077.812	nm	800 ml product recovered from P.B.
	24-Jan-05		11.755	11.755	trace	-	1077.833	nm	200 ml product recovered from P.B.
	26-Jan-05		11.665	11.665	trace	-	1077.923	nm	20 ml product recovered from P.B.
	28-Jan-05		11.767	11.767	trace	-	1077.821	nm	20 ml product recovered from P.B.
	2-Feb-05		11.746	11.746	trace	-	1077.842	>10,000	recovered 150 ml product from P.B.
	18-Feb-05		11.150	11.175	0.025	-	1078.433	nm	check of bailer showed no visible product
	22-Feb-05		11.502	11.540	0.038	-	1078.078	nm	recovered 10 ml product from P.B.
	24-Feb-05		11.796	11.796	trace	-	1077.792	nm	recovered 150 ml product from P.B.; H.B. 1 mm product
	2-Mar-05		11.790	11.791	0.001	-	1077.798	2,600	recovered 50 ml product from P.B.
	22-Mar-05		11.854	11.855	0.001	-	1077.734	nm	recovered 400 ml product from P.B.
	24-Mar-05		11.835	11.839	0.004	-	1077.752	nm	recovered 10 ml product from P.B.; H.B. 2 mm product
	28-Mar-05		11.674	11.675	0.001	-	1077.914	nm	recovered 20 ml product from P.B.
	30-Mar-05		11.822	11.823	0.001	-	1077.766	nm	recovered 50 ml product from P.B.
	1-Apr-05		11.736	11.738	0.002	-	1077.852	nm	recovered 20 ml product from P.B.
	5-Apr-05		11.859	11.860	0.001	-	1077.729	nm	recovered 100 ml product from P.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH509 Continued	11-Apr-05		11.790	11.791	0.001	-	1077.798	nm	recovered 100 ml product from P.B.
	15-Apr-05		-	11.826	0.000	-	1077.762	nm	recovered 50 ml product from P.B.
	18-Apr-05		11.856	11.857	0.001	-	1077.732	nm	recovered 25 ml product from P.B.
	20-Apr-05		11.818	11.819	0.001	-	1077.770	nm	recovered 10 ml product from P.B.
	22-Apr-05		-	11.834	0.000	-	1077.754	nm	recovered 10 ml product from P.B.
	25-Apr-05		11.822	11.823	0.000	-	1077.765	nm	recovered 50 ml product from P.B.
	27-Apr-05		11.863	11.864	0.001	-	1077.725	nm	recovered 20 ml product from P.B.
	4-May-05		11.881	11.882	0.001	-	1077.707	nm	recovered 200 ml product from P.B.
	6-May-05		11.523	11.524	0.001	-	1078.065	nm	recovered 10 ml product from P.B.; H.B. 0 mm product
	9-May-05		-	11.817	0.000	-	1077.771	nm	recovered 10 ml product from P.B.
	13-May-05		-	11.805	0.000	-	1077.783	nm	recovered 20 ml product from P.B.
	16-May-05		-	11.764	0.000	-	1077.824	nm	recovered 100 ml product from P.B.
	26-May-05			11.880	0.000	-	1077.708	nm	recovered 100 ml product from P.B.
	2-Jun-05		11.846	11.847	0.001	-	1077.742	>10,000	recovered 150 ml product from P.B.
	10-Jun-05		11.854	11.855	0.001	-	1077.734	nm	recovered 70 ml product from P.B.
	15-Jun-05		11.860	11.860	trace	-	1077.728	nm	recovered 100 ml product from P.B.
	17-Jun-05		11.810	11.810	trace	-	1077.778	nm	recovered 75 ml product from P.B.
	20-Jun-05		11.845	11.845	trace	-	1077.743	nm	recovered 10 ml product from P.B.
	22-Jun-05		11.783	11.783	trace	-	1077.805	nm	recovered 10 ml product from P.B.
	24-Jun-05		-	11.800	0.000	-	1077.788	nm	recovered 25 ml product from P.B.; H.B. conf no product in well.
	27-Jun-05		11.180	11.185	0.005	-	1078.407	nm	
	29-Jun-05		11.173	11.174	0.001	-	1078.415	nm	hand bailer had 2 mm of product
	6-Jul-05		11.120	11.128	0.008	-	1078.466	nm	Installed Passive bailer from BH706
	11-Jul-05		11.543	11.595	0.052	-	1078.035	nm	
	20-Jul-05		11.435	11.495	0.060	-	1078.141	nm	recovered 10 ml product from P.B., H.B. 300ml product
	22-Jul-05		11.423	11.503	0.080	-	1078.149	nm	65ml hand bailed, PB reset
	28-Jul-05		11.307	11.308	0.001	-	1078.281	nm	10 ml recovered from PB; H.B. 100 ml
	9-Aug-05		11.425	11.436	0.011	-	1078.161	nm	recovered 500 ml product from P.B.
	10-Aug-05		11.495	11.497	0.002	-	1078.093	nm	recovered 200 ml product from P.B.
	12-Aug-05		11.568	11.572	0.004	-	1078.019	nm	recovered 520 ml product from P.B.
	16-Aug-05		11.485	11.487	0.002	-	1078.103	nm	recovered 200 ml product from P.B.
	17-Aug-05		11.570	11.572	0.002	-	1078.018	nm	recovered 250 ml product from P.B.
	24-Aug-05		11.544	11.547	0.003	-	1078.043	nm	recovered 300 ml product from P.B.
	31-Aug-05		11.509	11.558	0.049	-	1078.069	nm	recovered 500 ml product from P.B.
	6-Sep-05		11.535	11.610	0.075	-	1078.038	nm	recovered 330 ml product from P.B. H.B 30 mm
	12-Sep-05		11.354	11.358	0.004	-	1078.233	nm	recovered 220 ml product from P.B.
	14-Sep-05		11.159	11.162	0.003	-	1078.428	nm	recovered 240 ml product from P.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH509 Continued	16-Sep-05		11.347	11.470	0.123	-	1078.216	nm	recovered 240 ml product from P.B.
	19-Sep-05		11.159	11.325	0.166	-	1078.396	nm	recovered 300 ml product from P.B.
	21-Sep-05		11.186	11.303	0.117	-	1078.379	nm	recovered 300 ml product from P.B.
	26-Sep-05		11.077	11.175	0.098	-	1078.491	nm	recovered 800 ml product from P.B.
	28-Sep-05		11.116	11.185	0.069	-	1078.458	nm	recovered 230 ml product from P.B.
	5-Oct-05		11.089	11.380	0.291	-	1078.441	nm	passive bailer = 0 ml reset
	18-Oct-05		10.967	11.505	0.538	-	1078.513	nm	passive bailer checked = 1000 mm, hand bailed 5.5L
	24-Oct-05		11.405	11.509	0.104	-	1078.162	nm	P.B. full of water; hand bailed 4.3 L product
	24-Oct-05		11.230	11.242	0.012	-	1078.356	nm	reset bailer after hand bailing as above
	1-Nov-05		10.966	11.500	0.534	-	1078.515	nm	0 ml product in P.B.; hand bailed 2.8 L
	1-Nov-05		11.185	11.195	0.010	-	1078.401	nm	reset passive bailer
	3-Nov-05		11.029	11.038	0.009	-	1078.557	nm	recovered 500 ml product from P.B.
	8-Nov-05		10.988	11.195	0.207	-	1078.559	nm	0 ml product in P.B.; H.B. 500 ml product
	10-Nov-05		11.105	11.314	0.209	-	1078.441	nm	0 ml product in P.B.
	14-Nov-05		cnm	cnm	cnm	-	cnm	cnm	P.B. fell in well; could not retrieve
	28-Nov-05		cnm	cnm	cnm	-	cnm	cnm	blocked with P.B. @ 9.970; P.B. retrieved
	30-Nov-05		10.865	10.887	0.022	-	1078.719	nm	P.B. full of water; reset
	6-Dec-05		10.848	11.325	0.477	-	1078.645	nm	P.B. had 100 ml product and 700 ml water
	12-Dec-05		10.818	10.827	0.009	-	1078.768	nm	PB-Recovered 100 ml
	14-Dec-05		10.836	10.840	0.004	-	1078.751	nm	PB-Recovered 100 ml
	16-Dec-05		10.837	10.854	0.017	-	1078.748	nm	PB-Recovered 10 ml
	19-Dec-05		10.853	10.859	0.006	-	1078.734	nm	PB-Recovered 20 ml
	22-Dec-05		10.840	10.923	0.083	-	1078.731	nm	PB-Recovered 20 ml
	23-Dec-05		10.853	10.597	-0.256	-	1078.786	nm	PB-Recovered 0 ml - PB reset
	3-Jan-06		10.851	10.987	0.136	-	1078.710	nm	PB-Recovered 800 ml
	5-Jan-06		10.863	10.967	0.104	-	1078.704	nm	PB-Recovered 800 ml
	6-Jan-06		11.870	12.101	0.231	-	1077.672	nm	PB-Recovered 800 ml
	9-Jan-06		10.857	10.960	0.103	-	1078.710	nm	PB-Recovered 800 ml
	12-Jan-06		10.864	10.978	0.114	-	1078.701	nm	PB-Recovered 800 ml
	13-Jan-06		11.863	11.983	0.120	-	1077.701	nm	PB-Recovered 800 ml. Hand bailed 6 L
	16-Jan-06		10.935	11.595	0.660	-	1078.521	nm	PB-Recovered 800 ml.
	19-Jan-06		10.906	11.670	0.764	-	1078.529	>10,000	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH509 Continued	20-Jan-06		11.910	12.768	0.858	-	1077.506	nm	PB-Recovered 800 ml.
	23-Jan-06		10.904	11.700	0.796	-	1078.525	nm	PB-Recovered 800 ml. Hand bailed 5.9 L
	30-Jan-06		10.905	11.507	0.602	-	1078.563	nm	PB-Recovered 800 ml. Hand bailed 4 L
	1-Feb-06		10.975	11.077	0.102	-	1078.593	nm	PB-Recovered 800 ml.
	3-Feb-06		10.960	11.477	0.517	-	1078.525	nm	P.B. had 0 ml product; bailer checked - 150 mm
	3-Feb-06		11.173	11.189	0.016	-	1078.412	nm	hand bailed 3 L product
	6-Feb-06		11.005	11.113	0.108	-	1078.561	nm	P.B. had 800 ml product; reset bailer
	8-Feb-06		11.049	11.347	0.298	-	1078.479	nm	P.B. had 800 ml product
	8-Feb-06		11.107	11.119	0.012	-	1078.479	nm	hand bailed 900 ml product
	10-Feb-06		11.158	11.163	0.005	-	1078.429	nm	P.B. had 200 ml product
	27-Feb-06		10.915	11.409	0.494	-	1078.574	nm	recovered 10 ml product from P.B.
	2-Mar-06		10.934	11.003	0.069	-	1078.640	nm	recovered 500 ml product from P.B.
	4-Mar-06		10.947	11.480	0.533	-	1078.534	nm	no product recovery in P.B.
	6-Mar-06		10.905	11.902	0.997	-	1078.484	nm	hand bailed 6.0 L product
	6-Mar-06		11.362	11.384	0.022	-	1078.222	nm	P.B. had 0 ml product; reset
	8-Mar-06		10.999	11.017	0.018	-	1078.585	nm	recovered 700 ml product from P.B.
	10-Mar-06		11.035	11.097	0.062	-	1078.541	nm	recovered 800 ml product from P.B.
	14-Mar-06		11.047	11.069	0.022	-	1078.537	nm	recovered 800 ml product from P.B.
	22-Mar-06		11.028	11.560	0.532	-	1078.454	nm	no product recovery in P.B.
	24-Mar-06		10.975	11.372	0.397	-	1078.534	nm	no product recovery in P.B.
	27-Mar-06		10.970	11.500	0.530	-	1078.512	nm	no product recovery in P.B.; switched bailers with 706
	29-Mar-06		10.964	11.535	0.571	-	1078.510	nm	recovered 150 ml product from P.B.
	31-Mar-06		10.954	11.594	0.640	-	1078.506	nm	recovered 50 ml product from P.B.
	7-Apr-06		10.957	11.505	0.548	-	1078.521	nm	no product recovery in P.B.
	12-Apr-06		10.966	11.583	0.617	-	1078.499	nm	recovered 800 ml product from P.B.
	17-Apr-06		10.970	11.595	0.625	0.800	1078.493	nm	recovered 800 ml product from P.B.
	18-Apr-06		11.003	11.665	0.662	0.650	1078.453	nm	recovered 650 ml product from P.B.
	21-Apr-06		10.985	11.584	0.599	0.750	1078.483	nm	recovered 750 ml product from P.B.
	26-Apr-06		10.930	11.194	0.264	-	1078.605	nm	recovered 0 ml product from P.B. Reset PB.
	28-Apr-06		10.993	11.602	0.609	0.300	1078.473	nm	recovered 300 ml product from P.B.
	1-May-06		10.998	11.605	0.607	1.000	1078.469	nm	recovered 1 L ml product from P.B.
	3-May-06		11.155	11.740	0.585	0.800	1078.316	nm	recovered 800 ml product from P.B.
	9-May-06		11.150	11.634	0.484	0.800	1078.341	nm	recovered 800 ml product from P.B.
	7-Jun-06		11.317	11.612	0.295	0.800	1078.212	nm	recovered 800 ml product from P.B.
	12-Jun-06		11.357	11.500	0.143	0.700	1078.202	nm	recovered 700 ml product from P.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH509 Continued	14-Jun-06		11.196	11.216	0.020	0.400	1078.388	nm	recovered 400 ml product from P.B.
	16-Jun-06		11.266	11.267	0.001	0.100	1078.322	nm	recovered 100 ml product from P.B.
	20-Jun-06		11.334	11.335	0.001	0.250	1078.254	nm	recovered 250 ml product from P.B.
	22-Jun-06		11.309	11.326	0.017	0.000	1078.276	nm	recovered 0 ml product from P.B.
	23-Jun-06		11.338	11.339	0.001	0.050	1078.250	nm	recovered 50 ml product from P.B.
	26-Jun-06		11.313	11.314	0.001	0.150	1078.275	nm	recovered 150 ml product from P.B.
	28-Jun-06		11.248	11.249	0.001	0.050	1078.340	nm	recovered 50 ml product from P.B.
	4-Jul-06		11.292	11.295	0.003	0.300	1078.295	nm	recovered 300 ml product from P.B.
	7-Jul-06		11.309	11.310	0.001	0.200	1078.279	nm	recovered 200 ml product from P.B.
	12-Jul-06		11.109	11.165	0.056	0.200	1078.468	nm	recovered 200 ml product from P.B.
	19-Jul-06		11.075	11.155	0.080	-	1078.497	nm	
	21-Jul-06		11.289	11.291	0.002	0.500	1078.299	nm	recovered 500 ml product from P.B.
	24-Jul-06		11.215	11.232	0.017	0.200	1078.370	nm	recovered 200 ml product from P.B.
	31-Jul-06		11.175	11.187	0.012	0.600	1078.411	nm	Hand bailed 600 ml of product
	3-Aug-06		11.246	11.248	0.002	0.250	1078.342	nm	Hand bailed 250 ml of product
	9-Aug-06		11.214	11.216	0.002	0.400	1078.374	nm	Hand Bailed 400 ml
	15-Aug-06		11.116	11.480	0.364	0.250	1078.399	nm	Hand Bailed 250 ml
	17-Aug-06		11.232	11.234	0.002	0.150	1078.356	nm	hand Bailed 150 ml
	18-Aug-06		11.245	11.246	0.001	0.100	1078.343	nm	Hand Bailed 100ml
	21-Aug-06		11.246	11.247	0.001	0.150	1078.342	nm	Hand Bailed 150ml
	24-Aug-06		11.204	11.207	0.003	0.200	1078.383	nm	Hand Bailed 200 ml
	25-Aug-06		11.285	11.286	0.001	0.050	1078.303	nm	Hand Bailed 50 ml
	28-Aug-06		11.233	11.236	0.003	0.110	1078.354	nm	Hand Bailed 110 ml
	30-Aug-06		11.195	11.196	0.001	0.150	1078.393	nm	Hand Bailed 150 ml
	18-Sep-06		11.233	11.234	0.001	0.010	1078.355	nm	hand bailed 10 ml
	20-Sep-06		11.189	11.190	0.001	0.005	1078.399	nm	hand bailed 5 ml
	22-Sep-06		11.188	11.192	0.004	0.050	1078.399	nm	recovered 50 ml product from passive bailer
	25-Sep-06		11.269	11.271	0.002	0.005	1078.319	nm	recovered 5 ml product from passive bailer
	3-Oct-06		11.255	11.256	0.001	0.010	1078.333	nm	recovered 10 ml product from passive bailer
	5-Oct-06		11.155	11.158	0.003	0.010	1078.432	nm	recovered 10 ml product from passive bailer
	4-Dec-06		11.029	11.485	0.456	2.800	1078.468	nm	HB - 2.3 L product - bailer checked 500ml
	19-Jan-07		11.060	11.520	0.460	-	1078.436	nm	
	22-Jan-07		11.070	11.400	0.330	0.100	1078.452	nm	recovered 100 ml product from passive bailer
	12-Mar-07		11.010	11.475	0.465	0.050	1078.485	nm	recovered 50 ml product from passive bailer
	15-Mar-07		10.995	11.203	0.208	0.050	1078.551	nm	recovered 50 ml product from passive bailer

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH509 Continued	17-Apr-07		11.010	11.420	0.410	-	1078.496	nm	passive bailer full of water; reset
	24-Apr-07		11.015	11.347	0.332	-	1078.507	nm	
	1-May-07		10.997	11.120	0.123	0.800	1078.566	nm	recovered 800 ml product from passive bailer
	4-May-07		11.063	11.195	0.132	-	1078.499	nm	
	8-May-07		11.215	11.224	0.009	0.800	1078.371	nm	recovered 800 ml product from passive bailer
	10-May-07		11.234	11.236	0.002	0.400	1078.354	nm	recovered 400 ml product from passive bailer
	8-Jun-07		11.100	11.110	0.010	0.750	1078.486	nm	recovered 750 ml product from passive bailer
	11-Jun-07		11.061	11.063	0.002	0.300	1078.527	nm	recovered 300 ml product from passive bailer
	13-Jun-07		11.050	11.055	0.005	0.120	1078.537	nm	recovered 120 ml product from passive bailer
	3-Jul-07		11.010	11.015	0.005	0.800	1078.577	nm	recovered 800 ml product from passive bailer
	5-Jul-07		11.016	11.019	0.003	0.300	1078.571	nm	recovered 300 ml product from passive bailer
	16-Jul-07		10.907	11.297	0.390	0.800	1078.603	nm	recovered 800 ml product from passive bailer
	20-Jul-07		10.883	11.010	0.127	0.200	1078.680	nm	recovered 200 ml product from passive bailer
	26-Jul-07		10.845	10.851	0.006	0.050	1078.742	nm	recovered 50 ml product from passive bailer
	30-Jul-07		10.845	11.000	0.155	0.210	1078.712	nm	recovered 210 ml product from passive bailer
	2-Aug-07		10.825	11.012	0.187	0.250	1078.726	nm	recovered 250 ml product from P.B.
	7-Aug-07		10.795	11.002	0.207	0.020	1078.752	nm	recovered 20 ml product from passive bailer
	9-Aug-07		10.870	11.201	0.331	0.100	1078.652	nm	recovered 100 ml product from P.B.
	24-Aug-07		10.895	11.435	0.540	0.750	1078.585	nm	recovered 750 ml product from passive bailer
	27-Aug-07		10.895	11.205	0.310	0.800	1078.631	nm	recovered 800 ml product from P.B.
	29-Aug-07		10.925	11.639	0.714	0.800	1078.520	nm	recovered 800 ml product from P.B.
	4-Sep-07		10.975	11.619	0.644	0.800	1078.484	nm	recovered 800 ml product from P.B.
	6-Sep-07		10.955	11.615	0.660	0.800	1078.501	nm	recovered 800 ml product from P.B.
	10-Sep-07		11.092	11.511	0.419	0.800	1078.412	nm	recovered 800 ml product from passive bailer
	12-Sep-07		10.974	11.530	0.556	0.800	1078.503	nm	recovered 800 ml product from passive bailer
	14-Sep-07		11.030	11.501	0.471	0.800	1078.464	nm	recovered 800 ml product from passive bailer
	17-Sep-07		11.005	11.521	0.516	0.510	1078.480	nm	recovered 510 ml product from passive bailer
	19-Sep-07		11.101	11.508	0.407	0.800	1078.406	nm	recovered 800 ml product from passive bailer
	21-Sep-07		11.040	11.455	0.415	0.800	1078.465	nm	recovered 800 ml product from passive bailer
	24-Sep-07		11.030	11.541	0.511	0.800	1078.456	nm	recovered 800 ml product from P.B.
	26-Sep-07		11.041	11.486	0.445	0.700	1078.458	nm	recovered 700 ml product from P.B.
	28-Sep-07		11.051	11.273	0.222	0.650	1078.493	nm	recovered 650 ml product from P.B.
	1-Oct-07		11.025	11.481	0.456	0.800	1078.472	nm	recovered 800 ml product from P.B.
	3-Oct-07		11.030	11.423	0.393	0.650	1078.479	nm	recovered 650 ml product from P.B.
	9-Oct-07		11.022	11.489	0.467	0.800	1078.473	nm	recovered 800 ml product from P.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH509 Continued	12-Oct-07		11.100	11.512	0.412	0.800	1078.406	nm	recovered 800 ml product from P.B.
	16-Oct-07		11.002	11.510	0.508	0.800	1078.484	nm	recovered 800 ml product from P.B.
	20-Oct-07		11.000	11.571	0.571	0.800	1078.474	nm	recovered 800 ml product from P.B.
	29-Oct-07		11.047	11.667	0.620	0.800	1078.417	nm	recovered 800 ml product from P.B.
	1-Nov-07		11.061	11.478	0.417	0.800	1078.444	nm	recovered 800 ml product from P.B.
	2-Nov-07		11.050	11.792	0.742	0.800	1078.390	nm	recovered 800 ml product from P.B.
	5-Nov-07		11.125	11.783	0.658	0.800	1078.331	nm	recovered 800 ml product from P.B.
	13-Nov-07		11.131	11.685	0.554	0.800	1078.346	nm	recovered 800 ml product from P.B.
	19-Nov-07		11.050	11.703	0.653	0.800	1078.407	nm	recovered 800 ml product from P.B.
	23-Nov-07		11.085	11.600	0.515	-	1078.400	nm	
	26-Nov-07		11.171	11.570	0.399	0.800	1078.337	nm	recovered 800 ml product from P.B.
	28-Nov-07		11.175	11.562	0.387	0.800	1078.336	nm	recovered 800 ml product from P.B.
	30-Nov-07		11.179	11.571	0.392	0.800	1078.331	nm	recovered 800 ml product from P.B.
	3-Dec-07		10.972	11.482	0.510	0.800	1078.514	nm	recovered 800 ml product from P.B.
	5-Dec-07		10.980	11.305	0.325	0.500	1078.543	nm	recovered 500 ml product from P.B.
	7-Dec-07		10.984	11.311	0.327	0.600	1078.539	nm	recovered 600 ml product from passive bailer
	10-Dec-07		10.973	11.507	0.534	0.800	1078.508	nm	recovered 800 ml product from passive bailer
	14-Dec-07		10.977	11.308	0.331	0.450	1078.545	nm	recovered 450 ml product from passive bailer
	17-Dec-07		10.976	11.409	0.433	0.800	1078.525	nm	recovered 800 ml product from passive bailer
	19-Dec-07		10.979	11.301	0.322	0.500	1078.545	nm	recovered 500 ml product from P.B.
	21-Dec-07		10.983	11.284	0.301	0.450	1078.545	nm	recovered 450 ml product from passive bailer
	2-Jan-08		10.974	11.478	0.504	0.800	1078.513	nm	recovered 800 ml product from passive bailer
	4-Jan-08		11.040	11.382	0.342	0.650	1078.480	nm	recovered 650 ml product from P.B.
	23-Jan-08		11.135	11.510	0.375	0.800	1078.378	nm	recovered 800 ml product from passive bailer
	25-Jan-08		11.160	11.295	0.135	0.500	1078.401	nm	recovered 500 ml product from P.B.
	7-Feb-08		11.416	11.420	0.004	0.100	1078.171	nm	recovered 100 ml product from P.B.
	9-Feb-08		11.419	11.423	0.004	0.200	1078.168	nm	recovered 200 ml product from passive bailer
	6-Mar-08		11.167	11.642	0.475	0.600	1078.326	nm	recovered 600 ml product from passive bailer
	7-Apr-08		11.295	11.302	0.007	0.400	1078.292	nm	recovered 400 ml product from passive bailer
	9-Apr-08		11.301	11.304	0.003	0.300	1078.286	nm	recovered 300 ml product from passive bailer
	11-Apr-08		11.304	11.307	0.003	0.200	1078.283	nm	recovered 200 ml product from passive bailer
	14-Apr-08		11.328	11.332	0.004	0.200	1078.259	nm	recovered 200 ml product from passive bailer
	16-Apr-08		11.415	11.417	0.002	0.500	1078.173	nm	recovered 500 ml product from P.B.
	28-Apr-08		11.633	11.645	0.012	0.350	1077.953	nm	recovered 350 ml product from P.B.
	30-Apr-08		11.638	11.649	0.011	0.250	1077.948	nm	recovered 250 ml product from passive bailer

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH509 Continued	2-May-08		11.641	11652.000	0.011	0.300	1077.945	nm	recovered 300 ml product from passive bailer
	5-May-08		11.412	11.416	0.004	0.200	1078.175	nm	recovered 200 ml product from passive bailer
	12-May-08		11.396	11.399	0.003	0.100	1078.191	nm	recovered 100 ml product from passive bailer
	14-May-08		11.399	11.401	0.002	0.050	1078.189	nm	recovered 50 ml product from passive bailer
	26-May-08		11.388	11.397	0.009	0.150	1078.198	nm	recovered 150 ml product from passive bailer
	28-May-08		11.392	11.395	0.003	0.050	1078.195	nm	recovered 50 ml product from passive bailer
	30-May-08		11.394	11.397	0.003	0.050	1078.193	nm	recovered 50 ml product from passive bailer
	9-Jun-08		11.363	11.369	0.006	0.020	1078.224	nm	recovered 20 ml product from P.B.
	11-Jun-08		11.309	11.313	0.004	0.100	1078.278	nm	recovered 100 ml product from P.B.
	13-Jun-08		11.311	11.315	0.004	0.050	1078.276	nm	recovered 50 ml product from passive bailer
	27-Jun-08		10.975	10.977	0.002	-	1078.613	>10,000	well decommissioned on 27 June 2008
BH510	5-Dec-02	1091.037	-	13.352	0.000	-	1077.685	>10,000	
	12-May-03		13.377	13.468	0.091	-	1077.642	>10,000	amber coloured LPH
	28-May-03		13.371	13.462	0.091	-	1077.648	n.m.	passive bailer installed from BH214.
	4-Jun-03		nm	nm	nm	-	nm	n.m	recovered 400 ml product from P.B.
	1-Jul-03		13.612	13.614	0.002	-	1077.425	n.m.	recovered 300 ml product from P.B.
	24-Jul-03		-	13.604	0.000	-	1077.433	-	moved passive bailer to BH214
	5-Aug-03		-	13.408	0.000	-	1077.629	-	
	7-Oct-03		-	13.295	0.000	-	1077.742	>10,000	
	13-Nov-03		13.321	13.335	0.014	-	1077.713	-	measured approx. 4 mm of clear pinkish product in bailer
	20-Nov-03		13.412	13.432	0.020	-	1077.621	7,400	
	3-Dec-03		13.377	13.413	0.036	-	1077.653	-	
	4-Dec-03		nm	nm	nm	-	nm	nm	recovered 100 ml product from P.B.
	8-Dec-03		-	13.584	0.000	-	1077.453	6,200	recovered 250 ml product from P.B.
	17-Dec-03		-	13.673	0.000	-	1077.364	>10,000	
	22-Dec-03		nm	nm	nm	-	nm	nm	recovered 40 ml product from P.B.
	7-Jan-04		-	13.508	0.000	-	1077.529	nm	recovered 100 ml product from P.B.
	10-Jan-04		-	13.524	0.000	-	1077.513	nm	recovered 50 ml product from P.B.
	12-Jan-04		-	13.578	0.000	-	1077.459	nm	recovered 50 ml product from P.B.
	15-Jan-04		-	13.500	0.000	-	1077.537	nm	recovered 50 ml product from P.B.
	20-Jan-04		-	14.234	0.000	-	1076.803	nm	water level too low; recovered 100 ml product from P.B.
	23-Jan-04		-	13.523	0.000	-	1077.514	nm	recovered 20 ml product from P.B.
	5-Feb-04		-	13.587	0.000	-	1077.450	nm	recovered 200 ml product from P.B.
	9-Feb-04		-	13.565	0.000	-	1077.472	nm	recovered 25 ml product from P.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH510 Continued	19-Feb-04		-	13.550	0.000	-	1077.487	nm	recovered 50 ml product from P.B.
	23-Feb-04		-	13.450	0.000	-	1077.587	nm	recovered 50 ml product from P.B.
	26-Feb-04		-	13.284	0.000	-	1077.753	nm	check of bailer showed no visible product
	3-Mar-04		-	13.368	0.000	-	1077.669	nm	check of bailer showed no visible product
	8-Mar-04		-	13.265	0.000	-	1077.772	>10,000	iced; check of bailer showed no visible product
	31-Mar-04		13.360	13.367	0.007	-	1077.670	nm	not enough to hand bail
	12-Apr-04		-	13.307	0.000	-	1077.730	nm	no passive bailer; H.B. 2 ml product
	13-Apr-04		-	13.355	0.000	-	1077.682	nm	no passive bailer
	15-Apr-04		-	13.310	0.000	-	1077.727	nm	no passive bailer
	16-Apr-04		-	13.355	0.000	-	1077.682	nm	no passive bailer
	19-Apr-04		-	13.310	0.000	-	1077.727	nm	no passive bailer
	22-Apr-04		13.395	13.397	0.002	-	1077.640	nm	no passive bailer
	30-Apr-04		13.395	13.400	0.005	-	1077.637	nm	no P.B.; hand bailed 1 cm product
	6-May-04		-	13.388	0.000	-	1077.649	nm	no P.B.; hand bailed 3 ml product
	7-May-04		-	13.345	0.000	-	1077.692	nm	no passive bailer
	10-May-04		-	13.336	0.000	-	1077.701	nm	no passive bailer
	17-May-04		-	13.367	0.000	-	1077.670	nm	no P.B.; hand bailed 1 ml product
	28-May-04		13.318	13.320	0.002	-	1077.717	nm	hand bailed 3 ml product
	15-Jun-04		-	13.389	0.000	-	1077.648	18	
	18-Jun-04		-	13.380	0.000	-	1077.657	nm	no passive bailer
	14-Jul-04		-	13.368	0.000	-	1077.669	2,000	bailer checked: 3 mm product
	28-Jul-04		13.355	13.360	0.005	-	1077.677	nm	no passive bailer
	6-Aug-04		13.359	13.363	0.004	-	1077.674	nm	no passive bailer
	10-Aug-04		13.375	13.380	0.005	-	1077.657	nm	no passive bailer
	11-Aug-04		13.355	13.357	0.002	-	1077.680	nm	no passive bailer
	13-Aug-04		-	13.360	0.000	-	1077.677	nm	no passive bailer
	18-Aug-04		-	13.375	0.000	-	1077.662	nm	no passive bailer
	24-Aug-04		-	13.313	0.000	-	1077.724	>10,000	Bailer check showed 2mm product
	7-Sep-04		-	13.355	0.000	-	1077.682	nm	no passive bailer
	9-Sep-04		-	13.364	0.000	-	1077.673	nm	no passive bailer
	13-Sep-04		-	13.328	0.000	-	1077.709	nm	no passive bailer
	15-Sep-04		-	13.340	0.000	-	1077.697	nm	no passive bailer
	17-Sep-04		-	13.320	0.000	-	1077.717	nm	no passive bailer
	20-Sep-04		13.395	13.410	0.015	-	1077.627	nm	no passive bailer
	22-Sep-04		13.355	13.360	0.005	-	1077.677	nm	no passive bailer

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH510 Continued	24-Sep-04		13.368	13.370	0.002	-	1077.667	nm	no passive bailer
	29-Sep-04		-	13.343	0.000	-	1077.694	nm	
	4-Oct-04		-	13.310	0.000	-	1077.727	nm	
	6-Oct-04		13.312	13.315	0.003	-	1077.722	nm	no passive bailer
	12-Oct-04		-	13.448	0.000	-	1077.589	nm	bailer checked; 3 ml recovered
	15-Oct-04		-	13.332	0.000	-	1077.705	nm	no passive bailer
	5-Nov-04		-	13.320	0.000	-	1077.717	nm	no passive bailer; disposable bailer had 1 mm product
	8-Nov-04		-	13.324	0.000	-	1077.713	nm	no passive bailer
	10-Nov-04		13.448	13.450	0.002	-	1077.587	nm	no passive bailer
	17-Nov-04		13.144	13.146	0.002	-	1077.891	nm	no passive bailer
	25-Nov-04		-	13.355	0.000	-	1077.682	nm	no passive bailer
	29-Nov-04		-	13.335	0.000	-	1077.702	nm	no passive bailer
	1-Dec-04		13.384	13.386	0.002	-	1077.651	nm	no passive bailer
	11-Jan-05		-	13.364	0.000	-	1077.673	>10,000	bailer check showed no visible product
	17-Jan-05		-	13.375	0.000	-	1077.662	nm	no passive bailer
	24-Jan-05		13.413	13.413	trace	-	1077.624	nm	no passive bailer
	26-Jan-05		-	13.436	0.000	-	1077.601	nm	no passive bailer
	28-Jan-05		-	13.439	0.000	-	1077.598	nm	no passive bailer
	2-Feb-05		13.417	13.417	trace	-	1077.620	5,000	slight odour; slight sheen on probe
	18-Feb-05		13.419	13.420	0.001	-	1077.617	nm	no passive bailer
	22-Feb-05		13.450	13.452	0.002	-	1077.585	nm	no passive bailer
	24-Feb-05		13.431	13.431	trace	-	1077.606	nm	no visible product in P.B.; sheen present
	2-Mar-05	1091.086	-	13.455	0.000	-	1077.631	5,400	checked bailer - sheen on water; well resurveyed
	22-Mar-05		-	13.485	0.000	-	1077.601	nm	
	24-Mar-05		-	13.484	0.000	-	1077.602	nm	checked bailer - no visible product
	28-Mar-05		-	13.375	0.000	-	1077.711	nm	
	30-Mar-05		-	13.490	0.000	-	1077.596	nm	
	1-Apr-05		-	13.415	0.000	-	1077.671	nm	
	5-Apr-05		-	13.520	0.000	-	1077.566	nm	
	11-Apr-05		-	13.455	0.000	-	1077.631	nm	
	15-Apr-05		-	13.494	0.000	-	1077.592	nm	
	18-Apr-05		-	13.518	0.000	-	1077.568	nm	
	20-Apr-05		-	13.490	0.000	-	1077.596	nm	
	22-Apr-05		-	13.487	0.000	-	1077.599	nm	
	25-Apr-05		-	13.475	0.000	-	1077.611	nm	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH510 Continued	27-Apr-05		-	13.513	0.000	-	1077.573	nm	
	4-May-05		-	13.505	0.000	-	1077.581	nm	
	6-May-05		-	13.464	0.000	-	1077.622	nm	checked bailer - no visible product
	9-May-05		-	13.475	0.000	-	1077.611	nm	
	13-May-05		-	13.498	0.000	-	1077.588	nm	
	16-May-05		-	13.404	0.000	-	1077.682	nm	
	26-May-05		-	13.525	0.000	-	1077.561	nm	
	2-Jun-05		-	13.479	0.000	-	1077.607	40	
	10-Jun-05		-	13.467	0.000	-	1077.619	nm	
	15-Jun-05		-	13.469	0.000	-	1077.617	nm	
	17-Jun-05		13.460	13.461	0.001	-	1077.625	nm	checked bailer - no visible product
	20-Jun-05		-	13.505	0.000	-	1077.581	nm	
	22-Jun-05		-	13.430	0.000	-	1077.656	nm	
	24-Jun-05		-	13.490	0.000	-	1077.596	nm	well could be slightly shortened or j-plug installed
	27-Jun-05		-	13.472	0.000	-	1077.614	nm	
	29-Jun-05		-	13.470	0.000	-	1077.616	nm	
	6-Jul-05		-	13.410	0.000	-	1077.676	nm	
	11-Jul-05		-	13.461	0.000	-	1077.625	nm	
	20-Jul-05		-	13.448	0.000	-	1077.638	nm	
	22-Jul-05		-	13.423	0.000	-	1077.663	nm	
	28-Jul-05		-	13.405	0.000	-	1077.681	nm	
	9-Aug-05		-	13.425	0.000	-	1077.661	nm	
	10-Aug-05		-	13.430	0.000	-	1077.656	nm	
	12-Aug-05		-	13.435	0.000	-	1077.651	nm	
	16-Aug-05		-	13.377	0.000	-	1077.709	nm	
	17-Aug-05		-	13.409	0.000	-	1077.677	nm	
	24-Aug-05		-	13.385	0.000	-	1077.701	nm	
	31-Aug-05		-	13.395	0.000	-	1077.691	nm	
	6-Sep-05		-	13.406	0.000	-	1077.680	nm	
	12-Sep-05		-	13.368	0.000	-	1077.718	nm	
	14-Sep-05		-	13.343	0.000	-	1077.743	nm	
	16-Sep-05		-	13.375	0.000	-	1077.711	nm	
	19-Sep-05		-	13.337	0.000	-	1077.749	nm	well needs clean-out cap replaced with j-plug
	21-Sep-05		-	13.375	0.000	-	1077.711	nm	
	26-Sep-05		-	13.311	0.000	-	1077.775	nm	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH510 Continued	28-Sep-05		-	13.348	0.000	-	1077.738	nm	
	18-Oct-05		-	13.347	0.000	-	1077.739	nm	
	24-Oct-05		-	13.309	0.000	-	1077.777	nm	
	1-Nov-05		-	13.297	0.000	-	1077.789	nm	
	3-Nov-05		-	13.268	0.000	-	1077.818	nm	0 ml product in P.B.
	8-Nov-05		-	13.334	0.000	-	1077.752	nm	
	10-Nov-05		-	13.325	0.000	-	1077.761	nm	
	14-Nov-05		-	13.352	0.000	-	1077.734	nm	
	28-Nov-05		-	13.339	0.000	-	1077.747	nm	
	30-Nov-05		-	13.298	0.000	-	1077.788	nm	
	6-Dec-05		-	13.323	0.000	-	1077.763	nm	
	12-Dec-05		-	13.238	0.000	-	1077.848	nm	
	14-Dec-05		-	13.327	0.000	-	1077.759	nm	
	16-Dec-05		-	13.284	0.000	-	1077.802	nm	
	19-Dec-05		-	13.270	0.000	-	1077.816	nm	
	22-Dec-05		-	13.195	0.000	-	1077.891	nm	
	23-Dec-05		-	13.309	0.000	-	1077.777	nm	
	3-Jan-06		-	13.298	0.000	-	1077.788	nm	
	5-Jan-06		-	13.274	0.000	-	1077.812	nm	
	6-Jan-06		-	13.265	0.000	-	1077.821	nm	
	9-Jan-06		-	13.229	0.000	-	1077.857	nm	
	12-Jan-06		-	13.308	0.000	-	1077.778	nm	
	13-Jan-06		-	13.238	0.000	-	1077.848	nm	
	16-Jan-06		-	13.292	0.000	-	1077.794	nm	
	20-Jan-06		-	13.262	0.000	-	1077.824	nm	
	23-Jan-06		-	13.264	0.000	-	1077.822	nm	
	30-Jan-06		-	13.187	0.000	-	1077.899	nm	
	1-Feb-06		-	13.193	0.000	-	1077.893	nm	
	3-Feb-06		-	13.323	0.000	-	1077.763	nm	
	6-Feb-06		-	13.337	0.000	-	1077.749	nm	
	8-Feb-06		-	13.268	0.000	-	1077.818	nm	
	10-Feb-06		-	13.368	0.000	-	1077.718	nm	
	27-Feb-06		-	13.187	0.000	-	1077.899	nm	
	2-Mar-06		-	13.343	0.000	-	1077.743	nm	
	4-Mar-06		-	13.279	0.000	-	1077.807	nm	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH510 Continued	6-Mar-06		-	13.242	0.000	-	1077.844	nm	
	8-Mar-06		-	13.305	0.000	-	1077.781	nm	
	10-Mar-06		-	13.301	0.000	-	1077.785	nm	
	14-Mar-06		-	13.267	0.000	-	1077.819	nm	
	22-Mar-06		cnm	cnm	cnm	-	cnm	cnm	iced up
	24-Mar-06		-	13.268	0.000	-	1077.818	nm	
	27-Mar-06		-	13.320	0.000	-	1077.766	nm	
	29-Mar-06		-	13.273	0.000	-	1077.813	nm	
	31-Mar-06		cnm	cnm	cnm	-	cnm	cnm	High volume traffic
	12-Apr-06		-	13.307	0.000	-	1077.779	nm	
	19-Jul-06		-	13.350	0.000	-	1077.736	nm	
	21-Jul-06		-	13.370	0.000	-	1077.716	nm	
	24-Jul-06		-	13.295	0.000	-	1077.791	nm	
	31-Jul-06		-	13.316	0.000	-	1077.770	nm	
	3-Aug-06		-	13.355	0.000	-	1077.731	nm	
	9-Aug-06		-	13.338	0.000	-	1077.748	nm	
	15-Aug-06		-	13.323	0.000	-	1077.763	nm	
	17-Aug-06		-	13.340	0.000	-	1077.746	nm	
	18-Aug-06		-	13.335	0.000	-	1077.751	nm	
	21-Aug-06		-	13.316	0.000	-	1077.770	nm	
	24-Aug-06		-	13.321	0.000	-	1077.765	nm	
	25-Aug-06		-	13.349	0.000	-	1077.737	nm	
	28-Aug-06		-	13.308	0.000	-	1077.778	nm	
	30-Aug-06		-	13.307	0.000	-	1077.779	nm	
	18-Sep-06		-	13.324	0.000	-	1077.762	nm	
	20-Sep-06		-	13.268	0.000	-	1077.818	nm	
	22-Sep-06		-	13.266	0.000	-	1077.820	nm	
	25-Sep-06		-	13.319	0.000	-	1077.767	nm	
	3-Oct-06		-	13.360	0.000	-	1077.726	nm	
	5-Oct-06		-	13.259	0.000		1077.827	nm	
	4-Dec-06		cnm	cnm	cnm	cnm	cnm	cnm	iced
	25-Jan-07		-	13.259	0.000	-	1077.827	>10,000	No bailer
	15-Mar-07		-	13.201	0.000	-	1077.885	nm	
	17-Apr-07		-	13.296	0.000	-	1077.790	nm	
	24-Apr-07		-	13.307	0.000	-	1077.779	nm	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH510 Continued	1-May-07		-	13.295	0.000	-	1077.791	nm	
	4-May-07		-	13.272	0.000	-	1077.814	nm	
	8-May-07		-	13.299	0.000	-	1077.787	nm	
	10-May-07		-	13.324	0.000	-	1077.762	nm	
	8-Jun-07		-	13.270	0.000	-	1077.816	nm	
	11-Jun-07		-	13.250	0.000	-	1077.836	nm	
	13-Jun-07		-	13.266	0.000	-	1077.820	nm	
	3-Jul-07		-	13.235	0.000	-	1077.851	nm	
	5-Jul-07		-	13.235	0.000	-	1077.851	nm	
	16-Jul-07		-	13.190	0.000	-	1077.896	nm	
	20-Jul-07		-	13.194	0.000	-	1077.892	nm	
	26-Jul-07		-	13.215	0.000	-	1077.871	nm	
	30-Jul-07		-	13.205	0.000	-	1077.881	nm	
	7-Aug-07		-	13.133	0.000	-	1077.953	nm	
	9-Aug-07		-	13.121	0.000	-	1077.965	nm	
	24-Aug-07		-	13.177	0.000	-	1077.909	nm	
	27-Aug-07		-	13.177	0.000	-	1077.909	nm	
	29-Aug-07		-	13.178	0.000	-	1077.908	nm	
	4-Sep-07		-	13.193	0.000	-	1077.893	nm	
	6-Sep-07		-	13.183	0.000	-	1077.903	nm	
	10-Sep-07		-	13.186	0.000	-	1077.900	nm	
	12-Sep-07		-	13.103	0.000	-	1077.983	nm	
	14-Sep-07		-	13.222	0.000	-	1077.864	nm	
	17-Sep-07		-	13.195	0.000	-	1077.891	nm	
	19-Sep-07		-	13.193	0.000	-	1077.893	nm	
	21-Sep-07		-	13.214	0.000	-	1077.872	nm	
	24-Sep-07		-	13.100	0.000	-	1077.986	nm	
	26-Sep-07		-	13.155	0.000	-	1077.931	nm	
	28-Sep-07		-	13.110	0.000	-	1077.976	nm	
	1-Oct-07		-	13.153	0.000	-	1077.933	nm	
	3-Oct-07		-	13.152	0.000	-	1077.934	nm	
	9-Oct-07		-	13.144	0.000	-	1077.942	nm	
	12-Oct-07		-	13.150	0.000	-	1077.936	nm	
	16-Oct-07		-	13.190	0.000	-	1077.896	nm	
	20-Oct-07		-	13.210	0.000	-	1077.876	nm	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH510 Continued	29-Oct-07		-	13.207	0.000	-	1077.879	nm	
	1-Nov-07		-	13.204	0.000	-	1077.882	nm	
	2-Nov-07		-	13.200	0.000	-	1077.886	nm	
	5-Nov-07		-	13.181	0.000	-	1077.905	nm	
	13-Nov-07		-	13.184	0.000	-	1077.902	nm	
	19-Nov-07		-	13.228	0.000	-	1077.858	nm	
	23-Nov-07		-	13.179	0.000	-	1077.907	5,000	
	26-Nov-07		-	13.215	0.000	-	1077.871	nm	
	28-Nov-07		-	13.228	0.000	-	1077.858	nm	
	30-Nov-07		-	13.232	0.000	-	1077.854	nm	
	3-Dec-07		-	13.180	0.000	-	1077.906	nm	
	5-Dec-07		-	13.182	0.000	-	1077.904	nm	
	7-Dec-07		-	13.185	0.000	-	1077.901	nm	
	10-Dec-07		-	13.188	0.000	-	1077.898	nm	
	14-Dec-07		-	13.185	0.000	-	1077.901	nm	
	17-Dec-07		-	13.188	0.000	-	1077.898	nm	
	19-Dec-07		-	13.189	0.000	-	1077.897	nm	
	21-Dec-07		-	13.192	0.000	-	1077.894	nm	
	2-Jan-08		-	13.183	0.000	-	1077.903	nm	
	4-Jan-08		-	13.251	0.000	-	1077.835	nm	
	23-Jan-08		-	13.176	0.000	-	1077.910	nm	
	25-Jan-08		-	13.185	0.000	-	1077.901	nm	
	7-Feb-08		-	13.297	0.000	-	1077.789	nm	
	9-Feb-08		-	13.295	0.000	-	1077.791	nm	
	6-Mar-08		-	13.279	0.000	-	1077.807	nm	
	6-Mar-08		-	13.254	0.000	-	1077.832	nm	
	10-Mar-08		-	13.235	0.000	-	1077.851	1,300	
	7-Apr-08		-	13.239	0.000	-	1077.847	nm	
	9-Apr-08		-	13.242	0.000	-	1077.844	nm	
	11-Apr-08		-	13.243	0.000	-	1077.843	nm	
	14-Apr-08		-	13.242	0.000	-	1077.844	nm	
	16-Apr-08		-	13.254	0.000	-	1077.832	nm	
	28-Apr-08		-	13.303	0.000	-	1077.783	nm	
	30-Apr-08		-	13.309	0.000	-	1077.777	nm	
	2-May-08		-	13.315	0.000	-	1077.771	nm	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
	5-May-08		-	13.292	0.000	-	1077.794	nm	
	12-May-08		-	13.298	0.000	-	1077.788	nm	
	14-May-08		-	13.300	0.000	-	1077.786	nm	
	26-May-08		-	13.227	0.000	-	1077.859	nm	
	28-May-08		-	13.230	0.000	-	1077.856	nm	
	30-May-08		-	13.240	0.000	-	1077.846	nm	
	9-Jun-08		-	13.260	0.000	-	1077.826	nm	
	11-Jun-08		-	13.258	0.000	-	1077.828	nm	
	13-Jun-08		-	13.262	0.000	-	1077.824	nm	
	3-Jul-08		-	13.227	0.000	-	1077.859	>10,000	well decommissioned on 03 July 2008
BH510A	11-Jan-05	1091.090	-	13.450	0.000	-	1077.640	>10,000	bailer check showed no product
	2-Feb-05		-	13.517	0.000	-	1077.573	6,200	4 inch well
	18-Feb-05		13.504	13.506	0.002	-	1077.586	nm	no P.B.; 4 inch well
	22-Feb-05		-	13.565	0.000	-	1077.525	nm	4 inch well
	24-Feb-05		-	13.529	0.000	-	1077.561	nm	bailer check showed no product, no sheen
	2-Mar-05		-	13.535	0.000	-	1077.555	8,200	checked bailer - sheen on water; well surveyed
	22-Mar-05		-	13.585	0.000	-	1077.505	nm	
	24-Mar-05		-	13.572	0.000	-	1077.518	nm	checked bailer - no product
	28-Mar-05		-	13.474	0.000	-	1077.616	nm	
	30-Mar-05		-	13.588	0.000	-	1077.502	nm	
	1-Apr-05		-	13.499	0.000	-	1077.591	nm	
	5-Apr-05		-	13.624	0.000	-	1077.466	nm	
	11-Apr-05		-	13.545	0.000	-	1077.545	nm	
	15-Apr-05		-	13.585	0.000	-	1077.505	nm	
	18-Apr-05		-	13.616	0.000	-	1077.474	nm	
	20-Apr-05		-	13.584	0.000	-	1077.506	nm	
	22-Apr-05		-	13.579	0.000	-	1077.511	nm	
	25-Apr-05		-	13.569	0.000	-	1077.521	nm	
	27-Apr-05		-	13.607	0.000	-	1077.483	nm	
	4-May-05		-	13.601	0.000	-	1077.489	nm	
	6-May-05		-	13.560	0.000	-	1077.530	nm	checked bailer - no product
	9-May-05		-	13.566	0.000	-	1077.524	nm	
	13-May-05		-	13.598	0.000	-	1077.492	nm	
	16-May-05		-	13.495	0.000	-	1077.595	nm	
	26-May-05		-	13.625	0.000	-	1077.465	nm	
	2-Jun-05		-	13.575	0.000	-	1077.515	>10,000	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH211 Continued	25-May-07		-	11.138	0.000	-	1078.200	68	
	23-Aug-07		-	11.004	0.000	-	1078.334	92	
	22-Nov-07		-	11.045	0.000	-	1078.293	14	
	10-Mar-08		-	11.065	0.000	-	1078.273	300	
	4-Jun-08		-	11.147	0.000	-	1078.191	62	
	3-Jul-08		-	-	0.000	-	-	1,000	well decommissioned on 03 July 2008
BH212	29-Oct-98	1088.070	-	9.044	0.000	-	1079.030	44	
	9-Nov-98		-	9.020	0.000	-	1079.050	200	
	22-Apr-99		-	9.350	0.000	-	1078.720	14	
	26-Jul-01		-	9.320	0.000	-	1078.750	22	cap labelled 211
	5-Dec-02	1088.127	-	9.418	0.000	-	1078.709	290	
	12-May-03		-	9.474	0.000	-	1078.653	50	
	7-Oct-03		-	9.315	0.000	-	1078.812	55	
	20-Nov-03		-	9.355	0.000	-	1078.772	210	
	17-Dec-03		-	9.310	0.000	-	1078.817	210	
	13-Jan-04		-	9.248	0.000	-	1078.879	20	
	8-Mar-04		-	8.765	0.000	-	1079.362	180	some surface water entered well (200ml)
	7-Apr-04		-	9.188	0.000	-	1078.939	120	was frozen
	16-Jun-04		-	9.300	0.000	-	1078.827	10	
	14-Jul-04		-	9.319	0.000	-	1078.808	20	
	23-Aug-04			9.318	0.000	-	1078.809	22	One bolt missing - could not be replaced
	14-Oct-04		-	9.349	0.000	-	1078.778	42	
	2-Feb-05		-	9.417	0.000	-	1078.710	20	
	2-Mar-05		-	9.393	0.000	-	1078.734	240	
	5-Oct-05		-	9.273	0.000	-	1078.854	65	
	19-Jan-06		-	9.235	0.000	-	1078.892	10	
	11-May-06		-	9.358	0.000	-	1078.769	220	
	25-Jan-07		-	6.284	0.000	-	1081.843	100	
	23-May-07		-	9.292	0.000	-	1078.835	68	
	23-Aug-07		-	9.074	0.000	-	1079.053	74	
	22-Nov-07		-	9.112	0.000	-	1079.015	160	
	13-Mar-08		cnm	cnm	cnm	cnm	cnm	88	well frozen in
	4-Jun-08		-	9.289	0.000	-	1078.838	20	
	23-Jun-08		-	9.241	0.000	-	1078.886	55	well decommissioned on 24 June 2008
BH213	29-Oct-98	1088.950	9.496	9.624	0.128	-	1079.430	2,000	passive bailer

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH213 Continued	3-Nov-98		9.875	9.876	0.001	-	1079.430	nm	recovered 150 ml product from P.B.
	5-Nov-98		-	9.677	0.000	-	1079.430	nm	recovered 75 ml product from P.B.
	13-Nov-98		-	9.630	0.000	-	1079.320	-	recovered 200 ml product from P.B.; H.B. 200 ml
	22-Nov-98		nm	nm	nm	-	nm	nm	recovered 200 ml product from P.B.; H.B. 200 ml
	26-Nov-98		-	9.648	0.000	-	1079.036	40	measured 60 mm product in bailer
	9-Dec-98		-	9.914	0.000	-	1079.036	1,200	recovered 200 ml product from passive bailer
	23-Dec-98		-	9.772	0.000	-	1079.178	nm	recovered 100 ml product from passive bailer
	4-Jan-99		-	9.705	0.000	-	1079.245	-	passive bailer
	11-Jan-99		nm	nm	nm	-	nm	nm	recovered 100 ml product from passive bailer
	29-Jan-99		nm	nm	nm	-	nm	nm	recovered 150 ml product from P.B.
	2-Feb-99		nm	nm	nm	-	nm	nm	recovered 200 ml product from P.B.
	22-Apr-99		-	10.408	0.000	-	1078.542	>10,000	passive bailer
	20-Aug-99		10.145	10.148	0.003	-	1078.804	120	
	27-Aug-99		-	10.087	0.000	-	1078.863	28	
	17-Sep-99		-	9.928	0.000	-	1079.022	nm	75 ml product in passive bailer
	22-Nov-99		-	9.766	0.000	-	1079.184	20	75 ml product in passive bailer
	20-Nov-03		-	9.724	0.000	-	1079.557	2,000	
	3-Dec-03		-	9.693	0.000	-	1079.588	nm	Heavy sheen, no LPH, no passive bailer
	8-Dec-03		-	9.725	0.000	-	1079.556	500	no passive bailer; disposable bailer shows no product
	17-Dec-03		-	9.723	0.000	-	1079.558	60	
	7-Jan-04		-	9.672	0.000	-	1079.609	nm	no passive bailer; checked with hand bailer - no product
	13-Jan-04		-	9.671	0.000	-	1079.610	60	Bailer Check - No product
	10-Mar-04		-	9.730	0.000	-	1079.551	6,000	cap broken; retrieved bailer stuck in well
	22-Mar-04		cnm	cnm	cnm	-	cnm	cnm	P.B. stuck in well (frozen)
	6-Apr-04		10.183	10.185	0.002	-	1079.098	>10,000	product in well
	16-Jun-04		-	10.020	0.000	-	1079.261	70	cap broken
	14-Jul-04		-	10.147	0.000	-	1079.134	72	cap has a hole
	24-Aug-04		-	10.366	0.000	-	1078.915	1,000	
	14-Oct-04		-	10.424	0.000	-	1078.857	1,000	
	2-Feb-05		10.094	10.094	trace	-	1079.187	5,400	bailer checked: 2 mm product in well
	2-Mar-05		cnm	cnm	cnm	-	cnm	cnm	well completely frozen
	5-Oct-05		-	10.294	0.000	-	1078.987	1,000	
	19-Jan-06		-	9.924	0.000	-	1079.357	1,000	
	11-May-06	1088.950	-	10.256	-	-	1079.025	>10,000	
	27-Jul-06		-	10.360	-	-	1078.921	200	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH213 Continued	25-Jan-07		-	10.334	-	-	1078.947	4,000	
	23-Aug-07		-	9.815	-	-	1079.466	200	
	23-Nov-07		-	9.823	-	-	1079.458	6,000	
	10-Mar-08		-	9.915	-	-	1079.366	240	
	4-Jun-08		-	9.945	-	-	1079.336	60	
	23-Jun-08		-	9.891	-	-	1079.390	520	well decommissioned on 23 June 2008
BH214	29-Oct-98	1089.100	-	8.006	0.000	-	1081.094	60	
	9-Nov-98		-	8.020	0.000	-	1081.080	1,100	
	26-Nov-98		7.946	7.963	0.017	-	1081.151	420	bailed 10 ml product
	9-Dec-98		nm	nm	0.000	-	nm	1,200	skim of product in passive bailer
	23-Dec-98		7.906	7.932	0.026	-	1081.189	nm	bailed 20 ml product
	4-Jan-99		-	7.933	0.016	-	1081.180	-	
	7-Mar-99		-	8.465	0.000	-	1080.635	-	passive bailer
	22-Apr-99		-	8.842	0.000	-	1080.258	1,200	passive bailer
	20-Aug-99		-	8.523	0.000	-	1080.577	1,000	
	27-Aug-99		-	8.489	0.000	-	1080.611	400	
	17-Sep-99		-	8.406	0.000	-	1080.694	nm	
	22-Nov-99		-	8.287	0.000	-	1080.813	600	
	10-Dec-99		-	8.235	0.000	-	1080.865	116	
	16-Dec-99		-	8.226	0.000	-	1080.874	860	
	5-Aug-03		9.187	9.211	0.024	-	1080.255	nm	
	16-Sep-03		nm	nm	nm	-	-	nm	repaired well cap and bailer chain
	7-Oct-03		-	-	-	-	-	>10,000	
	12-Nov-03		nm	nm	nm	-	nm	nm	did not measure because of P.B.; bailed 3.6 L product
	20-Nov-03		-	-	-	-	-	>10,000	CNM-PB Frozen
	3-Dec-03		-	8.979	0.000	-	1080.468	nm	
	4-Dec-03		nm	nm	nm	-	nm	nm	P.B. check showed approx. 5 ml product
	8-Dec-03		-	9.310	0.000	-	1080.137	260	recovered 150 ml product from P.B.
	17-Dec-03		-	9.345	0.000	-	1080.102	7,000	
	22-Dec-03		nm	nm	nm	-	nm	nm	recovered 80 ml product from P.B.
	7-Jan-04		-	9.020	0.000	-	1080.427	nm	recovered 100 ml product from P.B.
	10-Jan-04		-	9.140	0.000	-	1080.307	nm	recovered 50 ml product from passive bailer
	12-Jan-04		-	9.243	0.000	-	1080.204	nm	recovered 50 ml product from passive bailer
	15-Jan-04		-	9.210	0.000	-	1080.237	nm	recovered 100 ml product from P.B.
	20-Jan-04		-	9.335	0.000	-	1080.112	nm	recovered 100 ml product from P.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH214 Continued	23-Jan-04		-	9.072	0.000	-	1080.375	nm	recovered 10 ml product from P.B.
	5-Feb-04		-	9.342	0.000	-	1080.105	nm	recovered 100 ml product from P.B.
	9-Feb-04		-	9.434	0.000	-	1080.013	nm	recovered 100 ml product from P.B.
	19-Feb-04		-	8.890	0.000	-	1080.557	nm	recovered 50 ml product from passive bailer
	23-Feb-04		-	8.920	0.000	-	1080.527	nm	recovered 50 ml product from passive bailer
	26-Feb-04		cnm	cnm	cnm	-	cnm	cnm	iced - bailer frozen down well
	3-Mar-04		cnm	cnm	cnm	-	cnm	cnm	bailer frozen down well
	8-Mar-04		cnm	cnm	cnm	-	cnm	1,600	passive bailer frozen to side
	31-Mar-04		-	9.620	0.000	-	1079.827	nm	recovered 200 ml product from P.B.
	12-Apr-04		-	9.645	0.000	-	1079.802	nm	product in P.B. is greyish black with a slight sheen
	13-Apr-04		-	9.667	0.000	-	1079.780	nm	recovered 50 ml product from passive bailer
	15-Apr-04		-	9.644	0.000	-	1079.803	nm	product is blackish; recovered 100 ml from P.B.
	16-Apr-04		-	9.659	0.000	-	1079.788	nm	product is blackish; recovered 150 ml from P.B.
	19-Apr-04		-	9.664	0.000	-	1079.783	nm	product is black; recovered 300 ml from P.B.
	22-Apr-04		-	9.693	0.000	-	1079.754	nm	recovered 350 ml black product from P.B.
	30-Apr-04		-	9.735	0.000	-	1079.712	nm	recovered 150 ml product from P.B
	6-May-04		-	9.686	0.000	-	1079.761	nm	recovered 100 ml from passive bailer
	7-May-04		-	9.674	0.000	-	1079.773	nm	recovered 10 ml from passive bailer
	10-May-04		-	9.669	0.000	-	1079.778	nm	recovered 50 ml from passive bailer
	17-May-04		-	9.690	0.000	-	1079.757	nm	recovered 10 ml from passive bailer
	20-May-04		-	9.689	0.000	-	1079.758	nm	recovered 10 ml from passive bailer
	28-May-04		-	9.650	0.000	-	1079.797	nm	hand bailed 5 ml
	16-Jun-04		-	9.860	0.000	-	1079.587	10,000	
	18-Jun-04		-	10.860	0.000	-	1078.587	nm	passive bailer checked - no product
	14-Jul-04		-	9.920	0.000	-	1079.527	70	passive bailer checked - no product
	28-Jul-04		9.935	9.960	0.025	-	1079.507	nm	10 ml recovered
	6-Aug-04		9.935	9.982	0.047	-	1079.503	nm	10 ml recovered
	10-Aug-04		9.960	10.020	0.060	-	1079.475	nm	0 ml recovered
	11-Aug-04		9.935	10.000	0.065	-	1079.499	nm	10 ml recovered
	13-Aug-04		-	9.935	0.000	-	1079.512	nm	10 ml recovered
	18-Aug-04		-	9.955	0.000	-	1079.492	nm	10 ml recovered
	24-Aug-04		-	9.874	0.000	-	1079.573	2,800	No product in PB.
	7-Sep-04		-	9.975	0.000	-	1079.472	nm	0 ml recovered
	9-Sep-04		-	9.985	0.000	-	1079.462	nm	0 ml recovered
	13-Sep-04		-	9.935	0.000	-	1079.512	nm	0 ml recovered

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH214 Continued	15-Sep-04		-	9.957	0.000	-	1079.490	nm	0 ml recovered
	17-Sep-04		-	9.923	0.000	-	1079.524	nm	0 ml recovered
	20-Sep-04		9.980	10.025	0.045	-	1079.458	nm	0 ml recovered
	22-Sep-04		-	9.954	0.000	-	1079.493	nm	0 ml recovered
	24-Sep-04		-	9.975	0.000	-	1079.472	nm	0 ml recovered
	29-Sep-04		-	9.945	0.000	-	1079.502	nm	0 ml recovered
	4-Oct-04		-	9.895	0.000	-	1079.552	nm	0 ml recovered
	6-Oct-04		9.855	9.884	0.029	-	1079.586	nm	0 ml recovered
	12-Oct-04		-	9.965	0.000	-	1079.482	nm	0 ml recovered
	15-Oct-04		-	9.880	0.000	-	1079.567	nm	0 ml recovered
	5-Nov-04		9.845	9.849	0.004	-	1079.601	nm	0 ml recovered
	8-Nov-04		9.859	9.862	0.003	-	1079.587	nm	0 ml recovered
	10-Nov-04		9.986	9.988	0.002	-	1079.461	nm	0 ml recovered
	17-Nov-04		-	9.906	0.000	-	1079.541	nm	0 ml recovered
	25-Nov-04		-	9.725	0.000	-	1079.722	nm	10 ml recovered
	29-Nov-04		9.863	9.865	0.002	-	1079.584	nm	0 ml recovered
	1-Dec-04		9.899	9.901	0.002	-	1079.548	nm	0 ml recovered
	17-Jan-05		9.616	9.616	trace	-	1079.831	nm	trace product; no P.B. in well
	24-Jan-05		9.655	9.700	0.045	-	1079.783	nm	no passive bailer
	26-Jan-05		9.804	9.804	trace	-	1079.643	nm	passive bailer full of water; reset P.B.
	28-Jan-05		9.970	9.970	trace	-	1079.477	nm	recovered 2 ml product and 20 ml water from P.B.
	2-Feb-05		9.957	9.957	trace	-	1079.490	>10,000	passive bailer checked - no product; sheen on probe
	18-Feb-05		9.943	9.948	0.005	-	1079.503	nm	recovered 4 ml product and 150 ml water from P.B.
	22-Feb-05		10.004	10.006	0.002	-	1079.443	nm	recovered 5 ml product from passive bailer
	24-Feb-05		9.908	9.908	trace	-	1079.539	nm	P.B. full of water; observed 4 mm product in H.B.
	2-Mar-05		9.985	9.989	0.004	-	1079.461	>10,000	recovered 1 mm of product from P.B.
	22-Mar-05		10.010	10.015	0.005	-	1079.436	nm	recovered 10 ml product from P.B.
	24-Mar-05		10.085	10.100	0.015	-	1079.359	nm	no product in P.B.; hand bailed 10 mm product
	28-Mar-05		9.926	9.928	0.002	-	1079.521	nm	no product in P.B.
	30-Mar-05		10.053	10.055	0.002	-	1079.394	nm	no product in P.B.
	1-Apr-05		9.984	9.984	trace	-	1079.463	nm	no product in P.B.
	5-Apr-05		10.095	10.098	0.003	-	1079.351	nm	no product in P.B.
	11-Apr-05		10.036	10.038	0.002	-	1079.411	nm	no product in P.B.
	15-Apr-05		10.090	10.091	0.001	-	1079.357	nm	no product in P.B.
	18-Apr-05		10.110	10.111	0.001	-	1079.337	nm	no product in P.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH214 Continued	20-Apr-05		10.087	10.089	0.002	-	1079.360	nm	no product in P.B.
	22-Apr-05		10.102	10.104	0.002	-	1079.345	nm	no product in P.B.
	25-Apr-05		10.085	10.088	0.003	-	1079.361	nm	no product in P.B.
	27-Apr-05		-	10.105	0.000	-	1079.342	nm	no product in P.B.
	4-May-05		-	10.220	0.000	-	1079.227	nm	no product in P.B.
	6-May-05		-	10.375	0.000	-	1079.072	nm	no product in P.B.
	9-May-05		-	10.100	0.000	-	1079.347	nm	
	13-May-05		10.112	10.114	0.002	-	1079.335	nm	no product in P.B.
	16-May-05		-	10.029	0.000	-	1079.418	nm	no product in P.B.
	26-May-05		-	10.148	0.000	-	1079.299	nm	no product in P.B.
	10-Jun-05		10.165	10.168	0.003	-	1079.281	nm	no product in P.B.
	15-Jun-05		10.159	10.162	0.003	-	1079.287	nm	no product in P.B.
	17-Jun-05		10.150	10.159	0.009	-	1079.295	nm	no product in P.B.
	20-Jun-05		10.155	10.158	0.003	-	1079.291	nm	no product in P.B.
	22-Jun-05		10.124	10.130	0.006	-	1079.322	nm	no product in P.B.
	24-Jun-05		10.145	10.147	0.002	-	1079.302	nm	no product in P.B.
	27-Jun-05		10.124	10.126	0.002	-	1079.323	nm	no product in P.B.
	29-Jun-05		10.115	10.117	0.002	-	1079.332	nm	no product in P.B.
	6-Jul-05		9.984	9.985	0.001	-	1079.463	nm	no product in P.B.
	11-Jul-05		7.045	7.049	0.004	-	1082.401	nm	no product in P.B.
	20-Jul-05		9.989	9.992	0.003	-	1079.457	nm	no product in P.B.
	22-Jul-05		9.962	9.963	0.001	-	1079.485	nm	no product in P.B.
	28-Jul-05		9.893	9.895	0.002	-	1079.554	nm	no product in P.B.
	9-Aug-05		9.985	9.990	0.005	-	1079.461	nm	no product in P.B.
	10-Aug-05		9.976	9.978	0.002	-	1079.471	nm	no product in P.B.
	12-Aug-05		9.949	9.951	0.002	-	1079.498	nm	no product in P.B.
	16-Aug-05		9.738	9.739	0.001	-	1079.709	nm	no product in P.B.
	17-Aug-05		9.905	9.907	0.002	-	1079.542	nm	no product in P.B.
	24-Aug-05		9.758	9.759	0.001	-	1079.689	nm	no product in P.B.
	31-Aug-05		9.799	9.802	0.003	-	1079.647	nm	no product in P.B.
	6-Sep-05		9.862	9.864	0.002	-	1079.585	nm	no product in P.B.
	12-Sep-05		9.734	9.738	0.004	-	1079.712	nm	recovered 5 ml product from P.B.
	14-Sep-05		9.698	9.699	0.001	-	1079.749	nm	no product in P.B.
	16-Sep-05		9.715	9.716	0.001	-	1079.732	nm	no product in P.B.
	19-Sep-05		-	9.665	0.000	-	1079.782	nm	no product in P.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH214 Continued	21-Sep-05		-	9.705	0.000	-	1079.742	nm	no product in P.B.
	26-Sep-05		9.607	9.608	0.001	-	1079.840	nm	recovered 10 ml product from P.B.
	28-Sep-05		9.641	9.642	0.001	-	1079.806	nm	recovered 5 ml product from P.B.
	18-Oct-05		9.560	9.562	0.002	-	1079.887	nm	recovered 10 ml product from P.B.
	24-Oct-05		-	9.537	0.000	-	1079.910	nm	recovered 10 ml product from P.B.
	1-Nov-05		9.505	9.507	0.002	-	1079.942	nm	recovered 10 ml product from P.B.
	3-Nov-05		9.628	9.629	0.001	-	1079.819	nm	recovered 50 mm dark product and 115 mm light product
	8-Nov-05		9.653	9.654	0.001	-	1079.794	nm	recovered 20 ml black product
	10-Nov-05		9.527	9.529	0.002	-	1079.920	nm	recovered 10 ml product from P.B.
	14-Nov-05		9.664	9.665	0.001	-	1079.783	nm	recovered 10 ml product from P.B.
	28-Nov-05		9.610	9.612	0.002	-	1079.837	nm	recovered 30 ml product from P.B.
	30-Nov-05		9.567	9.569	0.002	-	1079.880	nm	recovered 10 ml product from P.B.
	6-Dec-05		9.599	9.602	0.003	-	1079.847	nm	recovered 10 ml product from P.B.
	12-Dec-05		9.473	9.475	0.002	-	1079.974	nm	PB-Recovered 10 ml
	14-Dec-05		9.594	9.596	0.002	-	1079.853	nm	PB-Recovered 10 ml
	16-Dec-05		9.528	9.530	0.002	-	1079.919	nm	PB-Recovered 10 ml
	19-Dec-05		9.509	9.510	0.001	-	1079.938	nm	PB-Recovered 10 ml
	22-Dec-05		9.378	9.379	0.001	-	1080.069	nm	PB-Recovered 5 ml
	23-Dec-05		9.428	9.930	0.502	-	1079.919	nm	PB-Recovered 10 ml
	3-Jan-06		9.554	9.556	0.002	-	1079.893	nm	PB-Recovered 5 ml
	5-Jan-06		9.561	9.562	0.001	-	1079.886	nm	PB-Recovered 5 ml
	6-Jan-06		9.552	9.553	0.001	-	1079.895	nm	PB-Recovered 5 ml
	9-Jan-06		9.450	9.451	0.001	-	1079.997	nm	
	12-Jan-06		9.245	9.247	0.002	-	1080.202	nm	PB-Recovered 5 ml
	13-Jan-06		9.194	9.195	0.001	-	1080.253	nm	PB-Recovered 10 ml
	16-Jan-06		9.578	9.580	0.002	-	1079.869	nm	PB-Recovered 10 ml
	20-Jan-06		9.533	9.534	0.001	-	1079.914	nm	PB-Recovered 5 ml
	23-Jan-06		8.835	8.836	0.001	-	1080.612	nm	
	30-Jan-06		8.698	8.699	0.001	-	1080.749	nm	moved PB to 706
	1-Feb-06		8.685	8.687	0.002	-	1080.762	nm	
	3-Feb-06		9.004	9.005	0.001	-	1080.443	nm	
	6-Feb-06		9.101	9.102	0.001	-	1080.346	nm	
	8-Feb-06		8.903	8.904	0.001	-	1080.544	nm	
	10-Feb-06		9.182	9.184	0.002	-	1080.265	nm	
	27-Feb-06		8.703	8.705	0.002	-	1080.744	nm	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH214 Continued	2-Mar-06		9.104	9.106	0.002	-	1080.343	nm	
	4-Mar-06		9.236	9.237	0.001	-	1080.211	nm	
	6-Mar-06		8.840	8.841	0.001	-	1080.607	nm	
	8-Mar-06		9.024	9.025	0.001	-	1080.423	nm	
	10-Mar-06		cnm	cnm	cnm	-	cnm	nm	
	14-Mar-06		cnm	cnm	cnm	-	cnm	nm	
	22-Mar-06		cnm	cnm	cnm	-	cnm	nm	
	24-Mar-06		cnm	cnm	cnm	-	cnm	nm	
	27-Mar-06		cnm	cnm	cnm	-	cnm	nm	
	29-Mar-06		cnm	cnm	cnm	-	cnm	nm	
	30-Mar-06		9.223	9.224	0.001	-	1080.224	nm	Chipped ice out
	31-Mar-06		cnm	cnm	cnm	-	cnm	nm	High volume of traffic
	12-Apr-06		cnm	cnm	cnm	-	cnm	nm	
	18-Apr-06		10.255	10.420	0.165	0.040	1079.159	nm	Hand bailed 40 ml
	26-Apr-06		9.145	9.147	0.002	-	1080.302	nm	
	28-Apr-06		9.320	9.321	0.001	-	1080.127	nm	
	1-May-06		9.216	9.217	0.001	-	1080.231	nm	
	3-May-06		9.432	9.433	0.001	-	1080.015	nm	
	9-May-06		9.366	9.368	0.002	-	1080.081	nm	
	7-Jun-06		9.567	9.571	0.004	-	1079.879	nm	
	12-Jun-06		9.526	9.529	0.003	-	1079.920	nm	
	14-Jun-06		9.235	9.239	0.004	-	1080.211	nm	
	16-Jun-06		9.214	9.215	0.001	-	1080.233	nm	
	20-Jun-06		9.242	9.243	0.001	-	1080.205	nm	
	22-Jun-06		9.375	9.379	0.004	-	1080.071	nm	
	23-Jun-06		9.380	9.381	0.001	-	1080.067	nm	
	26-Jun-06		9.293	9.294	0.001	-	1080.154	nm	
	28-Jun-06		9.129	9.131	0.002	-	1080.318	nm	
	4-Jul-06		9.263	9.266	0.003	-	1080.183	nm	
	7-Jul-06		9.190	9.193	0.003	-	1080.256	nm	
	12-Jul-06		9.094	9.096	0.002	-	1080.353	nm	
	19-Jul-06		9.209	9.211	0.002	-	1080.238	nm	
	21-Jul-06		9.268	9.269	0.001	-	1080.179	nm	
	24-Jul-06		9.065	9.067	0.002	-	1080.382	nm	
	31-Jul-06		9.095	9.096	0.001	-	1080.352	nm	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH214 Continued	3-Aug-06		9.245	9.246	0.001	-	1080.202	nm	
	9-Aug-06		9.213	9.214	0.001	-	1080.234	nm	
	15-Aug-06		9.082	9.084	0.002	-	1080.365	nm	
	17-Aug-06		11.355	11.356	0.001	-	1078.092	nm	
	18-Aug-06		9.173	9.175	0.002	-	1080.274	nm	
	21-Aug-06		9.157	9.159	0.002	-	1080.290	nm	
	24-Aug-06		9.191	9.193	0.002	-	1080.256	nm	
	25-Aug-06		9.274	9.275	0.001	-	1080.173	nm	
	28-Aug-06		9.233	9.234	0.001	-	1080.214	nm	
	30-Aug-06		9.134	9.136	0.002	-	1080.313	nm	
	18-Sep-06		9.330	9.331	0.001	-	1080.117	nm	
	20-Sep-06		9.165	9.167	0.002	-	1080.282	nm	
	22-Sep-06		9.160	9.162	0.002	-	1080.287	nm	
	25-Sep-06		9.215	9.218	0.003	-	1080.231	nm	
	3-Oct-06		9.329	9.330	0.001	-	1080.118	nm	
	5-Oct-06		9.054	9.056	0.002	-	1080.393	nm	
	4-Dec-06		8.709	8.731	0.022	-	1080.734	nm	
	17-Apr-07		8.705	8.728	0.023	-	1080.737	nm	
	24-Apr-07		8.970	8.982	0.012	-	1080.475	nm	
	1-May-07		8.923	8.928	0.005	0.005	1080.523	nm	recovered 5 ml product from passive bailer
	4-May-07		8.865	8.869	0.004	-	1080.581	nm	
	8-May-07		8.935	8.944	0.009	-	1080.510	nm	
	10-May-07		9.005	9.009	0.004	-	1080.441	nm	
	8-Jun-07		cnm	cnm	cnm	cnm	cnm	cnm	car parked over well
	3-Jul-07		8.105	8.127	0.022	-	1081.338	nm	
	5-Jul-07		8.111	8.130	0.019	-	1081.332	nm	
	16-Jul-07		8.063	8.082	0.019	-	1081.380	nm	
	20-Jul-07		8.065	8.069	0.004	-	1081.381	nm	
	26-Jul-07		8.150	8.155	0.005	-	1081.296	nm	
	30-Jul-07		8.155	8.174	0.019	-	1081.288	nm	
	2-Aug-07		8.160	8.172	0.012	-	1081.285	nm	
	7-Aug-07		8.115	8.123	0.008	-	1081.330	nm	
	9-Aug-07		8.009	8.038	0.029	-	1081.432	nm	
	24-Aug-07		8.347	8.355	0.008	-	1081.098	nm	
	27-Aug-07		8.360	8.388	0.028	-	1081.081	nm	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH214 Continued	29-Aug-07		8.355	8.392	0.037	-	1081.085	nm	
	4-Sep-07		8.382	8.389	0.007	-	1081.064	nm	
	6-Sep-07		8.385	8.391	0.006	-	1081.061	nm	
	10-Sep-07		10.700	10.705	0.005	-	1078.746	nm	
	12-Sep-07		10.523	10.525	0.002	-	1078.924	nm	
	14-Sep-07		10.491	10.493	0.002	-	1078.956	nm	
	17-Sep-07		10.711	10.715	0.004	0.010	1078.735	nm	recovered 10 ml product from passive bailer
	19-Sep-07		10.450	10.453	0.003	-	1078.996	nm	
	21-Sep-07		10.500	10.503	0.003	-	1078.946	nm	
	24-Sep-07		cnm	cnm	cnm	cnm	cnm	cnm	car parked over well
	26-Sep-07		cnm	cnm	cnm	cnm	cnm	cnm	car parked over well
	28-Sep-07		cnm	cnm	cnm	cnm	cnm	cnm	car parked over well
	1-Oct-07		8.395	8.399	0.004	-	1081.051	nm	
	3-Oct-07		8.399	8.402	0.003	-	1081.047	nm	no recovery
	9-Oct-07		8.392	8.396	0.004	-	1081.054	nm	
	12-Oct-07		8.382	8.387	0.005	-	1081.064	nm	
	16-Oct-07		8.503	8.508	0.005	-	1080.943	nm	
	20-Oct-07		8.557	8.559	0.002	-	1080.890	nm	
	29-Oct-07		8.414	8.417	0.003	-	1081.032	nm	
	1-Nov-07		8.410	8.412	0.002	-	1081.037	nm	
	2-Nov-07		8.412	8.416	0.004	-	1081.034	nm	
	5-Nov-07		nm	nm	nm	nm	nm	nm	
	13-Nov-07		8.441	8.445	0.004	-	1081.005	nm	
	19-Nov-07		8.376	8.379	0.003	-	1081.070	nm	
	23-Nov-07		8.338	8.340	0.002	-	1081.109	4,000	
	26-Nov-07		8.368	8.372	0.004	-	1081.078	nm	
	28-Nov-07		8.371	8.374	0.003	-	1081.075	nm	
	30-Nov-07		8.381	8.385	0.004	-	1081.065	nm	
	3-Dec-07		8.100	8.104	0.004	-	1081.346	nm	
	5-Dec-07		8.115	8.117	0.002	-	1081.332	nm	
	7-Dec-07		8.119	8.121	0.002	-	1081.328	nm	
	10-Dec-07		8.201	8.203	0.002	-	1081.246	nm	
	14-Dec-07		8.205	8.207	0.002	-	1081.242	nm	
	17-Dec-07		8.207	8.209	0.002	-	1081.240	nm	
	19-Dec-07		8.207	8.209	0.002	-	1081.240	nm	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH214 Continued	21-Dec-07		8.203	8.205	0.002	-	1081.244	nm	
	2-Jan-08		8.200	8.201	0.001	-	1081.247	nm	
	4-Jan-08		8.152	8.155	0.003	-	1081.294	nm	
	23-Jan-08		8.343	8.359	0.016	-	1081.101	nm	
	25-Jan-08		8.340	8.352	0.012	-	1081.105	nm	
	7-Feb-08		nm	nm	nm	nm	nm	nm	
	9-Feb-08		nm	nm	nm	nm	nm	nm	
	6-Mar-08		cnm	cnm	cnm	cnm	cnm	cnm	car parked over well
	7-Apr-08		8.523	8.538	0.015	-	1080.921	nm	
	9-Apr-08		8.525	8.537	0.012	-	1080.920	nm	
	11-Apr-08		8.524	8.535	0.011	-	1080.921	nm	
	14-Apr-08		8.480	8.489	0.009	-	1080.965	nm	
	16-Apr-08		8.472	8.475	0.003	-	1080.974	nm	
	28-Apr-08		8.601	8.606	0.005	-	1080.845	nm	
	30-Apr-08		8.603	8.608	0.005	-	1080.843	nm	
	2-May-08		8.600	8.606	0.006	-	1080.846	nm	
	5-May-08		nm	nm	nm	nm	nm	nm	
	12-May-08		8.548	8.559	0.011	-	1080.897	nm	
	14-May-08		8.550	8.560	0.010	-	1080.895	nm	
	26-May-08		8.450	8.455	0.005	-	1080.996	nm	
	28-May-08		8.455	8.458	0.003	-	1080.991	nm	
	30-May-08		8.460	8.462	0.002	-	1080.987	nm	
	9-Jun-08		8.384	8.387	0.003	-	1081.062	nm	
	11-Jun-08		nm	nm	nm	nm	nm	nm	
	13-Jun-08		8.390	8.393	0.003	-	1081.056	nm	
	23-Jun-08		8.345	8.357	0.012	-	1081.100	>10,000	well decommissioned on June 23, 2008
BH501	5-Dec-02	1090.027	-	12.065	0.000	-	1077.962	>10,000	
	12-May-03		-	12.078	0.000	-	1077.949	>10,000	
	7-Oct-03		-	12.010	0.000	-	1078.017	>10,000	
	12-Nov-03		-	12.074	0.000	-	1077.953	nm	no odour, no sheen
	20-Nov-03		-	12.099	0.000	-	1077.928	1,300	
	17-Dec-03		-	12.104	0.000	-	1077.923	70	
	13-Jan-04		-	12.012	0.000	-	1078.015	80	
	8-Mar-04		-	11.965	0.000	-	1078.062	>10,000	inside of well had to be chipped out
	6-Apr-04		-	11.950	0.000	-	1078.077	480	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH208 Continued	14-Jul-04		-	10.172	0.000	-	1078.765	46	
	24-Aug-04		-	10.146	0.000	-	1078.791	3,200	
	14-Oct-04		-	10.187	0.000	-	1078.750	290	
	2-Feb-05		-	10.185	0.000	-	1078.752	5,000	
	2-Mar-05		cnm	cnm	cnm	-	cnm	>10,000	
	5-Oct-05		-	10.117	0.000	-	1078.820	>10,000	
	19-Jan-06		-	10.010	0.000	-	1078.927	4,000	
	11-May-06		-	10.060	-	-	1078.877	>10,000	
	27-Jul-06		-	10.125	-	-	1078.812	320	
	25-Jan-07		-	10.063	-	-	1078.874	>10,000	
	29-May-07		-	10.153	-	-	1078.784	50	
	23-Aug-07		-	9.971	-	-	1078.966	1,400	
	23-Nov-07		-	10.001	-	-	1078.936	2,000	
	10-Mar-08		-	10.065	-	-	1078.872	>10,000	
	4-Jun-08		-	10.125	-	-	1078.812	5,000	
	24-Jun-08		-	10.114	-	-	1078.823	>10,000	well decommissioned on 24 June 2008
BH209	29-Oct-98	1088.800	-	10.056	0.000	-	1078.744	640	
	9-Nov-98		-	10.030	0.000	-	1078.770	880	
	22-Apr-99		-	inaccessible	-	-	-	nm	
	26-Jul-01		-	10.293	0.000	-	1078.507	2,200	
	5-Dec-02	1089.124	-	10.390	0.000	-	1078.734	>10,000	
	25-Apr-03		-	10.111	0.000	-	1079.013	n.m.	
	12-May-03		-	10.413	0.000	-	1078.711	1,800	
	7-Oct-03		-	10.335	0.000	-	1078.789	>10,000	
	20-Nov-03		-	10.436	0.000	-	1078.688	160	
	17-Dec-03		-	10.454	0.000	-	1078.670	140	
	13-Jan-04		-	10.358	0.000	-	1078.766	1,200	
	8-Mar-04		-	10.386	0.000	-	1078.738	1,400	
	6-Apr-04		cnm	cnm	cnm	-	cnm	cnm	
	16-Jun-04		-	10.404	0.000	-	1078.720	600	
	14-Jul-04		-	10.388	0.000	-	1078.736	38	
	24-Aug-04		-	10.347	0.000	-	1078.777	5,000	
	14-Oct-04		-	10.376	0.000	-	1078.748	300	
	2-Feb-05		-	10.395	0.000	-	1078.729	2,000	bailer checked: slight odour, no sheen
	2-Mar-05		-	10.369	0.000	-	1078.755	>10,000	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH209 Continued	5-Oct-05		-	10.319	0.000	-	1078.805	1,000	
	19-Jan-06		10.195	10.320	0.125	-	1078.904	3,400	Product
	20-Jan-06		10.175	10.178	0.003	-	1078.948	nm	Bailer checked - 1 mm
	23-Jan-06		10.165	10.425	0.260	-	1078.907	nm	Hand Bailed - 1.1 L.
	30-Jan-06		10.070	10.378	0.308	-	1078.992	nm	Hand Bailed - 700 ml.
	1-Feb-06		10.113	10.217	0.104	-	1078.990	nm	Hand Bailed - 330 ml.
	3-Feb-06		10.195	10.395	0.200	-	1078.889	nm	200 mm product in passive bailer
	3-Feb-06		10.413	10.417	0.004	-	1078.710	nm	hand bailed 400 ml product
	6-Feb-06		10.203	10.409	0.206	-	1078.880	nm	hand bailed 500 ml product
	6-Feb-06		10.405	10.409	0.004	-	1078.718	nm	
	8-Feb-06		10.204	10.407	0.203	-	1078.879	nm	hand bailed 500 ml product
	8-Feb-06		10.307	10.312	0.005	-	1078.816	nm	
	10-Feb-06		10.250	10.311	0.061	-	1078.862	nm	hand bailed 300 ml product
	10-Feb-06		10.346	10.348	0.002	-	1078.778	nm	
	27-Feb-06		10.004	10.873	0.869	-	1078.946	nm	800 ml product in P.B.
	27-Feb-06		10.505	10.514	0.009	-	1078.617	nm	hand bailed 2.1 L product
	2-Mar-06		10.197	10.480	0.283	-	1078.870	nm	hand bailed 1.2 L product
	2-Mar-06		10.451	10.459	0.008	-	1078.671	nm	
	4-Mar-06		10.164	10.169	0.005	-	1078.959	nm	
	6-Mar-06		10.135	10.331	0.196	-	1078.950	nm	hand bailed 300 ml product
	6-Mar-06		10.314	10.319	0.005	-	1078.809	nm	
	8-Mar-06		10.149	10.243	0.094	-	1078.956	nm	hand bailed 200 ml product
	8-Mar-06		10.289	10.298	0.009	-	1078.833	nm	
	10-Mar-06		cnm	cnm	cnm	-	cnm	nm	
	14-Mar-06		cnm	cnm	cnm	-	cnm	nm	
	22-Mar-06		cnm	cnm	cnm	-	cnm	nm	
	24-Mar-06		cnm	cnm	cnm	-	cnm	nm	
	27-Mar-06		cnm	cnm	cnm	-	cnm	nm	
	29-Mar-06		cnm	cnm	cnm	-	cnm	nm	
	30-Mar-06		10.073	10.885	0.812	-	1078.889	nm	Bailer checked - 1L; hand bailed 2.1 L
	31-Mar-06		cnm	cnm	cnm	-	cnm	nm	High volume traffic
	12-Apr-06		10.145	10.542	0.397	-	1078.900	nm	Hand bailed 1.1 L product
	18-Apr-06		cnm	cnm	cnm	cnm	cnm	cnm	Iced
	21-Apr-06		10.162	10.300	0.138	0.030	1078.934	nm	Hand bailed 30 ml
	26-Apr-06		10.170	10.319	0.149	0.350	1078.924	nm	Hand bailed 350 ml

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH209 Continued	28-Apr-06		10.232	10.265	0.033	-	1078.885	nm	
	1-May-06		10.189	10.262	0.073	-	1078.920	nm	
	3-May-06		10.260	10.355	0.095	0.500	1078.845	nm	Hand bailed 500 ml
	9-May-06		10.257	10.400	0.143	0.500	1078.838	nm	
	7-Jun-06		9.250	9.521	0.271	0.350	1079.820	nm	Hand bailed 350 ml
	12-Jun-06		10.309	10.401	0.092	0.300	1078.797	nm	Hand bailed 300 ml
	14-Jun-06		10.236	10.287	0.051	-	1078.878	nm	
	16-Jun-06		10.268	10.315	0.047	-	1078.847	nm	
	20-Jun-06		10.275	10.350	0.075	-	1078.834	nm	
	22-Jun-06		10.303	10.351	0.048	-	1078.811	nm	0 ml product in passive bailer
	23-Jun-06		10.310	10.355	0.045	-	1078.805	nm	
	26-Jun-06		10.274	10.298	0.024	-	1078.845	nm	
	28-Jun-06		10.255	10.293	0.038	-	1078.861	nm	
	4-Jul-06		10.279	10.355	0.076	-	1078.830	nm	
	7-Jul-06		10.287	10.289	0.002	-	1078.837	nm	
	12-Jul-06		9.250	9.334	0.084	-	1079.857	nm	no passive bailer
	19-Jul-06		10.287	10.322	0.035	-	1078.830	nm	
	21-Jul-06		10.309	10.325	0.016	-	1078.812	nm	
	24-Jul-06		10.255	10.318	0.063	0.100	1078.856	nm	recovered 100 ml product
	24-Jul-06		10.262	10.269	0.007	-	1078.861	nm	
	31-Jul-06		10.265	10.297	0.032	-	1078.853	nm	
	3-Aug-06		10.295	10.364	0.069	0.040	1078.815	nm	Hand Bailed 40 ml
	9-Aug-06		10.293	10.360	0.067	0.020	1078.818	nm	Hand bailed 20 ml
	15-Aug-06		10.270	10.321	0.051	0.100	1078.844	nm	Hand bailed 100 ml
	17-Aug-06		10.293	10.295	0.002	-	1078.831	nm	
	18-Aug-06		9.285	9.330	0.045	-	1079.830	nm	
	21-Aug-06		10.267	10.320	0.053	-	1078.846	nm	
	24-Aug-06		10.275	10.310	0.035	0.100	1078.842	nm	Hand Bailed 100 ml
	25-Aug-06		10.301	10.309	0.008	-	1078.821	nm	
	28-Aug-06		10.260	10.289	0.029	-	1078.858	nm	
	30-Aug-06		10.269	10.309	0.040	-	1078.847	nm	
	18-Sep-06		10.275	10.276	0.001	-	1078.849	nm	
	20-Sep-06		10.237	10.267	0.030	0.030	1078.881	nm	before purge - hand bailed 30 ml
	20-Sep-06		10.241	10.242	0.001	-	1078.883	nm	after purge
	22-Sep-06		10.238	10.240	0.002	-	1078.886	nm	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH209 Continued	25-Sep-06		10.266	10.343	0.077	-	1078.843	nm	
	3-Oct-06		10.305	10.390	0.085	0.100	1078.802	nm	hand bailed 100 ml
	5-Oct-06		10.229	10.241	0.012	-	1078.893	nm	
	4-Dec-06		cnm	cnm	cnm	cnm	cnm	cnm	iced
	17-Apr-07		9.950	10.503	0.553	1.000	1079.063	nm	recovered 700 ml product from P.B.; hand bailed 300 ml
	24-Apr-07		10.265	10.372	0.107	1.000	1078.838	nm	hand bailed 1.0 L
	1-May-07		10.283	10.293	0.010	0.010	1078.839	nm	recovered 10 ml product from passive bailer
	4-May-07		10.260	10.300	0.040	-	1078.856	nm	
	8-May-07		10.279	10.289	0.010	0.010	1078.843	nm	recovered 10 ml product from passive bailer
	10-May-07		10.295	10.300	0.005	-	1078.828	nm	
	29-May-07		10.301	10.365	0.064	-	1078.810	>10,000	Product, not sampled
	8-Jun-07		10.255	10.286	0.031	0.050	1078.863	nm	hand bailed 50 ml
	11-Jun-07		10.239	10.245	0.006	-	1078.884	nm	
	13-Jun-07		10.245	10.326	0.081	0.050	1078.863	nm	recovered 50 ml from PB
	3-Jul-07		10.193	10.300	0.107	-	1078.910	nm	
	5-Jul-07		10.190	10.302	0.112	-	1078.912	nm	
	16-Jul-07		10.128	10.203	0.075	-	1078.981	nm	
	20-Jul-07		10.110	10.207	0.097	-	1078.995	nm	
	26-Jul-07		10.095	10.208	0.113	-	1079.006	nm	
	30-Jul-07		10.092	10.207	0.115	-	1079.009	nm	
	2-Aug-07		10.060	10.225	0.165	-	1079.031	nm	
	7-Aug-07		10.024	10.310	0.286	-	1079.043	nm	
	9-Aug-07		10.575	10.709	0.134	0.400	1078.522	nm	recovered 400 ml product from passive bailer
	24-Aug-07		10.631	10.633	0.002	0.800	1078.493	nm	recovered 800 ml product from passive bailer
	27-Aug-07		10.681	10.684	0.003	0.060	1078.442	nm	recovered 60 ml from PB
	29-Aug-07		10.670	10.672	0.002	0.100	1078.454	nm	recovered 100 ml from PB
	4-Sep-07		10.675	10.677	0.002	0.150	1078.449	nm	recovered 150 ml from PB
	6-Sep-07		10.696	10.698	0.002	0.100	1078.428	nm	recovered 100 ml from PB
	10-Sep-07		10.672	10.675	0.003	0.060	1078.451	nm	recovered 60 ml product from passive bailer
	12-Sep-07		10.553	10.557	0.004	0.100	1078.570	nm	recovered 100 ml product from passive bailer
	14-Sep-07		10.680	10.684	0.004	0.100	1078.443	nm	recovered 100 ml product from passive bailer
	17-Sep-07		10.613	10.616	0.003	-	1078.510	nm	
	19-Sep-07		10.688	10.692	0.004	0.250	1078.435	nm	recovered 250 ml product from passive bailer
	21-Sep-07		10.698	10.701	0.003	0.300	1078.425	nm	recovered 300 ml product from passive bailer
	24-Sep-07		10.655	10.664	0.009	0.300	1078.467	nm	recovered 300 ml from PB

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH209 Continued	26-Sep-07		10.665	10.667	0.002	0.200	1078.459	nm	recovered 200 ml from PB
	28-Sep-07		10.672	10.675	0.003	0.100	1078.451	nm	recovered 100 ml from PB
	1-Oct-07		10.690	10.693	0.003	0.110	1078.433	nm	recovered 110 ml from PB
	3-Oct-07		10.688	10.690	0.002	0.050	1078.436	nm	recovered 50 ml from PB
	9-Oct-07		10.694	10.699	0.005	0.080	1078.429	nm	recovered 80 ml from PB
	12-Oct-07		10.701	10.705	0.004	0.100	1078.422	nm	recovered 100 ml from PB
	16-Oct-07		10.703	10.705	0.002	0.200	1078.421	nm	recovered 200 ml from PB
	20-Oct-07		10.725	10.728	0.003	0.100	1078.398	nm	recovered 100 ml from PB
	29-Oct-07		10.652	10.800	0.148	0.800	1078.442	nm	recovered 800 ml product from passive bailer
	1-Nov-07		10.653	10.660	0.007	0.200	1078.470	nm	recovered 200 ml product from passive bailer
	2-Nov-07		10.655	10.658	0.003	0.100	1078.468	nm	recovered 100 ml product from passive bailer
	5-Nov-07		10.725	10.741	0.016	0.450	1078.396	nm	recovered 450 ml product from passive bailer
	13-Nov-07		10.721	10.727	0.006	0.100	1078.402	nm	recovered 100 ml product from passive bailer
	19-Nov-07		10.729	10.783	0.054	0.600	1078.384	nm	recovered 600 ml product from passive bailer
	23-Nov-07		10.673	10.675	0.002	0.200	1078.451	>10,000	recovered 200 ml product from passive bailer
	26-Nov-07		10.700	10.708	0.008	0.300	1078.422	nm	recovered 300 ml product from passive bailer
	28-Nov-07		10.705	10.706	0.001	0.200	1078.419	nm	recovered 200 ml product from passive bailer
	30-Nov-07		10.714	10.716	0.002	0.080	1078.410	nm	recovered 80 ml product from passive bailer
	3-Dec-07		10.577	10.579	0.002	0.400	1078.547	nm	recovered 400 ml product from passive bailer
	5-Dec-07		10.583	10.586	0.003	0.100	1078.540	nm	recovered 100 ml product from passive bailer
	7-Dec-07		10.587	10.589	0.002	0.020	1078.537	nm	recovered 20 ml product from passive bailer
	10-Dec-07		10.583	10.589	0.006	0.200	1078.540	nm	recovered 200 ml product from passive bailer
	14-Dec-07		10.582	10.585	0.003	0.150	1078.541	nm	recovered 150 ml product from passive bailer
	17-Dec-07		10.584	10.589	0.005	0.200	1078.539	nm	recovered 200 ml product from passive bailer
	19-Dec-07		10.588	10.592	0.004	0.040	1078.535	nm	recovered 40 ml product from passive bailer
	21-Dec-07		10.591	10.593	0.002	0.010	1078.533	nm	recovered 10 ml product from passive bailer
	2-Jan-08		10.582	10.595	0.013	0.800	1078.539	nm	recovered 800 ml product from passive bailer
	4-Jan-08		10.637	10.645	0.008	0.040	1078.485	nm	recovered 40 ml product from passive bailer
	23-Jan-08		10.695	10.743	0.048	0.500	1078.419	nm	recovered 500 ml product from passive bailer
	25-Jan-08		10.700	10.703	0.003	0.040	1078.423	nm	recovered 40 ml product from passive bailer
	7-Feb-08		10.722	10.775	0.053	0.100	1078.391	nm	recovered 100 ml product from passive bailer
	9-Feb-08		10.725	10.797	0.072	0.100	1078.385	nm	recovered 100 ml product from passive bailer
	6-Mar-08		10.708	10.711	0.003	0.800	1078.415	nm	recovered 800 ml product from passive bailer
	7-Apr-08		cnm	cnm	cnm	cnm	cnm	cnm	car parked over well
	9-Apr-08		cnm	cnm	cnm	cnm	cnm	cnm	well frozen

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH209 Continued	11-Apr-08		cnm	cnm	cnm	cnm	cnm	cnm	well frozen
	14-Apr-08		cnm	cnm	cnm	cnm	cnm	cnm	well frozen
	16-Apr-08		cnm	cnm	cnm	cnm	cnm	cnm	well frozen
	28-Apr-08		cnm	cnm	cnm	cnm	cnm	cnm	car parked over well
	30-Apr-08		cnm	cnm	cnm	cnm	cnm	cnm	car parked over well
	2-May-08		cnm	cnm	cnm	cnm	cnm	cnm	car parked over well
	5-May-08		10.723	10.777	0.054	0.100	1078.390	nm	recovered 100 ml product from passive bailer
	12-May-08		10.753	10.911	0.158	0.100	1078.339	nm	recovered 100 ml product from passive bailer
	14-May-08		10.755	10.915	0.160	0.100	1078.337	nm	recovered 100 ml product from passive bailer
	26-May-08		11.008	11.015	0.007	0.300	1078.115	nm	recovered 300 ml product from passive bailer
	28-May-08		11.002	11.017	0.015	0.100	1078.119	nm	recovered 100 ml product from passive bailer
	30-May-08		11.009	11.014	0.005	0.010	1078.114	nm	recovered 10 ml product from passive bailer
	9-Jun-08		11.045	11.069	0.024	0.100	1078.074	nm	recovered 100 ml product from passive bailer
	11-Jun-08		10.895	10.897	0.002	0.050	1078.229	nm	recovered 50 ml product from passive bailer
	13-Jun-08		10.898	10.899	0.001	0.050	1078.226	nm	recovered 50 ml product from passive bailer
	23-Jun-08		10.869	10.871	0.002	0.200	1078.255	>10,000	well decommissioned on 23 June 2008
BH210	29-Oct-98	1088.860	-	10.286	0.000	-	1078.570	800	
	9-Nov-98		-	10.270	0.000	-	1078.590	1,100	
	22-Apr-99		-	10.445	0.000	-	1078.415	82	
	26-Jul-01		-	10.468	0.000	-	1078.392	8	cap labelled 212
	5-Dec-02	1088.895	cnl	cnl	cnl	-	cnl	cnl	
	12-May-03		cnm	cnm	cnm	-	cnm	1,100	
	7-Oct-03		-	10.525	0.000	-	1078.370	1,100	
	20-Nov-03		-	10.600	0.000	-	1078.295	180	
	17-Dec-03		-	10.614	0.000	-	1078.281	20	
	13-Jan-04		-	10.533	0.000	-	1078.362	15	
	8-Mar-04		-	10.435	0.000	-	1078.460	1,000	iced; no bolts
	6-Apr-04		-	10.468	0.000	-	1078.427	72	well was completely frozen in
	15-Jun-04		-	10.544	0.000	-	1078.351	32	
	14-Jul-04		-	10.549	0.000	-	1078.346	8	
	23-Aug-04		-	10.515	0.000	-	1078.380	34	
	14-Oct-04		-	10.554	0.000	-	1078.341	540	
	2-Feb-05		-	10.576	0.000	-	1078.319	10	
	2-Mar-05		-	10.554	0.000	-	1078.341	1,200	
	2-Jun-05		-	10.630	0.000	-	1078.265	1,000	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH701 Continued	23-Aug-07		-	10.317	0.000	-	1079.011	200	
	23-Nov-07		-	10.355	0.000	-	1078.973	660	
	10-Mar-08		-	10.422	0.000	-	1078.906	360	
	4-Jun-08		-	10.472	0.000	-	1078.856	58	
	23-Jun-08		-	10.436	0.000	-	1078.892	56	well decommissioned on 23 June 2008
BH702	7-Oct-03	1089.187	-	10.440	0.000	-	1078.747	3,000	
	20-Nov-03		-	10.694	0.000	-	1078.493	130	
	17-Dec-03		-	10.545	0.000	-	1078.642	400	
	13-Jan-04		-	10.468	0.000	-	1078.719	40	
	11-Mar-04		-	10.436	0.000	-	1078.751	>10,000	iced; bailer stuck
	6-Apr-04		-	10.459	0.000	-	1078.728	76	
	16-Jun-04		-	10.510	0.000	-	1078.677	200	
	14-Jul-04		-	10.495	0.000	-	1078.692	52	
	24-Aug-04		-	10.443	0.000	-	1078.744	500	
	14-Oct-04		-	10.483	0.000	-	1078.704	76	
	2-Feb-05		-	10.516	0.000	-	1078.671	200	
	2-Mar-05		-	10.518	0.000	-	1078.669	1,000	
	5-Oct-05		-	10.395	0.000	-	1078.792	200	
	19-Jan-06		-	10.325	0.000	-	1078.862	700	
	11-May-06		-	10.371	0.000	-	1078.816	100	
	27-Jul-06		-	10.396	0.000	-	1078.791	200	
	23-Nov-07		10.185	10.344	0.159	0.200	1078.970	>10,000	recovered 200 ml product from passive bailer
	23-Nov-07		10.445	10.448	0.003	0.700	1078.741		hand bailed 700 ml product
	25-Jan-07		10.339	10.343	0.004	-	1078.847	300	
	29-May-07		10.415	10.427	0.012	-	1078.770	210	product in well
	23-Aug-07		-	10.197	0.000	-	1078.990	160	
	28-Nov-07		10.289	10.295	0.006	-	1078.897	nm	
	30-Nov-07		10.293	10.297	0.004	0.040	1078.893	nm	recovered 40 ml product from passive bailer
	3-Dec-07		10.592	10.597	0.005	0.080	1078.594	nm	recovered 80 ml product from passive bailer
	5-Dec-07		10.598	10.601	0.003	0.030	1078.588	nm	recovered 30 ml product from passive bailer
	7-Dec-07		10.602	10.604	0.002	0.010	1078.585	nm	recovered 10 ml product from passive bailer
	10-Dec-07		10.607	10.610	0.003	0.100	1078.579	nm	recovered 100 ml product from passive bailer
	14-Dec-07		10.609	10.611	0.002	0.040	1078.578	nm	recovered 40 ml product from passive bailer
	17-Dec-07		10.608	10.610	0.002	0.100	1078.579	nm	recovered 100 ml product from passive bailer
	19-Dec-07		10.612	10.614	0.002	0.030	1078.575	nm	recovered 30 ml product from passive bailer

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH702 Continued	21-Dec-07		10.615	10.617	0.002	0.020	1078.572	nm	recovered 20 ml product from passive bailer
	2-Jan-08		10.605	10.608	0.003	0.050	1078.581	nm	recovered 50 ml product from passive bailer
	4-Jan-08		10.665	10.705	0.040	0.010	1078.514	nm	recovered 10 ml product from passive bailer
	23-Jan-08		10.710	10.719	0.009	0.030	1078.475	nm	recovered 30 ml product from passive bailer
	25-Jan-08		10.710	10.712	0.002	0.020	1078.477	nm	recovered 20 ml product from passive bailer
	7-Feb-08		10.783	10.795	0.012	0.050	1078.402	nm	recovered 50 ml product from passive bailer
	9-Feb-08		10.785	10.799	0.014	0.030	1078.399	nm	recovered 30 ml product from passive bailer
	6-Mar-08		10.562	10.617	0.055	-	1078.614	nm	
	7-Apr-08		10.645	10.679	0.034	0.020	1078.535	nm	recovered 20 ml product from passive bailer
	9-Apr-08		10.649	10.678	0.029	0.010	1078.532	nm	recovered 10 ml product from passive bailer
	11-Apr-08		10.643	10.650	0.007	0.010	1078.543	nm	recovered 10 ml product from passive bailer
	14-Apr-08		10.701	10.706	0.005	0.030	1078.485	nm	recovered 30 ml product from passive bailer
	16-Apr-08		10.740	10.744	0.004	0.020	1078.446	nm	recovered 20 ml product from passive bailer
	28-Apr-08		cnm	cnm	cnm	cnm	cnm	cnm	car parked over well
	30-Apr-08		cnm	cnm	cnm	cnm	cnm	cnm	car parked over well
	2-May-08		cnm	cnm	cnm	cnm	cnm	cnm	car parked over well
	5-May-08		10.780	10.791	0.011	0.100	1078.405	nm	recovered 100 ml product from passive bailer
	12-May-08		10.910	10.914	0.004	0.200	1078.276	nm	recovered 200 ml product from passive bailer
	14-May-08		10.913	10.915	0.002	0.150	1078.274	nm	recovered 150 ml product from passive bailer
	26-May-08		10.901	10.910	0.009	0.050	1078.284	nm	recovered 50 ml product from passive bailer
	28-May-08		10.905	10.909	0.004	0.010	1078.281	nm	recovered 10 ml product from passive bailer
	30-May-08		10.908	10.910	0.002	0.010	1078.279	nm	recovered 10 ml product from passive bailer
	9-Jun-08		10.980	10.983	0.003	0.020	1078.206	nm	recovered 20 ml product from passive bailer
	11-Jun-08		10.971	10.973	0.002	0.010	1078.216	nm	recovered 10 ml product from passive bailer
	13-Jun-08		10.975	10.979	0.004	0.010	1078.211	nm	recovered 10 ml product from passive bailer
	23-Jun-08		10.949	10.950	0.001	-	1078.238	>10,000	well decommissioned on 24 June 2008
BH703	7-Oct-03	1090.172	-	11.395	0.000	-	1078.777	60	
	20-Nov-03		-	11.446	0.000	-	1078.726	175	
	17-Dec-03		-	11.459	0.000	-	1078.713	120	
	13-Jan-04		-	11.405	0.000	-	1078.767	40	
	11-Mar-04		-	11.358	0.000	-	1078.814	220	
	5-Apr-04		-	11.333	0.000	-	1078.839	70	
	16-Jun-04		-	11.405	0.000	-	1078.767	200	
	13-Jul-04		-	11.351	0.000	-	1078.821	54	
	23-Aug-04		-	11.320	0.000	-	1078.852	54	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH704 Continued	21-Aug-07		-	12.142	0.000	-	1080.226	60	
	22-Nov-07		-	12.039	0.000	-	1080.329	62	
	13-Mar-08		-	11.198	0.000	-	1081.170	210	
	3-Jun-08		-	11.059	0.000	-	1081.309	52	
	26-Jun-08		-	10.791	0.000	-	1081.577	52	well decommissioned on 26 June 2008
BH705	7-Oct-03	1089.614	-	11.046	0.000	-	1078.568	>10,000	
	20-Nov-03		10.985	10.987	trace	-	1078.629	1,200	
	17-Dec-03		10.99	11.615	0.625	-	1078.499	5,000	Bailed 800 mm with disposable bailer ~ 0.75L
	19-Dec-03		nm	nm	nm	-	nm	nm	Bailer check- 100 mm in bailer
	13-Jan-04		11.010	cnm	cnm	-	cnm	8,000	Depth to water not established due to probe malfunction
	9-Feb-04		nm	nm	nm	-	nm	nm	recovered 1.3 L product by hand bailing
	23-Feb-04		10.940	11.410	0.470	-	1078.580	nm	before installation of P.B.
	23-Feb-04		11.175	11.580	0.405	-	1078.358	nm	recovered 300 ml 5 minutes after installation of P.B.
	23-Feb-04		-	11.233	0.000	-	1078.381	nm	recovered 400 ml 15 minutes after installation of P.B.
	26-Feb-04		-	11.254	0.000	-	1078.360	nm	recovered 800 ml product from P.B.
	26-Feb-04		-	11.469	0.000	-	1078.145	nm	70 minutes later recovered 400 ml product from P.B.
	3-Mar-04		-	11.407	0.000	-	1078.207	nm	recovered 800 ml product from P.B.
	3-Mar-04		-	11.423	0.000	-	1078.191	nm	recovered 150 ml after hand bailing
	31-Mar-04		11.575	11.609	0.034	-	1078.032	nm	recovered 300 ml from P.B.; not enough to H.B.
	12-Apr-04		11.485	11.494	0.009	-	1078.127	nm	recovered 300 ml from passive bailer (before H.B.)
	12-Apr-04		-	11.505	0.000	-	1078.109	nm	recovered 100 ml product after hand bailing
	13-Apr-04		11.514	11.530	0.016	-	1078.097	nm	recovered 300 ml product from P.B.; not enough to H.B.
	15-Apr-04		-	11.490	0.000	-	1078.124	nm	recovered 250 ml from P.B.
	16-Apr-04		-	11.475	0.000	-	1078.139	nm	recovered 250 ml from P.B.
	19-Apr-04		11.515	11.529	0.014	-	1078.096	nm	recovered 300 ml from P.B.; not enough to H.B.
	22-Apr-04		-	11.565	0.000	-	1078.049	nm	recovered 400 ml product from P.B.
	30-Apr-04		-	11.555	0.000	-	1078.059	nm	no product in P.B.; H.B.- no product
	6-May-04		-	11.639	0.000	-	1077.975	nm	recovered 300 ml from passive bailer
	7-May-04		-	11.614	0.000	-	1078.000	nm	recovered 100 ml from passive bailer
	10-May-04		-	11.638	0.000	-	1077.976	nm	recovered 300 ml from passive bailer
	17-May-04		-	11.656	0.000	-	1077.958	nm	recovered 350 ml from passive bailer
	20-May-04		-	11.635	0.000	-	1077.979	nm	recovered 350 ml from passive bailer
	28-May-04		11.637	11.667	0.030	-	1077.971	nm	recovered 400 ml from passive bailer
	15-Jun-04		11.460	11.429	0.031	-	1078.210	1,000	800 ml recovered
	15-Jun-04		-	11.545	0.000	-	1078.069	-	hand bailed - 1.5 L recovered

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH705 Continued	14-Jul-04		cnm	11.505	cnm	-	cnm	3,400	1.6 L recovered before hand bailing.
	14-Jul-04		cnm	11.055	cnm	-	cnm	3,400	0.4 L recovered by hand bailing
	28-Jul-04		11.470	11.859	0.389	-	1078.066	nm	800 ml recovered - before hand bailing
	28-Jul-04		11.645	11.649	0.004	-	1077.968	nm	800 ml recovered by hand bailing
	6-Aug-04		11.640	11.700	0.060	-	1077.962	nm	400 ml recovered
	10-Aug-04		11.726	11.785	0.059	-	1077.876	nm	400 ml recovered
	11-Aug-04		11.675	11.680	0.005	-	1077.938	nm	400 ml recovered
	13-Aug-04		-	11.695	0.000	-	1077.919	nm	300 ml recovered
	18-Aug-04		11.695	11.725	0.030	-	1077.913	nm	350 ml recovered
	24-Aug-04		11.443	11.565	0.122	-	1078.147	>10,000	400ml product in PB. HB 100ml.
	7-Sep-04		-	11.462	0.000	-	1078.152	nm	800 ml recovered
	9-Sep-04		-	11.605	0.000	-	1078.009	nm	hand bailer had 2 ml product
	13-Sep-04		-	11.605	0.000	-	1078.009	nm	500 ml recovered
	15-Sep-04		-	11.626	0.000	-	1077.988	nm	200 ml recovered
	17-Sep-04		-	11.625	0.000	-	1077.989	nm	200 ml recovered
	20-Sep-04		-	11.609	0.000	-	1078.005	nm	350 ml recovered
	22-Sep-04		-	11.615	0.000	-	1077.999	nm	150 ml recovered
	24-Sep-04		-	11.639	0.000	-	1077.975	nm	150 ml recovered
	29-Sep-04		-	11.627	0.000	-	1077.987	nm	425 ml product recovered from passive bailer
	4-Oct-04		-	11.640	0.000	-	1077.974	nm	450 ml product recovered from passive bailer
	6-Oct-04		-	11.620	0.000	-	1077.994	nm	150 ml product recovered fro P.B.
	12-Oct-04		-	11.613	0.000	-	1078.001	nm	650 ml product recovered from P.B.
	15-Oct-04		-	11.595	0.000	-	1078.019	nm	300 ml product recovered from passive bailer
	5-Nov-04		11.486	11.802	0.316	-	1078.065	nm	800 ml recovered from passive bailer
	5-Nov-04		11.670	11.685	0.015	-	1077.941	nm	hand bailed following removal of PB; recovered 700 ml
	8-Nov-04		-	11.603	0.000	-	1078.011	nm	recovered 600 ml
	10-Nov-04		-	11.653	0.000	-	1077.961	nm	recovered 100 ml
	17-Nov-04		-	11.612	0.000	-	1078.002	nm	recovered 750 ml
	25-Nov-04		-	11.615	0.000	-	1077.999	nm	recovered 650 ml
	29-Nov-04		-	11.625	0.000	-	1077.989	nm	recovered 350 ml
	1-Dec-04		-	11.636	0.000	-	1077.978	nm	recovered 150 ml product from P.B.
	17-Jan-05		11.519	11.519	trace	-	1078.095	nm	recovered 200 ml product from P.B.
	17-Jan-05		-	11.510	0.000	-	1078.104	nm	recovered 300 ml product by H.B.
	24-Jan-05		11.519	11.650	0.131	-	1078.069	nm	recovered 800 ml product from P.B. - before H.B.
	24-Jan-05		11.455	11.500	0.045	-	1078.150	nm	recovered 600 ml product by H.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH705 Continued	26-Jan-05		11.583	11.583	trace	-	1078.031	nm	recovered 300 ml product from P.B.
	28-Jan-05		11.615	11.615	trace	-	1077.999	nm	recovered 200 ml product from P.B.
	2-Feb-05		11.598	11.598	trace	-	1078.016	>10,000	recovered 300 ml product from P.B.
	18-Feb-05		11.570	11.594	0.024	-	1078.039	nm	recovered 800 ml product from P.B.
	22-Feb-05		11.609	11.612	0.003	-	1078.004	nm	recovered 350 ml product from P.B.
	24-Feb-05		11.573	11.573	0.002	-	1078.043	nm	100 ml from P.B.; bailer checked - no product; sheen present.
	2-Mar-05		11.508	11.509	0.001	-	1078.106	>10,000	recovered 500 ml product from passive bailer
	22-Mar-05		11.605	11.660	0.055	-	1077.998	nm	recovered 800 ml product from passive bailer
	24-Mar-05		11.619	11.635	0.016	-	1077.992	nm	recovered 200 ml product from P.B.; 7 mm in H.B.
	28-Mar-05		11.565	11.566	0.001	-	1078.049	nm	recovered 350 ml product from P.B.
	30-Mar-05		11.618	11.620	0.002	-	1077.996	nm	recovered 100 ml product from P.B.
	1-Apr-05		11.615	11.616	0.001	-	1077.999	nm	recovered 50 ml product from P.B.
	5-Apr-05		11.635	11.636	0.001	-	1077.979	nm	recovered 300 ml product from P.B.
	11-Apr-05		11.615	11.616	0.001	-	1077.999	nm	recovered 200 ml product from P.B.
	15-Apr-05		-	11.637	0.000	-	1077.977	nm	recovered 250 ml product from P.B.
	18-Apr-05		11.633	11.634	0.001	-	1077.981	nm	recovered 150 ml product from P.B.
	20-Apr-05		11.644	11.645	0.001	-	1077.970	nm	recovered 10 ml product from P.B.
	22-Apr-05		11.640	11.641	0.001	-	1077.974	nm	recovered 40 ml product from P.B.
	25-Apr-05		11.635	11.636	0.001	-	1077.979	nm	recovered 200 ml product from P.B.
	27-Apr-05		11.651	11.653	0.002	-	1077.963	nm	recovered 10 ml product from P.B.
	4-May-05		11.686	11.687	0.001	-	1077.928	nm	recovered 250 ml product from P.B.
	6-May-05		11.508	11.509	0.001	-	1078.106	nm	recovered 100 ml product from P.B.
	9-May-05		11.615	11.635	0.020	-	1077.995	nm	recovered 10 ml product from P.B.
	13-May-05		-	11.615	0.000	-	1077.999	nm	recovered 170 ml product from P.B.
	16-May-05		-	11.605	0.000	-	1078.009	nm	recovered 100 ml product from P.B.
	26-May-05		-	11.665	0.000	-	1077.949	nm	recovered 300 ml product from P.B.
	2-Jun-05		11.633	11.634	0.001	-	1077.981	20	recovered 300 ml product from P.B.
	10-Jun-05		11.665	11.666	0.001	-	1077.949	nm	recovered 300 ml product from P.B.
	15-Jun-05		11.645	11.645	trace	-	1077.969	nm	recovered 150 ml product from P.B.
	17-Jun-05		11.834	11.842	0.008	-	1077.778	nm	recovered 50 ml product from P.B.
	20-Jun-05		11.653	11.658	0.005	-	1077.960	nm	recovered 120 ml product from P.B.
	22-Jun-05		11.615	11.615	trace	-	1077.999	nm	recovered 50 ml product from P.B.
	24-Jun-05		-	11.605	0.000	-	1078.009	nm	recovered 50 ml product from P.B.; hand bailer -no LPH
	27-Jun-05		11.617	11.617	trace	-	1077.997	nm	recovered 100 ml product from P.B.
	29-Jun-05		11.615	11.615	trace	-	1077.999	nm	recovered 100 ml product from P.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH705 Continued	6-Jul-05		11.500	11.500	trace	-	1078.114	nm	recovered 300 ml product from P.B.
	11-Jul-05		11.605	11.605	trace	-	1078.009	nm	recovered 300 ml product from P.B.
	20-Jul-05		11.575	11.577	0.002	-	1078.039	nm	recovered 500 ml product from P.B.
	22-Jul-05		11.567	11.568	0.001	-	1078.047	nm	recovered 100 ml product from P.B.
	28-Jul-05		11.518	11.519	0.001	-	1078.096	nm	recovered 360 ml product from P.B.
	9-Aug-05		11.569	11.569	trace	-	1078.045	nm	recovered 1L product from P.B.
	10-Aug-05		11.604	11.605	0.001	-	1078.010	nm	recovered 100 ml product from P.B.
	12-Aug-05		11.578	11.579	0.001	-	1078.036	nm	recovered 100 ml product from P.B.
	17-Aug-05		11.548	11.549	0.001	-	1078.066	nm	recovered 130 ml product from P.B.
	17-Aug-05		11.546	11.547	0.001	-	1078.068	nm	recovered 200 ml product from P.B.
	24-Aug-05		11.565	11.567	0.002	-	1078.049	nm	recovered 510 ml product from P.B.
	31-Aug-05		11.532	11.534	0.002	-	1078.082	nm	recovered 520 ml product from P.B.
	6-Sep-05		11.488	11.489	0.001	-	1078.126	nm	recovered 470 ml product from P.B.
	12-Sep-05		11.520	11.522	0.002	-	1078.094	nm	recovered 500 ml product from P.B.
	14-Sep-05		11.497	11.499	0.002	-	1078.117	nm	recovered 200 ml product from P.B.
	16-Sep-05		11.503	11.506	0.003	-	1078.110	nm	recovered 200 ml product from P.B.
	19-Sep-05		11.456	11.457	0.001	-	1078.158	nm	recovered 300 ml product from P.B.
	21-Sep-05		11.506	11.507	0.001	-	1078.108	nm	recovered 200 ml product from P.B.
	26-Sep-05		11.441	11.442	0.001	-	1078.173	nm	recovered 600 ml product from P.B.
	28-Sep-05		11.483	11.485	0.002	-	1078.131	nm	recovered 220 ml product from P.B.
	5-Oct-05		11.482	11.484	0.002	-	1078.132	nm	recovered 800 ml product from P.B.
	18-Oct-05		11.427	11.435	0.008	-	1078.185	nm	recovered 800 ml product from P.B.
	24-Oct-05		11.302	11.312	0.010	-	1078.310	nm	recovered 800 ml product from P.B.
	1-Nov-05		11.312	11.334	0.022	-	1078.298	nm	recovered 800 ml product from P.B.
	3-Nov-05		11.308	11.310	0.002	-	1078.306	nm	recovered 800 ml product from P.B.
	8-Nov-05		11.326	11.329	0.003	-	1078.287	nm	recovered 600 ml product from P.B.
	10-Nov-05		11.265	11.269	0.004	-	1078.348	nm	recovered 250 ml product from P.B.
	14-Nov-05		11.385	11.387	0.002	-	1078.229	nm	recovered 350 ml product from P.B.
	28-Nov-05		11.268	11.279	0.011	-	1078.344	nm	recovered 800 ml product from P.B.
	30-Nov-05		11.293	11.294	0.001	-	1078.321	nm	recovered 750 ml product form P.B.
	6-Dec-05		11.319	11.321	0.002	-	1078.295	nm	recovered 800 ml product from P.B.
	12-Dec-05		11.304	11.308	0.004	-	1078.309	nm	PB-Recovered 800 ml.
	14-Dec-05		11.364	11.366	0.002	-	1078.250	nm	PB-Recovered 350 ml.
	16-Dec-05		11.348	11.350	0.002	-	1078.266	nm	PB-Recovered 250 ml.
	19-Dec-05		11.301	11.303	0.002	-	1078.313	nm	PB-Recovered 320 ml.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH705 Continued	22-Dec-05		11.243	11.245	0.002	-	1078.371	nm	PB-Recovered 350 ml.
	23-Dec-05		11.329	11.331	0.002	-	1078.285	nm	PB-Recovered 100 ml.
	3-Jan-06		11.233	11.245	0.012	-	1078.379	nm	PB-Recovered 800 ml.
	5-Jan-06		11.375	11.379	0.004	-	1078.238	nm	PB-Recovered 400 ml.
	6-Jan-06		11.363	11.365	0.002	-	1078.251	nm	PB-Recovered 200 ml.
	9-Jan-06		11.304	11.306	0.002	-	1078.310	nm	PB-Recovered 400 ml.
	12-Jan-06		11.375	11.378	0.003	-	1078.238	nm	PB-Recovered 300 ml.
	13-Jan-06		11.286	11.289	0.003	-	1078.327	nm	PB-Recovered 200 ml.
	16-Jan-06		11.360	11.362	0.002	-	1078.254	nm	PB-Recovered 250 ml.
	20-Jan-06		11.387	11.389	0.002	-	1078.227	nm	PB-Recovered 300 ml.
	23-Jan-06		11.180	11.181	0.001	-	1078.434	nm	PB-Recovered 100 ml.
	30-Jan-06		11.254	11.256	0.002	-	1078.360	nm	PB-Recovered 500 ml.
	1-Feb-06		11.293	11.295	0.002	-	1078.321	nm	PB-Recovered 100 ml.
	3-Feb-06		11.307	11.308	0.001	-	1078.307	nm	10 ml product from P.B.; bailer check yielded 1 mm product
	6-Feb-06		11.168	11.169	0.001	-	1078.446	nm	recovered 200 ml product from P.B.
	8-Feb-06		11.214	11.219	0.005	-	1078.399	nm	recovered 20 ml product from P.B.
	10-Feb-06		11.107	11.111	0.004	-	1078.506	nm	recovered 10 ml product from P.B.
	27-Feb-06		11.186	11.217	0.031	-	1078.422	nm	recovered 500 ml product from P.B.
	2-Mar-06		11.403	11.407	0.004	-	1078.210	nm	recovered 400 ml product from P.B.
	4-Mar-06		11.140	11.171	0.031	-	1078.468	nm	No product recovered; reset
	6-Mar-06		11.326	11.327	0.001	-	1078.288	nm	recovered 200 ml product from P.B.
	8-Mar-06		11.265	11.268	0.003	-	1078.348	nm	recovered 100 ml product from P.B.
	10-Mar-06		11.115	11.124	0.009	-	1078.497	nm	recovered 10 ml product from P.B.
	14-Mar-06		11.065	11.089	0.024	-	1078.544	nm	
	22-Mar-06		11.223	11.300	0.077	-	1078.376	nm	recovered 10 ml product from P.B.
	24-Mar-06		11.215	11.216	0.001	-	1078.399	nm	recovered 10 ml product from P.B.
	27-Mar-06		11.176	11.197	0.021	-	1078.434	nm	recovered 10 ml product from P.B.
	29-Mar-06		11.161	11.163	0.002	-	1078.453	nm	No product recovered; reset
	31-Mar-06		11.040	11.062	0.022	-	1078.570	nm	recovered 50 ml product from P.B.
	7-Apr-06		11.215	11.332	0.117	-	1078.376	nm	No product recovered; reset
	12-Apr-06		11.225	11.227	0.002	-	1078.389	nm	recovered 150 ml product from P.B.
	17-Apr-06		11.182	11.199	0.017	0.400	1078.429	nm	recovered 400 ml product from P.B.
	18-Apr-06		11.304	11.307	0.003	0.010	1078.309	nm	recovered 10 ml product from P.B.
	21-Apr-06		11.267	11.268	0.001	0.010	1078.347	nm	recovered 10 ml product from P.B.
	26-Apr-06		11.217	11.311	0.094	0.100	1078.378	nm	recovered 100 ml product from P.B. Reset PB

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH705 Continued	28-Apr-06		11.029	11.034	0.005	0.400	1078.584	nm	recovered 400 ml product from P.B.
	1-May-06		10.923	10.952	0.029	-	1078.685	nm	recovered 0 ml product from P.B.
	3-May-06		11.323	11.329	0.006	0.010	1078.290	nm	recovered 10 ml product from P.B.
	9-May-06		11.284	11.303	0.019	0.150	1078.326	nm	recovered 150 ml product from P.B.
	7-Jun-06		11.421	11.428	0.007	0.600	1078.192	nm	recovered 600 ml product from P.B.
	12-Jun-06		11.433	11.500	0.067	0.200	1078.168	nm	recovered 200 ml product from P.B.
	14-Jun-06		11.398	11.404	0.006	0.050	1078.215	nm	recovered 50 ml product from P.B.
	16-Jun-06		11.437	11.439	0.002	0.750	1078.177	nm	recovered 750 ml product from P.B.
	20-Jun-06		11.382	11.384	0.002	0.150	1078.232	nm	recovered 150 ml product from P.B.
	22-Jun-06		11.392	11.398	0.006	0.010	1078.221	nm	recovered 10 ml product from P.B.
	23-Jun-06		11.449	11.452	0.003	0.020	1078.164	nm	recovered 20 ml product from P.B.
	26-Jun-06		11.377	11.378	0.001	0.050	1078.237	nm	recovered 50 ml product from P.B.
	28-Jun-06		11.351	11.353	0.002	0.050	1078.263	nm	recovered 50 ml product from P.B.
	4-Jul-06		11.389	11.390	0.001	0.100	1078.225	nm	recovered 100 ml product from P.B.
	7-Jul-06		11.382	11.386	0.004	0.075	1078.231	nm	recovered 75 ml product from P.B.
	12-Jul-06		11.256	11.265	0.009	0.200	1078.356	nm	recovered 200 ml product from P.B.
	19-Jul-06		11.355	11.357	0.002	0.200	1078.259	nm	recovered 200 ml product from P.B.
	21-Jul-06		11.365	11.367	0.002	0.050	1078.249	nm	recovered 50 ml product from P.B.
	24-Jul-06		11.241	11.249	0.008	0.100	1078.371	nm	recovered 100 ml product from P.B.
	18-Sep-06		11.372	11.374	0.002	0.400	1078.242	nm	recovered 400 ml product from P.B.
	20-Sep-06		11.386	11.387	0.001	0.030	1078.228	nm	recovered 30 ml product from P.B.
	22-Sep-06		11.388	11.389	0.001	0.050	1078.226	nm	recovered 50 ml product from P.B.
	25-Sep-06		11.403	11.404	0.001	0.100	1078.211	nm	recovered 100 ml product from P.B.
	3-Oct-06		11.404	11.406	0.002	0.300	1078.210	nm	recovered 300 ml product from P.B.
	5-Oct-06		11.329	11.331	0.002	0.100	1078.285	nm	recovered 100 ml product from P.B.
	4-Dec-06		11.312	11.314	0.002	0.600	1078.302	nm	recovered 600 ml product from P.B.
	12-Mar-07		cnm	cnm	cnm	cnm	cnm	cnm	passive bailer stuck in well
	15-Mar-07		10.844	10.846	0.002	0.000	1078.770	nm	passive bailer stuck in well
	17-Apr-07		10.883	10.892	0.009	0.000	1078.729	nm	passive bailer stuck in well
	24-Apr-07		cnm	cnm	cnm	cnm	cnm	cnm	passive bailer stuck in well
	23-Nov-07		cnm	cnm	cnm	cnm	cnm	nm	Blocked at 9.580 m below top of pipe
	19-Jan-07		11.389	11.391	0.002	0.500	1078.225	nm	recovered 500 ml product from passive bailer
	22-Jan-07		11.345	11.346	0.001	0.050	1078.269	nm	recovered 50 ml product from passive bailer
	27-Jun-08		cnm	cnm	cnm	cnm	cnm	>10,000	Well decommissioned on 27 June 2008
BH706	7-Oct-03	1089.518	-	11.223	0.000	-	1078.295	>10,000	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH706 Continued	20-Nov-03		11.206	11.208	0.002	-	1078.312	2,900	
	17-Dec-03		-	11.192	trace	-	1078.326	>10,000	Bailed 5 mm with disposable bailer
	13-Jan-04		-	11.189	0.000	-	1078.329	800	
	8-Mar-04		-	11.198	0.000	-	1078.320	120	checked bailer - trace product (1-2 mm)
	6-Apr-04		-	11.150	0.000	-	1078.368	>10,000	
	15-Jun-04		-	11.170	0.000	-	1078.348	2,000	bailer checked, 10 ml product
	14-Jul-04		-	11.165	0.000	-	1078.353	>10,000	bailer checked; 1 mm of product
	24-Aug-04		-	11.143	0.000	-	1078.375	>10,000	Bailer check showed 3mm product
	13-Oct-04		-	11.192	0.000	-	1078.326	>10,000	bailer checked, 7 ml product
	1-Feb-05		11.239	11.239	trace	-	1078.279	700	
	2-Mar-05		-	11.207	0.000	-	1078.311	>10,000	checked bailer - 10 mm of product
	27-Apr-05		-	11.285	0.000	-	1078.233	nm	
	1-Jun-05		-	11.244	trace	-	1078.274	5,000	checked bailer - 15 mm product
	24-Jun-05		11.225	11.259	0.034	-	1078.286	nm	installed PB from BH509; recovered 25 ml product from P.B.
	27-Jun-05	1088.878	11.255	11.260	0.005	-	1077.622	nm	checked bailer - no visible product
	29-Jun-05		11.619	11.621	0.002	-	1077.259	nm	recovered 5 ml product from passive bailer
	5-Oct-05		11.076	11.105	0.029	-	1077.796	>10,000	bailer checked, 35 mm product
	19-Jan-06		10.840	11.004	0.164	-	1078.005	1,000	
	20-Jan-06		10.827	11.833	1.006	-	1077.850	nm	PB-Recovered 800 ml. Hand bailed 1.4 L
	23-Jan-06		11.240	11.351	0.111	-	1077.616	nm	PB-Recovered 900 ml.
	30-Jan-06		11.076	11.265	0.189	-	1077.764	nm	PB-Recovered 330 ml. Hand bailed 600 ml
	1-Feb-06		11.145	11.303	0.158	-	1077.701	nm	PB-Recovered 220 ml. Hand bailed 250 ml
	3-Feb-06		11.290	11.500	0.210	-	1077.546	nm	0 ml product in P.B.; bailer check yielded 150 mm
	3-Feb-06		11.299	11.335	0.036	-	1077.572	nm	recovered 200 ml product from P.B.
	6-Feb-06		11.255	11.283	0.028	-	1077.617	nm	recovered 10 ml product from P.B.; reset bailer
	8-Feb-06		11.225	11.301	0.076	-	1077.638	nm	recovered 50 ml product from P.B.
	10-Feb-06		11.345	11.475	0.130	-	1077.507	nm	recovered 100 ml product from P.B.
	27-Feb-06		11.347	11.368	0.021	-	1077.527	nm	recovered 800 ml product from P.B.
	2-Mar-06		11.485	11.488	0.003	-	1077.392	nm	recovered 250 ml product from P.B.
	4-Mar-06		11.355	11.382	0.027	-	1077.518	nm	
	6-Mar-06		11.467	11.468	0.001	-	1077.411	nm	recovered 150 ml product from P.B.
	8-Mar-06		11.452	11.454	0.002	-	1077.426	nm	recovered 100 ml product from P.B.
	10-Mar-06		11.472	11.474	0.002	-	1077.406	nm	recovered 150 ml product from P.B.
	14-Mar-06		11.447	11.448	0.001	-	1077.431	nm	recovered 100 ml product from P.B.
	22-Mar-06		11.464	11.475	0.011	-	1077.412	nm	recovered 250 ml product from P.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH706 Continued	24-Mar-06		11.465	11.467	0.002	-	1077.413	nm	recovered 300 ml product from P.B.
	27-Mar-06		11.486	11.487	0.001	-	1077.392	nm	recovered 300 ml product from P.B.
	29-Mar-06		11.405	11.417	0.012	-	1077.471	nm	recovered 10 ml product from P.B.
	31-Mar-06		11.394	11.439	0.045	-	1077.475	nm	recovered 10 ml product from P.B.
	7-Apr-06		11.369	11.385	0.016	-	1077.506	nm	recovered 100 ml product from P.B.
	12-Apr-06		11.365	11.500	0.135	-	1077.486	nm	recovered 50 ml product from P.B.
	17-Apr-06		11.455	11.478	0.023	0.600	1077.418	nm	recovered 600 ml product from P.B.
	18-Apr-06		11.386	11.392	0.006	0.010	1077.491	nm	recovered 10 ml product from P.B.
	21-Apr-06		11.433	11.439	0.006	0.250	1077.444	nm	recovered 250 ml product from P.B.
	26-Apr-06		11.356	11.365	0.009	0.300	1077.520	nm	recovered 300 ml product from P.B.
	28-Apr-06		11.130	11.133	0.003	-	1077.747	nm	
	1-May-06		11.167	11.184	0.017	-	1077.708	nm	
	3-May-06		11.476	11.481	0.005	0.020	1077.401	nm	recovered 20 ml product from P.B.
	9-May-06		11.415	11.434	0.019	0.300	1077.459	nm	recovered 300 ml product from P.B.
	7-Jun-06		11.364	11.455	0.091	0.350	1077.496	nm	recovered 350 ml product from P.B.
	12-Jun-06		11.385	11.550	0.165	0.100	1077.460	nm	recovered 100 ml product from P.B.
	14-Jun-06		11.332	11.348	0.016	0.600	1077.543	nm	recovered 600 ml product from P.B.
	16-Jun-06		11.575	11.577	0.002	0.050	1077.303	nm	recovered 50 ml product from P.B.
	20-Jun-06		11.556	11.557	0.001	0.020	1077.322	nm	recovered 20 ml product from P.B.
	22-Jun-06		11.503	11.504	0.001	0.050	1077.375	nm	recovered 50 ml product from P.B.
	23-Jun-06		-	11.372	0.000	-	1077.506	nm	
	26-Jun-06		11.584	11.585	0.001	0.010	1077.294	nm	recovered 10 ml product from P.B.
	28-Jun-06		11.516	11.518	0.002	0.200	1077.362	nm	recovered 200 ml product from P.B.
	4-Jul-06		11.375	11.376	0.001	0.010	1077.503	nm	recovered 10 ml product from P.B.
	7-Jul-06		11.523	11.527	0.004	0.150	1077.354	nm	recovered 150 ml product from P.B.
	12-Jul-06		11.321	11.326	0.005	-	1077.556	nm	
	19-Jul-06		11.533	11.535	0.002	0.100	1077.345	nm	recovered 100 ml product from P.B.
	21-Jul-06		11.531	11.532	0.001	0.010	1077.347	nm	recovered 10 ml product from P.B.
	24-Jul-06		11.237	11.239	0.002	0.200	1077.641	nm	recovered 200 ml product from P.B.
	31-Jul-06		11.490	11.491	0.001	0.050	1077.388	nm	Hand bailed 50 ml of product
	3-Aug-06		11.515	11.516	0.001	0.100	1077.363	nm	Hand Bailed 100 ml of product
	9-Aug-06		11.525	11.527	0.002	0.020	1077.353	nm	Hand Bailed 20 ml of product
	15-Aug-06		11.545	11.546	0.001	0.050	1077.333	nm	Hand Bailed 50 ml of product
	17-Aug-06		11.530	11.531	0.001	0.010	1077.348	nm	Hand Bailed 10 ml of product
	18-Aug-06		11.553	11.554	0.001	0.050	1077.325	nm	Hand Bailed 50 ml of product

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH706 Continued	21-Aug-06		11.550	11.552	0.002	0.020	1077.328	nm	Hand Bailed 20ml of product
	24-Aug-06		11.560	11.562	0.002	0.010	1077.318	nm	Hand Bailed 10 ml of product
	25-Aug-06		11.493	11.495	0.002	0.050	1077.385	nm	Hand bailed 50 ml of product
	28-Aug-06		11.517	11.519	0.002	0.100	1077.361	nm	Hand Bailed 100 ml of product
	30-Aug-06		11.531	11.532	0.001	0.010	1077.347	nm	Hand Bailed 10 ml of product
	18-Sep-06		11.627	11.628	0.001	0.200	1077.251	nm	recovered 200 ml product from P.B.
	20-Sep-06		11.575	11.577	0.002	0.020	1077.303	nm	recovered 20 ml product from P.B.
	22-Sep-06		11.573	11.575	0.002	0.050	1077.305	nm	recovered 50 ml product from P.B.
	25-Sep-06		11.574	11.575	0.001	0.010	1077.304	nm	recovered 10 ml product from P.B.
	3-Oct-06		11.554	11.556	0.002	0.200	1077.324	nm	recovered 200 ml product from P.B.
	5-Oct-06		11.535	11.537	0.002	0.050	1077.343	nm	recovered 50 ml product from P.B.
	4-Dec-06		11.485	11.489	0.004	0.600	1077.392	nm	recovered 600 ml product from P.B.
	19-Jan-07		11.673	11.674	0.001	0.030	1077.205	nm	recovered 30 ml product from passive bailer
	22-Jan-07		11.617	11.619	0.002	0.010	1077.261	nm	recovered 10 ml product from passive bailer
	12-Mar-07		11.537	11.542	0.005	0.600	1077.340	nm	recovered 600 ml product from passive bailer
	15-Mar-07		11.523	11.526	0.003	0.300	1077.354	nm	recovered 300 ml product from passive bailer
	17-Apr-07		11.585	11.587	0.002	0.010	1077.293	nm	recovered 10 ml product from P.B.
	24-Apr-07		11.584	11.589	0.005	0.020	1077.293	nm	recovered 20 ml product from passive bailer
	1-May-07		11.603	11.605	0.002	0.030	1077.275	nm	recovered 30 ml product from P.B.
	4-May-07		11.559	11.560	0.001	-	1077.319	nm	
	8-May-07		11.589	11.594	0.005	0.010	1077.288	nm	recovered 10 ml product from P.B.
	10-May-07		11.532	11.539	0.007	-	1077.345	nm	
	8-Jun-07		11.545	11.549	0.004	0.300	1077.332	nm	recovered 300 ml product from passive bailer
	11-Jun-07		11.500	11.512	0.012	0.010	1077.376	nm	recovered 10 ml product from P.B.
	13-Jun-07		11.509	11.511	0.002	0.030	1077.369	nm	recovered 30 ml product from P.B.
	3-Jul-07		11.479	11.482	0.003	0.250	1077.398	nm	recovered 250 ml product from P.B.
	5-Jul-07		11.483	11.488	0.005	0.120	1077.394	nm	recovered 120 ml product from P.B.
	16-Jul-07		11.309	11.312	0.003	0.020	1077.568	nm	recovered 20 ml product from P.B.
	20-Jul-07		11.311	11.317	0.006	0.020	1077.566	nm	recovered 20 ml product from P.B.
	26-Jul-07		11.373	11.382	0.009	0.150	1077.503	nm	recovered 150 ml product from P.B.
	30-Jul-07		11.376	11.379	0.003	0.020	1077.501	nm	recovered 20 ml product from P.B.
	2-Aug-07		11.405	11.409	0.004	0.200	1077.472	nm	recovered 200 ml product from P.B.
	7-Aug-07		11.243	11.292	0.049	0.100	1077.625	nm	recovered 100 ml product from P.B.
	9-Aug-07		11.415	11.419	0.004	0.150	1077.462	nm	recovered 150 ml product from P.B.
	24-Aug-07		11.468	11.470	0.002	0.100	1077.410	nm	recovered 100 ml product from passive bailer

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH706 Continued	27-Aug-07		11.480	11.482	0.002	0.150	1077.398	nm	recovered 150 ml product from P.B.
	29-Aug-07		11.466	11.468	0.002	0.010	1077.412	nm	recovered 10 ml product from P.B.
	4-Sep-07		11.475	11.480	0.005	0.100	1077.402	nm	recovered 100 ml product from P.B.
	6-Sep-07		11.456	11.458	0.002	0.075	1077.422	nm	recovered 75 ml product from P.B.
	10-Sep-07		11.482	11.486	0.004	0.030	1077.395	nm	recovered 30 ml product from passive bailer
	12-Sep-07		11.450	11.453	0.003	0.100	1077.427	nm	recovered 100 ml product from passive bailer
	14-Sep-07		11.485	11.488	0.003	0.050	1077.392	nm	recovered 50 ml product from passive bailer
	17-Sep-07		11.512	11.515	0.003	0.300	1077.365	nm	recovered 300 ml product from passive bailer
	19-Sep-07		11.453	11.456	0.003	0.080	1077.424	nm	recovered 80 ml product from passive bailer
	21-Sep-07		11.470	11.473	0.003	0.100	1077.407	nm	recovered 100 ml product from passive bailer
	24-Sep-07		11.475	11.479	0.004	0.080	1077.402	nm	recovered 80 ml product from P.B.
	26-Sep-07		11.462	11.469	0.007	0.020	1077.415	nm	recovered 20 ml product from P.B.
	28-Sep-07		11.435	11.438	0.003	0.080	1077.442	nm	recovered 80 ml product from P.B.
	1-Oct-07		11.456	11.457	0.001	0.060	1077.422	nm	recovered 60 ml product from P.B.
	3-Oct-07		11.455	11.457	0.002	0.050	1077.423	nm	recovered 50 ml product from P.B.
	9-Oct-07		11.451	11.455	0.004	0.050	1077.426	nm	recovered 50 ml product from P.B.
	12-Oct-07		11.407	11.410	0.003	0.300	1077.470	nm	recovered 300 ml product from P.B.
	16-Oct-07		11.500	11.504	0.004	0.100	1077.377	nm	recovered 100 ml product from P.B.
	20-Oct-07		11.510	11.512	0.002	0.080	1077.368	nm	recovered 80 ml product from P.B.
	29-Oct-07		11.150	11.163	0.013	0.250	1077.725	nm	recovered 250 ml product from passive bailer
	1-Nov-07		11.146	11.152	0.006	0.200	1077.731	nm	recovered 200 ml product from passive bailer
	2-Nov-07		11.159	11.161	0.002	0.100	1077.719	nm	recovered 100 ml product from passive bailer
	5-Nov-07		11.583	11.587	0.004	0.080	1077.294	nm	recovered 80 ml product from passive bailer
	13-Nov-07		11.581	11.584	0.003	0.030	1077.296	nm	recovered 30 ml product from passive bailer
	19-Nov-07		11.434	11.438	0.004	0.100	1077.443	nm	recovered 100 ml product from passive bailer
	23-Nov-07		11.516	11.518	0.002	0.120	1077.362	nm	recovered 120 ml product from passive bailer
	26-Nov-07		11.263	11.274	0.011	0.100	1077.613	nm	recovered 100 ml product from passive bailer
	28-Nov-07		11.269	11.274	0.005	0.080	1077.608	nm	recovered 80 ml product from passive bailer
	30-Nov-07		11.271	11.275	0.004	0.050	1077.606	nm	recovered 50 ml product from passive bailer
	3-Dec-07		11.473	11.475	0.002	0.200	1077.405	nm	recovered 200 ml product from passive bailer
	5-Dec-07		11.478	11.481	0.003	0.080	1077.399	nm	recovered 80 ml product from passive bailer
	7-Dec-07		11.480	11.482	0.002	0.040	1077.398	nm	recovered 40 ml product from passive bailer
	10-Dec-07		11.484	11.486	0.002	0.100	1077.394	nm	recovered 100 ml product from passive bailer
	14-Dec-07		11.488	11.492	0.004	0.150	1077.389	nm	recovered 150 ml product from passive bailer
	17-Dec-07		11.488	11.490	0.002	0.180	1077.390	nm	recovered 180 ml product from passive bailer

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH706 Continued	19-Dec-07		11.490	11.492	0.002	0.100	1077.388	nm	recovered 100 ml product from passive bailer
	21-Dec-07		11.494	11.496	0.002	0.080	1077.384	nm	recovered 80 ml product from passive bailer
	2-Jan-08		11.485	11.489	0.004	0.200	1077.392	nm	recovered 200 ml product from passive bailer
	4-Jan-08		11.445	11.447	0.002	0.020	1077.433	nm	recovered 20 ml product from passive bailer
	23-Jan-08		11.580	11.583	0.003	0.200	1077.297	nm	recovered 200 ml product from passive bailer
	25-Jan-08		11.502	11.505	0.003	0.050	1077.375	nm	recovered 50 ml product from passive bailer
	7-Feb-08		11.613	11.617	0.004	0.200	1077.264	nm	recovered 200 ml product from passive bailer
	9-Feb-08		11.615	11.618	0.003	0.100	1077.262	nm	recovered 100 ml product from passive bailer
	6-Mar-08		11.625	11.627	0.002	0.600	1077.253	nm	recovered 600 ml product from passive bailer
	7-Apr-08		11.480	11.489	0.009	0.010	1077.396	nm	recovered 10 ml product from passive bailer
	9-Apr-08		11.485	11.488	0.003	0.010	1077.392	nm	recovered 10 ml product from passive bailer
	11-Apr-08		11.484	11.488	0.004	0.010	1077.393	nm	recovered 10 ml product from passive bailer
	14-Apr-08		11.491	11.496	0.005	0.010	1077.386	nm	recovered 10 ml product from passive bailer
	16-Apr-08		11.500	11.504	0.004	0.010	1077.377	nm	recovered 10 ml product from passive bailer
	28-Apr-08		11.545	11.581	0.036	0.030	1077.326	nm	recovered 30 ml product from passive bailer
	30-Apr-08		11.548	11.578	0.030	0.020	1077.324	nm	recovered 20 ml product from passive bailer
	2-May-08		11.545	11.582	0.037	0.010	1077.326	nm	recovered 10 ml product from passive bailer
	5-May-08		11.611	11.615	0.004	0.350	1077.266	nm	recovered 350 ml product from passive bailer
	12-May-08		11.590	11.598	0.008	0.010	1077.286	nm	recovered 10 ml product from passive bailer
	14-May-08		11.594	11.596	0.002	-	1077.284	nm	no recovery from passive bailer; reset
	26-May-08		11.628	11.640	0.012	0.200	1077.248	nm	recovered 200 ml product from passive bailer
	28-May-08		11.632	11.635	0.003	0.100	1077.245	nm	recovered 100 ml product from passive bailer
	30-May-08		11.634	11.636	0.002	0.050	1077.244	nm	recovered 50 ml product from passive bailer
	9-Jun-08		11.575	11.580	0.005	0.050	1077.302	nm	recovered 50 ml product from passive bailer
	11-Jun-08		11.600	11.603	0.003	0.020	1077.277	nm	recovered 20 ml product from passive bailer
	13-Jun-08		11.603	11.605	0.002	0.010	1077.275	nm	recovered 10 ml product from passive bailer
	2-Jul-08		11.480	11.485	0.005	-	1077.397	>10,000	well decommissioned on 01 July 2008
BH707	7-Oct-03	1089.309	-	11.423	0.000	-	1077.886	6,500	
	20-Nov-03		-	11.492	0.000	-	1077.817	580	
	17-Dec-03		-	11.492	0.000	-	1077.817	15	
	13-Jan-04		-	11.463	0.000	-	1077.846	15	Bolt Required for RoadBox
	8-Mar-04		-	11.567	0.000	-	1077.742	36	bailer checked - no product
	6-Apr-04		-	11.439	0.000	-	1077.870	4,200	
	15-Jun-04		-	11.475	0.000	-	1077.834	240	
	13-Jul-04		-	11.455	0.000	-	1077.854	1,300	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH724 Continued	6-Apr-04		-	11.435	0.000	-	1078.136	200	J-plug
	15-Jun-04		-	11.505	0.000	-	1078.066	26	
	14-Jul-04		-	11.513	0.000	-	1078.058	500	
	23-Aug-04		-	11.486	0.000	-	1078.085	2,400	
	14-Oct-04		-	11.520	0.000	-	1078.051	300	
	2-Feb-05		-	11.545	0.000	-	1078.026	10	
	2-Mar-05		-	11.529	0.000	-	1078.042	700	
	2-Jun-05		-	11.626	0.000	-	1077.945	400	
	5-Oct-05		-	11.453	0.000	-	1078.118	420	
	19-Jan-06		-	11.421	0.000	-	1078.150	50	
	10-May-06		-	11.527	0.000	-	1078.044	420	
	26-Jul-06		-	11.500	0.000	-	1078.071	44	
	25-Jan-07		-	11.435	0.000	-	1078.136	400	
	25-May-07		-	11.457	0.000	-	1078.114	180	
	23-Aug-07		-	11.325	0.000	-	1078.246	80	
	22-Nov-07		-	11.366	0.000	-	1078.205	89	
	10-Mar-08		-	11.450	0.000	-	1078.121	260	
	4-Jun-08		-	11.471	0.000	-	1078.100	54	
	4-Jul-08		-	11.430	0.000	-	1078.141	300	well decommissioned on 04 July 2008
BH725	7-Oct-03	1091.321	-	13.652	0.000	-	1077.669	>10,000	
	13-Nov-03		13.534	13.965	0.431	-	1077.701	-	measured approx. 4 cm of product in bailer
	20-Nov-03		13.553	14.302	0.749	-	1077.618	>10,000	
	3-Dec-03		13.444	14.313	0.869	-	1077.703	nm	
	9-Dec-03		14.01	14.040	0.030	-	1077.305	1,900	800 ml product from P.B.; 300 ml product from H.B.
	10-Dec-03		13.884	13.965	0.081	-	1077.421	nm	monitored at 8:15 a.m.
	10-Dec-03		-	14.009	0.000	-	1077.223	nm	monitored at 4:50 p.m.
	11-Dec-03		-	14.163	0.000	-	1077.158	nm	monitored at 7:15 a.m.
	11-Dec-03		-	14.173	0.000	-	1077.148	nm	monitored at 3:15 p.m.
	12-Dec-03		14.156	14.221	0.065	-	1077.152	nm	monitored at 7:30 a.m.
	12-Dec-03		-	14.162	0.000	-	1077.159	nm	monitored at 1:40 p.m.
	15-Dec-03		-	14.440	0.000	-	1076.881	nm	
	17-Dec-03		-	14.061	0.000	-	1077.260	>10,000	
	19-Dec-03		14.12	14.392	0.272	-	1077.147	-	monitored at 10:05 a.m.
	19-Dec-03		14.285	14.370	0.085	-	1077.019	-	monitored at 10:15 a.m.
	19-Dec-03		-	14.264	0.000	-	1077.057	-	monitored at 10:30 a.m.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH725 Continued	22-Dec-03		nm	nm	nm	-	nm	nm	recovered 150 ml product from P.B.
	24-Dec-03		nm	nm	nm	-	nm	nm	recovered 100 ml product from P.B.
	7-Jan-04		14.170	14.365	0.000	-	1076.956	nm	recovered 750 ml product from P.B.
	7-Jan-04		-	14.265	0.000	-	1077.056	nm	after 20 minutes recovered 300 ml product from P.B.
	10-Jan-04		-	14.288	0.000	-	1077.033	nm	recovered 250 ml product from P.B.
	12-Jan-04		-	14.355	0.000	-	1076.966	nm	recovered 350 ml product from P.B.
	15-Jan-04		14.220	14.335	0.115	-	1077.078	nm	recovered 650 ml product from P.B.
	15-Jan-04		-	14.200	0.000	-	1077.121	nm	after 10 minutes, recovered 300 ml product from P.B.
	20-Jan-04		-	14.296	0.000	-	1077.025	nm	recovered 600 ml product from P.B.
	23-Jan-04		-	14.197	0.000	-	1077.124	nm	recovered 300 ml product from P.B.
	23-Jan-04		-	13.938	0.000	-	1077.383	nm	after 34 minutes, checked P.B.; no product
	5-Feb-04		-	13.888	0.000	-	1077.433	nm	recovered 600 ml product from P.B.
	5-Feb-04		-	14.100	0.000	-	1077.221	nm	75 minutes later recovered 100 ml product from P.B.
	9-Feb-04		14.085	14.204	0.119	-	1077.212	nm	recovered 400 ml product from P.B.;
	9-Feb-04		-	14.289	0.000	-	1077.032	nm	25 minutes later recovered 500 ml product from P.B.
	19-Feb-04		14.111	14.350	0.239	-	1077.162	nm	recovered 750 ml product from P.B.
	23-Feb-04		14.105	14.250	0.145	-	1077.187	nm	recovered 750 ml product from P.B.
	23-Feb-04		-	13.570	0.000	-	1077.751	nm	10 minutes later recovered 100 ml from P.B.
	26-Feb-04		-	13.963	0.000	-	1077.358	nm	recovered 800 ml product from P.B.
	26-Feb-04		-	14.088	0.000	-	1077.233	nm	17 minutes later recovered 50 ml product from P.B
	3-Mar-04		-	13.443	0.000	-	1077.878	nm	recovered 30 ml product from P.B.
	3-Mar-04		-	13.499	0.000	-	1077.822	nm	no product in P.B.
	8-Mar-04		13.375	14.075	0.700	-	1077.806	>10,000	recovered 800 ml from passive bailer before H.B.
	8-Mar-04		13.955	14.110	0.155	-	1077.335	>10,000	hand bailed 150 ml product
	22-Mar-04		14.010	14.595	0.585	-	1077.194	nm	P.B. full of water; no product before H.B.
	22-Mar-04		14.135	14.203	0.068	-	1077.172	nm	hand bailed 1.4 L of product
	23-Mar-04		14.105	14.110	0.005	-	1077.215	nm	recovered 250 ml product from P.B.; H.B. had 1 cm product
	24-Mar-04		-	14.998	0.000	-	1076.323	nm	recovered 150 ml from P.B.; H.B. had 1.5 cm. product
	26-Mar-04		14.190	14.225	0.035	-	1077.124	nm	recovered 350 ml product from P.B.
	29-Mar-04		14.110	14.585	0.475	-	1077.116	nm	recovered 800 ml product from P.B.
	30-Mar-04		14.175	14.464	0.289	-	1077.088	nm	recovered 800 ml product from P.B. - before H.B.
	30-Mar-04		14.437	14.475	0.038	-	1076.876	nm	recovered 600 ml from hand bailing
	31-Mar-04		14.327	14.329	0.002	-	1076.994	nm	recovered 100 ml product from P.B.
	12-Apr-04		14.252	14.535	0.283	-	1077.012	nm	recovered 800 ml product from P.B. - before H.B.
	12-Apr-04		14.440	14.530	0.090	-	1076.863	nm	recovered 500 ml product after hand bailing

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH725 Continued	13-Apr-04		14.375	14.390	0.015	-	1076.943	nm	recovered 300 ml product from P.B.; not enough to H.B.
	15-Apr-04		14.305	14.310	0.005	-	1077.015	nm	recovered 350 ml product from P.B.; not enough to H.B.
	16-Apr-04		-	14.239	0.000	-	1077.082	nm	recovered 250 ml product from P.B.; H.B. 1 mm prod.
	19-Apr-04		14.316	14.329	0.013	-	1077.002	nm	recovered 400 ml product from P.B.; not enough to H.B.
	22-Apr-04		14.422	14.465	0.043	-	1076.890	nm	recovered 650 ml product from P.B.
	30-Apr-04		-	14.319	0.000	-	1077.002	nm	recovered 600 ml from P.B.; H.B. 1 mm product
	6-May-04		-	14.374	0.000	-	1076.947	nm	recovered 10 ml from passive bailer
	7-May-04		-	14.334	0.000	-	1076.987	nm	recovered 5 ml from P.B.; hand bailed dry @ 6.0 L
	10-May-04		-	14.339	0.000	-	1076.982	nm	recovered 5 ml product from P.B.; no product HB
	17-May-04		-	14.355	0.000	-	1076.966	nm	recovered 350 ml from P.B.; hand bailed 1 ml product
	20-May-04		-	14.385	0.000	-	1076.936	nm	recovered 400 ml from passive bailer; H.B. 50 ml
	28-May-04		14.175	14.179	0.004	-	1077.145	nm	recovered 200 ml from passive bailer
	15-Jun-04		cnm	cnm	cnm	-	cnm	>10,000	probe not reading product; PB - 800 ml product
	15-Jun-04		-	14.435	0.000	-	1076.886	>10,000	bailer checked, 0.5 L recovered; hand bailed 1.0 L
	18-Jun-04		14.275	14.285	0.010	-	1077.044	nm	600 ml recovered
	14-Jul-04		-	12.217	0.000	-	1079.104	>10,000	passive bailer; bailer check showed 4 mm product.
	28-Jul-04		14.184	14.215	0.031	-	1077.131	nm	500 ml recovered
	6-Aug-04		14.092	14.100	0.008	-	1077.227	nm	50 ml recovered
	10-Aug-04		14.175	14.180	0.005	-	1077.145	nm	750 ml recovered
	11-Aug-04		14.110	14.112	0.002	-	1077.211	nm	50 ml recovered
	13-Aug-04		-	14.115	0.000	-	1077.206	nm	20ml recovered
	18-Aug-04		14.115	14.117	0.002	-	1077.206	nm	50 ml recovered
	24-Aug-04		-	14.017	0.000	-	1077.304	>10,000	100ml product in PB. Bailer check showed 2mm product
	7-Sep-04		-	14.135	0.000	-	1077.186	nm	200 ml recovered
	9-Sep-04		-	14.054	0.000	-	1077.267	nm	50 ml recovered
	13-Sep-04		14.035	14.064	0.029	-	1077.280	nm	100 ml recovered
	15-Sep-04		14.085	14.090	0.005	-	1077.235	nm	50 ml recovered
	17-Sep-04		-	14.045	0.000	-	1077.276	nm	75 ml recovered
	20-Sep-04		14.149	14.154	0.005	-	1077.171	nm	100 ml recovered
	22-Sep-04		14.115	14.119	0.004	-	1077.205	nm	100 ml recovered
	24-Sep-04		14.096	14.100	0.004	-	1077.224	nm	75 ml recovered
	29-Sep-04		14.075	14.078	0.003	-	1077.245	nm	200 ml recovered
	4-Oct-04		-	14.015	0.000	-	1077.306	--	200 ml recovered
	6-Oct-04		14.085	14.090	0.005	-	1077.235	nm	100 ml recovered
	12-Oct-04		-	14.142	0.000	-	1077.179	nm	bailer checked, 100 ml recovered; PB - 800 ml recovered

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH725 Continued	15-Oct-04		-	14.130	0.000	-	1077.191	nm	
	5-Nov-04		14.123	14.125	0.002	-	1077.198	nm	800 ml recovered
	8-Nov-04		-	14.105	0.000	-	1077.216	nm	350 ml recovered
	10-Nov-04		14.204	14.209	0.005	-	1077.116	nm	700 ml recovered
	17-Nov-04		14.167	14.170	0.003	-	1077.153	nm	100 ml recovered
	25-Nov-04		14.120	14.122	0.002	-	1077.201	nm	400 ml recovered
	29-Nov-04		14.058	14.060	0.002	-	1077.263	nm	30 ml recovered
	1-Dec-04		14.131	14.139	0.008	-	1077.188	nm	recovered 75 ml product from P.B.
	11-Jan-05		13.680	13.705	0.025	-	1077.636	>10,000	
	17-Jan-05		13.669	13.700	0.031	-	1077.646	nm	no passive bailer; P.B. installed following monitoring
	24-Jan-05		13.740	13.740	trace	-	1077.581	nm	no product in P.B.; checked H.B. - 20 mm product
	26-Jan-05		13.823	13.850	0.027	-	1077.493	nm	recovered 800 ml product from P.B.
	28-Jan-05		13.815	13.815	trace	-	-	nm	0 ml product from P.B.; H.B. check showed 2 mm product
	2-Feb-05		13.574	13.574	trace	-	1077.747	1,000	P.B. full of water; ice inside well; HB had 10 mm product
	18-Feb-05		13.782	13.784	0.002	-	1077.539	nm	recovered 10 ml product from P.B.
	22-Feb-05		13.835	13.835	trace	-	1077.486	nm	recovered 5 ml product from P.B.
	24-Feb-05		13.799	13.799	trace	-	1077.522	nm	checked bailer - no visible product; sheen present
	2-Mar-05	1091.295	-	13.795	0.000	-	1077.500	3,800	checked bailer - sheen on water; well resurveyed
	22-Mar-05		-	13.805	0.000	-	1077.490	nm	checked bailer - no product; reset P.B.
	24-Mar-05		-	13.835	0.000	-	1077.460	nm	checked bailer - no product
	28-Mar-05		-	13.705	0.000	-	1077.590	nm	checked bailer - no product
	30-Mar-05		-	13.886	0.000	-	1077.409	nm	checked bailer - no product
	1-Apr-05		-	13.783	0.000	-	1077.512	nm	checked bailer - no product
	5-Apr-05		-	13.895	0.000	-	1077.400	nm	checked bailer - no product
	11-Apr-05		-	13.824	0.000	-	1077.471	nm	checked bailer - no product
	15-Apr-05		-	13.865	0.000	-	1077.430	nm	checked bailer - no product
	18-Apr-05		-	13.890	0.000	-	1077.405	nm	checked bailer - no product
	20-Apr-05		-	13.861	0.000	-	1077.434	nm	checked bailer - no product
	22-Apr-05		-	13.849	0.000	-	1077.446	nm	checked bailer - no product
	25-Apr-05		-	13.840	0.000	-	1077.455	nm	checked bailer - no product
	27-Apr-05		-	13.870	0.000	-	1077.425	nm	recovered 25 ml product from P.B.; H.B. 0 ml product
	4-May-05		-	13.876	0.000	-	1077.419	nm	recovered 150 ml product from P.B.
	6-May-05		-	13.835	0.000	-	1077.460	nm	recovered 50 ml product from P.B.; H.B. 0 ml product
	9-May-05		-	13.837	0.000	-	1077.458	nm	recovered 110 ml product from P.B.
	13-May-05		-	13.867	0.000	-	1077.428	nm	recovered 100 ml product from P.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH725 Continued	16-May-05		-	13.765	0.000	-	1077.530	nm	recovered 100 ml product from P.B.
	26-May-05		-	13.888	0.000	-	1077.407	nm	recovered 500 ml product from P.B. - 4" well
	10-Jun-05		13.839	13.841	0.002	-	1077.456	nm	recovered 400 ml product from P.B.
	15-Jun-05		13.842	13.842	trace	-	1077.453	nm	recovered 300 ml product from P.B.
	17-Jun-05		13.818	13.818	trace	-	1077.477	nm	recovered 150 ml product from P.B.
	20-Jun-05		-	13.876	0.000	-	1077.419	nm	checked bailer - no product
	22-Jun-05		13.814	13.814	trace	-	1077.481	nm	recovered 250 ml product from P.B.
	24-Jun-05		-	13.862	0.000	-	1077.433	nm	
	27-Jun-05		13.853	13.853	trace	-	1077.442	nm	recovered 200 ml from passive bailer
	29-Jun-05		13.855	13.855	trace	-	1077.440	nm	recovered 150 ml product from P.B.
	6-Jul-05		13.795	13.795	trace	-	1077.500	nm	recovered 400 ml product from P.B.
	11-Jul-05		13.845	13.850	0.005	-	1077.449	nm	recovered 100 ml product from P.B.
	20-Jul-05		13.825	13.827	0.002	-	1077.470	nm	recovered 500 ml product from P.B.
	22-Jul-05		-	13.807	0.000	-	1077.488	nm	recovered 200 ml product from P.B.
	28-Jul-05		13.794	13.796	0.002	-	1077.501	nm	recovered 300 ml product from P.B.
	9-Aug-05		13.719	13.875	0.156	-	1077.545	nm	100 ml product from P.B. & 900 ml water - Reset bailer
	10-Aug-05		13.805	nm	0.000	-	1091.295	nm	
	12-Aug-05		13.824	13.826	0.002	-	1077.471	nm	recovered 620 ml product from P.B.
	16-Aug-05		13.784	13.786	0.002	-	1077.511	nm	recovered 140 ml product from P.B.
	17-Aug-05		13.807	13.811	0.004	-	1077.487	nm	recovered 200 ml product from P.B.
	24-Aug-05		13.763	13.770	0.007	-	1077.531	nm	recovered 150 ml product and 350 ml water from P.B.
	31-Aug-05		13.738	13.772	0.034	-	1077.550	nm	
	6-Sep-05		13.797	13.799	0.002	-	1077.498	nm	recovered 80 ml product from P.B.
	12-Sep-05		13.725	13.736	0.011	-	1077.568	nm	recovered 100 ml product from P.B.
	14-Sep-05		13.746	13.748	0.002	-	1077.549	nm	recovered 800 ml product from P.B.
	16-Sep-05		13.787	13.789	0.002	-	1077.508	nm	recovered 200 ml product from P.B.
	19-Sep-05		-	13.740	0.000	-	1077.555	nm	recovered 200 ml product & 100 ml water from P.B.
	21-Sep-05		-	13.788	0.000	-	1077.507	nm	recovered 50 ml product & 25 ml water from P.B.
	26-Sep-05		13.706	13.707	0.001	-	1077.589	nm	recovered 320 ml product from P.B.
	5-Oct-05		13.775	13.777	0.002	-	1077.520	nm	recovered 360 ml product from P.B.
	18-Oct-05		13.735	13.746	0.011	-	1077.558	nm	recovered 600 ml product from P.B.
	24-Oct-05		13.726	13.729	0.003	-	1077.568	nm	recovered 600 ml product from P.B.
	1-Nov-05		-	13.703	0.000	-	1077.592	nm	recovered 650 ml product from P.B.
	3-Nov-05		13.684	13.684	0.000	-	1077.611	nm	recovered 20 ml product from P.B.; H.B. 0 mm
	8-Nov-05		13.737	13.748	0.011	-	1077.556	nm	recovered 500 ml product from P.B.
	10-Nov-05		13.624	13.627	0.003	-	1077.670	nm	recovered 350 ml product from P.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH725 Continued	14-Nov-05		13.789	13.793	0.004	-	1077.505	nm	recovered 350 ml product from P.B.
	28-Nov-05		13.729	13.739	0.010	-	1077.564	nm	recovered 450 ml product from P.B.
	30-Nov-05		13.712	13.719	0.007	-	1077.582	nm	recovered 400 ml product from P.B.
	6-Dec-05		13.724	13.726	0.002	-	1077.571	nm	recovered 750 ml product from P.B.
	12-Dec-05		13.639	13.641	0.002	-	1077.656	nm	PB-Recovered 450 ml.
	14-Dec-05		13.728	13.737	0.009	-	1077.565	nm	PB-Recovered 300 ml.
	16-Dec-05		13.688	13.691	0.003	-	1077.606	nm	PB-Recovered 300 ml.
	19-Dec-05		13.665	13.668	0.003	-	1077.629	nm	PB-Recovered 300 ml.
	22-Dec-05		13.582	13.583	0.001	-	1077.713	nm	PB-Recovered 300 ml.
	23-Dec-05		13.703	13.709	0.006	-	1077.591	nm	PB-Recovered 100 ml.
	3-Jan-06		13.679	13.683	0.004	-	1077.615	nm	PB-Recovered 800 ml.
	5-Jan-06		13.655	13.657	0.002	-	1077.640	nm	PB-Recovered 700 ml.
	6-Jan-06		13.644	13.646	0.002	-	1077.651	nm	PB-Recovered 10 ml.
	9-Jan-06		13.600	13.603	0.003	-	1077.694	nm	PB-Recovered 5 ml.
	12-Jan-06		13.703	13.706	0.003	-	1077.591	nm	PB-Recovered 350 ml.
	13-Jan-06		13.624	13.626	0.002	-	1077.671	nm	PB-Recovered 400 ml.
	16-Jan-06		13.654	13.665	0.011	-	1077.639	nm	PB-Recovered 10 ml.
	20-Jan-06		13.615	13.619	0.004	-	1077.679	nm	PB-Recovered 10 ml. Hand bailed 5 mm.
	23-Jan-06		13.647	13.649	0.002	-	1077.648	nm	PB-Recovered 750 ml.
	30-Jan-06		13.545	13.547	0.002	-	1077.750	nm	PB-Recovered 500 ml.
	1-Feb-06		13.574	13.575	0.001	-	1077.721	nm	PB-Recovered 10 ml.
	3-Feb-06		13.694	13.696	0.002	-	1077.601	nm	recovered 300 ml product from P.B.
	6-Feb-06		13.699	13.701	0.002	-	1077.596	nm	recovered 300 ml product from P.B.
	8-Feb-06		13.649	13.652	0.003	-	1077.645	nm	recovered 100 ml product from P.B.
	10-Feb-06		13.725	13.726	0.001	-	1077.570	nm	recovered 100 ml product from P.B.
	27-Feb-06		13.535	13.544	0.009	-	1077.758	nm	recovered 700 ml product from P.B.
	2-Mar-06		13.690	13.692	0.002	-	1077.605	nm	recovered 500 ml product form P.B.
	4-Mar-06		cnm	cnm	cnm	-	cnm	nm	Iced - P.B. stuck in well
	6-Mar-06		13.593	13.595	0.002	-	1077.702	nm	recovered 200 ml product from P.B.
	8-Mar-06		13.569	13.571	0.002	-	1077.726	nm	P.B. full of water; reset
	10-Mar-06		13.629	13.630	0.001	-	1077.666	nm	No recovery from P.B.; reset
	14-Mar-06		13.573	13.575	0.002	-	1077.722	nm	No recovery from P.B.; reset
	22-Mar-06		13.619	13.647	0.028	-	1077.670	nm	recovered 20 ml product from P.B.
	24-Mar-06		13.579	13.583	0.004	-	1077.715	nm	recovered 30 ml product from P.B.
	27-Mar-06		13.572	13.593	0.021	-	1077.719	nm	recovered 10 ml product from P.B.

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH725 Continued	29-Mar-06		cnm	cnm	cnm	-	cnm	nm	Iced
	31-Mar-06		cnm	cnm	cnm	-	cnm	nm	High volume traffic
	12-Apr-06		13.630	13.632	0.002	-	1077.665	nm	recovered 100 ml product from P.B.
	18-Apr-06		13.705	13.718	0.013	0.400	1077.587	nm	recovered 400 ml product from P.B.
	21-Apr-06		13.601	13.642	0.041	0.800	1077.686	nm	recovered 800 ml product from P.B.
	26-Apr-06		13.592	13.600	0.008	0.900	1077.701	nm	recovered 900 ml product from P.B.
	28-Apr-06		13.649	13.651	0.002	0.200	1077.646	nm	recovered 200 ml product from P.B.
	1-May-06		13.603	13.607	0.004	0.200	1077.691	nm	recovered 200 ml product from P.B.
	3-May-06		13.693	13.699	0.006	0.250	1077.601	nm	recovered 250 ml product from P.B.
	9-May-06		13.694	13.699	0.005	0.300	1077.626	nm	recovered 300 ml product from P.B.
	7-Jun-06		13.684	13.756	0.072	0.600	1077.597	nm	recovered 600 ml product from P.B.
	12-Jun-06		13.694	13.699	0.005	0.600	1077.600	nm	recovered 600 ml product from P.B.
	14-Jun-06		13.602	13.614	0.012	0.400	1077.691	nm	recovered 400 ml product from P.B.
	16-Jun-06		13.665	13.666	0.001	0.010	1077.630	nm	recovered 10 ml product from P.B.
	20-Jun-06		13.662	13.664	0.002	-	1077.633	nm	4" well
	22-Jun-06		13.693	13.696	0.003	0.350	1077.601	nm	recovered 350 ml product from P.B.
	23-Jun-06		13.696	13.699	0.003	0.100	1077.598	nm	recovered 100 ml product from P.B.
	26-Jun-06		13.659	13.660	0.001	0.400	1077.636	nm	recovered 400 ml product from P.B.
	28-Jun-06		13.615	13.616	0.001	0.010	1077.680	nm	recovered 10 ml product from P.B.
	4-Jul-06		13.654	13.671	0.017	0.300	1077.638	nm	recovered 300 ml product from P.B.
	7-Jul-06		13.671	13.679	0.008	0.500	1077.622	nm	recovered 500 ml product from P.B.
	12-Jul-06		13.616	13.620	0.004	0.300	1077.678	nm	recovered 300 ml product from P.B.
	19-Jul-06		13.662	13.665	0.003	0.400	1077.632	nm	recovered 400 ml product from P.B.
	21-Jul-06		13.685	13.688	0.003	0.300	1077.609	nm	recovered 300 ml product from P.B.
	24-Jul-06		-	13.611	0.000	0.150	1077.684	nm	recovered 150 ml product from P.B.
	31-Jul-06		13.613	13.619	0.006	0.400	1077.681	nm	recovered 400 ml of product from PB
	3-Aug-06		13.640	13.641	0.001	0.010	1077.655	nm	recovered 10 ml of product from PB
	9-Aug-06		13.635	13.637	0.002	0.600	1077.660	nm	recovered 600 ml of product from PB
	15-Aug-06		13.615	13.617	0.002	0.350	1077.680	nm	recovered 350 ml of product from PB
	17-Aug-06		13.633	13.636	0.003	0.300	1077.661	nm	recovered 300 ml of product from PB
	18-Aug-06		13.836	13.838	0.002	0.200	1077.459	nm	recovered 200 ml of product from PB
	21-Aug-06		13.613	13.615	0.002	0.070	1077.682	nm	recovered 70 ml of product from PB
	24-Aug-06		13.620	13.622	0.002	0.010	1077.675	nm	recovered 10 ml of product from PB
	25-Aug-06		13.643	13.645	0.002	0.300	1077.652	nm	recovered 300 ml of product from PB
	28-Aug-06		13.600	13.602	0.002	0.300	1077.695	nm	recovered 300 ml of product from PB

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH725 Continued	30-Aug-06		13.605	13.606	0.001	0.010	1077.690	nm	recovered 10 ml of product from PB
	18-Sep-06		13.595	13.598	0.003	0.750	1077.699	nm	recovered 750 ml product from P.B.
	20-Sep-06		13.557	13.560	0.003	0.400	1077.737	nm	recovered 400 ml product from P.B.
	22-Sep-06		13.555	13.556	0.001	0.350	1077.740	nm	recovered 350 ml product from P.B.
	25-Sep-06		13.624	13.626	0.002	0.300	1077.671	nm	recovered 300 ml product from P.B.
	3-Oct-06		13.675	13.689	0.014	0.300	1077.617	nm	recovered 300 ml product from P.B.
	5-Oct-06		-	13.566	0.000	0.550	1077.729	nm	recovered 550 ml product from P.B.
	4-Dec-06		13.523	13.576	0.053	0.450	1077.761	nm	recovered 450 ml product from P.B.
	19-Jan-07		13.560	13.562	0.002	0.300	1077.735	nm	recovered 300 ml product from passive bailer
	22-Jan-07		13.536	13.537	0.001	0.030	1077.759	nm	recovered 30 ml product from passive bailer
	15-Mar-07		13.494	13.510	0.016	0.010	1077.798	nm	recovered 10 ml product from passive bailer
	17-Apr-07		13.520	13.543	0.023	-	1077.770	nm	passive bailer full of water; reset
	24-Apr-07		13.543	13.567	0.024	0.050	1077.747	nm	recovered 50 ml product from passive bailer
	1-May-07		13.495	13.499	0.004	0.010	1077.799	nm	recovered 10 ml product from passive bailer
	4-May-07		13.509	13.511	0.002	0.300	1077.786	nm	recovered 300 ml product from P.B.
	8-May-07		13.532	13.535	0.003	0.010	1077.762	nm	recovered 10 ml product from passive bailer
	10-May-07		13.543	13.548	0.005	0.010	1077.751	nm	recovered 10 ml product from passive bailer
	8-Jun-07		13.485	13.487	0.002	-	1077.810	nm	no recovery from passive bailer - reset
	11-Jun-07		13.468	13.469	0.001	0.010	1077.827	nm	recovered 10 ml of product from PB
	13-Jun-07		13.476	13.477	0.001	-	1077.819	nm	No recovery from P.B.; reset
	3-Jul-07		13.448	13.449	0.001	0.010	1077.847	nm	recovered 10 ml of product from PB
	5-Jul-07		13.503	13.505	0.002	0.010	1077.792	nm	recovered 10 ml of product from PB
	16-Jul-07		13.406	13.408	0.002	0.010	1077.889	nm	recovered 10 ml of product from PB
	20-Jul-07		13.404	13.407	0.003	0.010	1077.890	nm	recovered 10 ml of product from PB
	26-Jul-07		13.415	13.417	0.002	0.010	1077.880	nm	recovered 10 ml of product from PB
	30-Jul-07		13.425	13.427	0.002	0.010	1077.870	nm	recovered 10 ml of product from PB
	7-Aug-07		13.362	13.363	0.001	-	1077.933	nm	No recovery from P.B.; reset
	9-Aug-07		13.354	13.355	0.001	-	1077.941	nm	No recovery from P.B.; reset
	23-Aug-07		-	13.707	0.000	-	1077.588	26	
	24-Aug-07		13.255	13.256	0.001	-	1078.040	nm	
	27-Aug-07		13.303	13.305	0.002	-	1077.992	nm	No recovery from P.B.; reset
	29-Aug-07		13.293	13.295	0.002	-	1078.002	nm	No recovery from P.B.; reset
	4-Sep-07		13.270	13.272	0.002	-	1078.025	nm	No recovery from P.B.; reset
	6-Sep-07		13.275	13.277	0.002	-	1078.020	nm	No recovery from P.B.; reset
	10-Sep-07		13.271	13.273	0.002	-	1078.024	nm	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH725 Continued	12-Sep-07		13.118	13.120	0.002	-	1078.177	nm	
	14-Sep-07		13.343	13.345	0.002	-	1077.952	nm	
	17-Sep-07		13.211	13.214	0.003	-	1078.083	nm	
	19-Sep-07		13.202	13.204	0.002	-	1078.093	nm	
	21-Sep-07		13.312	13.314	0.002	-	1077.983	nm	
	24-Sep-07		13.103	13.107	0.004	-	1078.191	nm	
	26-Sep-07		13.225	13.227	0.002	-	1078.070	nm	
	28-Sep-07		13.109	13.111	0.002	-	1078.186	nm	
	1-Oct-07		13.221	13.225	0.004	-	1078.073	nm	
	3-Oct-07		13.224	13.227	0.003	-	1078.070	nm	
	9-Oct-07		13.210	13.213	0.003	-	1078.084	nm	
	12-Oct-07		13.217	13.219	0.002	-	1078.078	nm	
	16-Oct-07		13.303	13.305	0.002	-	1077.992	nm	
	20-Oct-07		13.311	13.315	0.004	-	1077.983	nm	
	29-Oct-07		13.255	13.259	0.004	-	1078.039	nm	
	1-Nov-07		13.260	13.264	0.004	-	1078.034	nm	
	2-Nov-07		13.261	13.265	0.004	-	1078.033	nm	
	5-Nov-07		13.289	13.291	0.002	-	1078.006	nm	
	13-Nov-07		13.292	13.294	0.002	-	1078.003	nm	
	19-Nov-07		13.293	13.294	0.001	-	1078.002	nm	
	23-Nov-07		13.239	13.241	0.002	-	1078.056	nm	
	26-Nov-07		13.288	13.291	0.003	-	1078.006	nm	
	28-Nov-07		13.295	13.297	0.002	-	1078.000	nm	
	30-Nov-07		13.305	13.307	0.002	-	1077.990	nm	
	3-Dec-07		13.161	13.162	0.001	-	1078.134	nm	
	5-Dec-07		13.163	13.165	0.002	-	1078.132	nm	
	7-Dec-07		13.165	13.167	0.002	-	1078.130	nm	
	10-Dec-07		13.170	13.172	0.002	-	1078.125	nm	
	14-Dec-07		13.167	13.170	0.003	-	1078.127	nm	
	17-Dec-07		13.170	13.172	0.002	-	1078.125	nm	
	19-Dec-07		13.172	13.174	0.002	-	1078.123	nm	
	21-Dec-07		13.170	13.172	0.002	-	1078.125	nm	
	2-Jan-08		13.165	13.166	0.001	-	1078.130	nm	
	4-Jan-08		13.514	13.515	0.001	-	1077.781	nm	
	23-Jan-08		13.210	13.211	0.001	-	1078.085	nm	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 **SUMMARY OF ALL WELL MONITORING DATA 1998-2013**

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH725 Continued	25-Jan-08		13.216	13.218	0.002	-	1078.079	nm	
	7-Feb-08		13.463	13.464	0.001	-	1077.832	nm	
	9-Feb-08		13.465	13.466	0.001	-	1077.830	nm	
	6-Mar-08		13.333	13.334	0.001	-	1077.962	nm	
	7-Apr-08		13.354	13.355	0.001	-	1077.941	nm	
	9-Apr-08		13.356	13.357	0.001	-	1077.939	nm	
	11-Apr-08		13.359	13.360	0.001	-	1077.936	nm	
	14-Apr-08		13.411	13.412	0.001	-	1077.884	nm	
	16-Apr-08		13.433	13.434	0.001	-	1077.862	nm	
	28-Apr-08		13.468	13.470	0.002	-	1077.827	nm	
	30-Apr-08		13.470	13.471	0.001	-	1077.825	nm	
	2-May-08		13.478	13.479	0.001	-	1077.817	nm	
	5-May-08		13.461	13.462	0.001	-	1077.834	nm	
	12-May-08		13.453	13.454	0.001	-	1077.842	nm	
	14-May-08		13.450	13.452	0.002	-	1077.845	nm	
	26-May-08		13.358	13.359	0.001	-	1077.937	nm	
	28-May-08		13.364	13.366	0.002	-	1077.931	nm	
	30-May-08		13.366	13.367	0.001	-	1077.929	nm	
	9-Jun-08		13.365	13.366	0.001	-	1077.930	nm	
	11-Jun-08		13.363	13.364	0.001	-	1077.932	nm	
	13-Jun-08		13.370	13.371	0.001	-	1077.925	nm	
	3-Jul-08		-	13.335	0.000	-	1077.960	90	well decommissioned on 03 July 2008
BH726	7-Oct-03	1091.178	dry	dry	0.000	-	dry	1,900	
	20-Nov-03		dry	dry	dry	-	dry	480	
	17-Dec-03		dry	dry	dry	-	dry	220	
	13-Jan-04		dry	dry	dry	-	dry	250	dry; blocked at 5.740
	8-Mar-04		dry	dry	dry	-	dry	800	dry
	6-Apr-04		dry	dry	dry	-	dry	200	
	6-May-04		dry	dry	dry	-	dry		blocked at 5.715 m
	15-Jun-04		dry	dry	dry	-	dry	42	dry
	14-Jul-04		dry	dry	dry	-	dry	60	dry
	24-Aug-04		dry	dry	dry	-	dry	72	
	14-Oct-04		dry	dry	dry	-	dry	74	dry
	2-Feb-05		dry	dry	dry	-	dry	320	
	2-Mar-05		dry	dry	dry	-	dry	240	

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

TABLE 2 SUMMARY OF ALL WELL MONITORING DATA 1998-2013

Updated Site Management Plan (2014)
Hounsfield Heights - Briar Hill Community
Calgary, Alberta

Monitoring Well	Date (dd-mmm-yy)	Top of Casing Elevation[1] (m)	Depth to LPH[2] (m)	Depth to Water[2] (m)	Apparent Thickness of LPH (m)	LPH Recovery Volume (L)	Water Elevation[3] (m)	Combustible Vapour Concentration[4] (ppm)	Comments
BH1104 Continued	21-Mar-12		-	9.015	0.000	-	1081.027	12	
	4-Oct-12		-	8.620	0.000	-	1081.422	360	
	30-Apr-13		-	9.180	0.000	-	1080.832	510	Top of pipe elevation w/o collar was 1090.012m.
BH1105	3-Mar-04	1091.038	-	11.392	0.000	-	1079.646	nm	
	8-Mar-04		-	11.315	0.000	-	1079.723	1,000	
	5-Apr-04		-	11.334	0.000	-	1079.704	2,800	
	21-May-04		-	11.389	0.000	-	1079.649	nm	
	15-Jun-04		-	11.457	0.000	-	1079.581	9,400	
	13-Jul-04		-	11.407	0.000	-	1079.631	>10,000	bailer checked: no product
	23-Aug-04		-	11.349	0.000	-	1079.689	>10,000	
	13-Oct-04		-	11.460	0.000	-	1079.578	>10,000	bailer checked: no product
	1-Feb-05		-	11.462	0.000	-	1079.576	>10,000	bailer checked: no product
	28-Feb-05		11.420	11.420	trace	-	1079.618	>10,000	bailer checked; no product; sheen present
	30-May-05		-	11.502	0.000	-	1079.536	>10,000	bailer checked: no product
	3-Oct-05		-	11.228	0.000	-	1079.810	1,600	
	17-Jan-06		-	11.152	0.000	-	1079.886	>10,000	
	8-May-06		-	11.185	0.000	-	1079.853	>10,000	
	24-Jul-06		-	11.145	0.000	-	1079.893	>10,000	
	24-Jan-07		-	10.205	0.000	-	1080.833	>10,000	
	22-May-07		-	11.265	0.000	-	1079.773	>10,000	
	21-Aug-07		-	11.178	0.000	-	1079.860	8,200	bailer checked - no visible product; odour, no sheen
	20-Nov-07		-	11.258	0.000	-	1079.780	8,700	
	10-Mar-08		-	11.223	0.000	-	1079.815	>10,000	
	2-Jun-08		-	11.212	0.000	-	1079.826	2,000	
	4-Jul-08		-	11.125	0.000	-	1079.913	>10,000	well decommissioned on 04 July 2008
BH1106	3-Mar-04	1090.788	-	11.180	0.000	-	1079.608	nm	
	8-Mar-04		-	11.340	0.000	-	1079.448	1,100	
	5-Apr-04		-	11.295	0.000	-	1079.493	200	
	21-May-04		-	11.308	0.000	-	1079.480	nm	
	15-Jun-04		-	11.329	0.000	-	1079.459	64	
	13-Jul-04		-	11.264	0.000	-	1079.524	320	
	23-Aug-04		-	11.218	0.000	-	1079.570	300	
	13-Oct-04		-	11.334	0.000	-	1079.454	700	
	1-Feb-05		-	11.294	0.000	-	1079.494	1,000	
	28-Feb-05		-	11.175	0.000	-	1079.613	7,200	
	30-May-05		-	11.199	0.000	-	1079.589	1,200	has bailer

Notes:

1 Elevations are geodetic based on ASCM 75838 elevation 1091.349, Coordinates are 3TM NAD 83.

2 Depth relative to top of standpipe.

3 Water elevation referenced to Geodetic. Water elevation adjusted for presence of LPHs (using LPH density of 0.8).

4 Headspace combustible vapour concentrations measured in monitoring well standpipes using a Gastech TraceTector vapour analyzer or a RKI Eagle II portable gas monitor with Photo Ionization Detector.

LPH liquid petroleum hydrocarbons.

trace trace amount of LPH observed (<1 mm).

passive bailer LPH collection and recovery device.

HB hand bailed.

nm not measured.

cnm could not monitor.

cnl could not locate.

ppm parts per million; 1% LEL (lower explosive limit)=110ppm

n/s not surveyed

- no data available.

Table 2 - Summary of Well Monitoring
Liquid Petroleum Hydrocarbon Removal

Monitor Well	Monitor Date	Top of PVC Pipe Elevation	Ground Surface Elevation	Total Depth to LPH bTOP	Depth to Water bTOP	LPH Thickness	Volume Removed	Total Volume Removed
	(dd-mmm-yy)	(masl[1])	(masl[2])	(m)	(m)	(mm)	(m^3)	(m^3)
BH1704	8-Sep-15	1089.46	1089.58	10.491	10.592	101	0.000203	0.000203
	17-Sep-15	1089.46	1089.58	10.511	10.575	64	0.000046	0.000248
	22-Sep-15	1089.46	1089.58	10.532	10.532	0	0.000076	0.000325
	28-Sep-15	1089.46	1089.58	10.562	10.595	33	0.000023	0.000347
	6-Oct-15	1089.46	1089.58	10.549	10.603	54	0.000034	0.000382
	13-Oct-15	1089.46	1089.58	10.615	10.673	58	0.000046	0.000427
	19-Oct-15	1089.46	1089.58	10.543	10.575	32	0.000006	0.000433
	29-Oct-15	1089.46	1089.58	10.548	10.578	30	0.000008	0.000441
	13-Nov-15	1089.46	1089.58	10.436	10.562	126	0.000133	0.000574
	19-Nov-15	N/A	N/A	N/A	N/A	50	0.000057	0.000631
	27-Nov-15	N/A	N/A	N/A	N/A	2	0.000002	0.000634
	4-Dec-15	1089.46	1089.58	10.473	10.541	68	0.000103	0.000736
	11-Dec-15	1089.46	1089.58	10.505	10.544	39	0.000067	0.000804
	17-Dec-15	1089.46	1089.58	10.475	10.539	64	0.000113	0.000916
	8-Jan-16	1089.46	1089.58	10.455	10.639	184	0.000341	0.001257
	15-Jan-16	1089.46	1089.58	10.498	10.561	63	0.000071	0.001328
	22-Jan-16	1089.46	1089.58	10.42	10.491	71	0.000068	0.001396
	28-Jan-16	1089.46	1089.58	10.36	10.482	122	0.000205	0.001602
	5-Feb-16	1089.46	1089.58	10.456	10.489	33	0.000025	0.001627
	12-Feb-16	1089.46	1089.58	10.459	10.491	32	0.000057	0.001684
	18-Feb-16	1089.46	1089.58	10.335	10.455	120	0.000285	0.001969
	26-Feb-16	1089.46	1089.58	10.335	10.525	190	0.000570	0.002539
	4-Mar-16	1089.46	1089.58	10.436	10.584	148	0.000241	0.002779
	11-Mar-16	1089.46	1089.58	10.505	10.59	85	0.000160	0.002939
	24-Mar-16	N/A	N/A	N/A	N/A	200	0.000228	0.003167
	1-Apr-16	1089.46	1089.58	10.478	10.595	117	0.000206	0.003373
	7-Apr-16	1089.46	1089.58	10.519	10.6	81	0.000084	0.003458
	15-Apr-16	1089.46	1089.58	10.56	10.65	90	0.000091	0.003549
	21-Apr-16	1089.46	1089.58	10.555	10.61	55	0.000068	0.003617
	5-May-16	N/A	N/A	N/A	N/A	175	0.000200	0.003817
	16-May-16	1089.46	1089.58	10.513	10.534	21	0.000176	0.003793
	27-May-16	1089.46	1089.58	10.517	10.604	87	0.000164	0.003981
	16-Aug-16	1089.46	1089.58	N/A	10.568	N/A	N/A	0.003981
	31-Oct-16	1089.46	1089.58	10.486	10.545	59	0.000067	0.004048
	27-Feb-17	1089.46	1089.58	N/A	10.505	N/A	N/A	0.004048
	5-May-17	1089.46	1089.58	10.47	10.61	140	0.000160	0.004208
	5-Sep-18	1089.46	1089.58	10.6	10.667	67	0.000076	0.004125
	20-Mar-18	1089.46	1089.58	10.585	10.72	135	0.000154	0.004362
	24-Oct-18	1089.46	1089.58	10.68	10.715	35	0.000040	0.004165

Notes:

bTOP Below top of pipe

LPH Liquid Petroleum Hydrocarbon

N/A Not measured